

CALIFORNIA PUBLIC UTILITIES COMMISSION

# Safety Review Report of PG&E's PSEP Update Application

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A.13-10-017

Safety and Enforcement Division

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Appendix A – Safety Review Results: MAOP Validation Project

Appendix B – Safety Review Results: PSEP Update

# Safety Review of PG&E's MAOP Validation and PSEP Update

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## Executive Summary

Pursuant to Decision (D.) 12-12-30, Pacific Gas & Electric (PG&E) filed Application (A.) 13-10-017 on October 29, 2013 (PSEP Update Application), to update the scope of its Pipeline Safety Enhancement Plan (PSEP) based on the results of the Maximum Allowable Operating Pressure (MAOP) Validation Project.

In accordance with its Quality Review Plan for oversight of PG&E's PSEP implementation, the Safety and Enforcement Division (SED) of the California Public Utilities Commission (CPUC) conducted a safety review of PG&E's MAOP Validation project and of the updated scope of the PSEP program to ensure its alignment with regulatory requirements, mandates, and expectations.

Aside from the exceptions detailed in this report, SED learned that PG&E's validation of MAOP was generally consistent with the CPUC's requirements under D.11-06-017, D.12-12-030, and Resolution (R.) L- 410. However, the Pipeline Feature Lists utilized to validate MAOP are not a perfect product. PG&E does not have traceable, verifiable and complete records for every pipeline component in its transmission system nor has every component in its system been pressure tested. The MAOP Validation Project results in a substantial improvement over the previous system of record by providing a level of detail not previously available. Much work still remains to ensure the continued improvement of the data quality gathered through the MAOP Validation project.

In terms of the PSEP Update scope, SED also learned that the workpapers supporting the PSEP Update Application are not error-free and that the scope update is not entirely consistent with SED's expectations. However, no imminent safety concerns arose from SED's review. SED's observations should not delay the continuation of the PSEP program especially considering the that the first Phase of this program is set to conclude at the end of 2014. Attention must be focused on PG&E's 2015 Gas Transmission and Storage Rate Case, currently before the CPUC, to ensure PG&E's continued progress towards complying with the CPUC's and Sate of California order ending historic exemptions from pressure testing for natural gas transmission pipeline.

## Part 1: MAOP Validation Project

### Background

Following the tragic explosion of PG&E's transmission pipeline in San Bruno, the National Transportation and Safety Board (NTSB) issued a set of recommendations driven, in part, by its discovery that the operator's records of the ruptured pipeline were inaccurate and contained discrepancies. Acting on its concern of widespread record inaccuracies the NTSB issued a set of recommendations later ratified by the CPUC through Res. L-410, including:

**(P-10-2)** "Aggressively and diligently search for all as-built drawings, alignment sheets, and specifications, and all design, construction, inspection, testing, maintenance, and other related records, including those records in locations controlled by personnel or firms other than Pacific Gas and Electric Company, relating to pipeline system components, such as pipe segments, valves, fittings, and weld seams for Pacific Gas and Electric Company natural gas transmission lines in class 3 and class 4 locations and class 1 and class 2 high consequence areas that have not had a maximum allowable operating pressure established through prior hydrostatic testing. These records should be traceable, verifiable, and complete."

**(P-10-3)** "Use the traceable, verifiable, and complete records located by implementation of Safety Recommendation P-10-2 (Urgent) to determine the valid maximum allowable operating pressure, based on the weakest section of the pipeline or component to ensure safe operation, of Pacific Gas and Electric Company natural gas transmission lines in class 3 and class 4 locations and class 1 and class 2 high consequence areas that have not had a maximum allowable operating pressure established through prior hydrostatic testing." (P-10-3) (Urgent)

By D. 11-06-017, issued June 9, 2011, the CPUC required PG&E and other operators to file an implementation plan to pressure test or replace all untested transmission pipeline and to establish an MAOP based on pressure testing. This requirement effectively eliminated what is often referred to as the "Grandfathering<sup>1</sup>" clause contained in the federal regulations. By the following Ordering Paragraphs (O.P.s) D.11-06-017 further directed PG&E to:

(O.P.1)"..... complete its Maximum Allowable Operating Pressure determination based on pipeline features and may use engineering-based assumptions for pipeline components where complete records are not available. Such assumptions must be

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<sup>1</sup> Title 49 Code of Federal Regulations (CFR) § 192.619(c)

clearly identified, based on sound engineering principles, and, where ambiguities arise, the assumption allowing the greatest safety margin must be adopted. The calculated values must be used for interim pressure reductions and to prioritize segments for subsequent pressure testing.”

(O.P.3) “A pressure test record must include all elements required by the regulations in effect when the test was conducted. For pressure tests conducted prior to the effective date of General Order 112, one hour is the minimum acceptable duration for a pressure test”

Ultimately, by D.12-12-030, the CPUC approved PG&E’s implementation plan, commonly referred to as the PSEP, submitted on August 11, 2011, and requiring PG&E to:

(O.P. 11) “ ... file an application within 30 days after the completion of its Maximum Allowable Operating Pressure validation and records search to present the results of those efforts and update its Implementation Plan authorized revenue requirements and related budgets, consistent with this decision.”

In response to the mandates described above, PG&E conducted a massive effort to search its records and validate the MAOP of its transmission pipeline. This effort is described under Chapter 1 “MAOP Validation Project” of the testimony filed in support of A. 13-10-017 to update the PSEP program scope (PSEP Update Testimony). The updated scope is based on incorporation of the MAOP Validation Project results as required by O.P.11 of D.12-12-030. SED’s review of the updated scope is discussed later in this report.

## PG&E Implementation

PG&E completed MAOP Validation of its transmission pipeline system, comprised of approximately 6,750 miles, on July 1, 2013. As described in Chapter 1 “MAOP Validation Project” of the PSEP Update Testimony, the MAOP Validation project was conducted in three Parts:

- Part 1- Record search.
- Part 2 – MAOP Validation of priority mileage<sup>2</sup>
- Part 3 –MAOP Validation of remaining transmission pipeline.

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<sup>2</sup> Priority mileage refers to Class 3 and 4 Locations and Class 1 and 2 High Consequence Areas (HCA).

The main components of the process used by PG&E to validate MAOP were comprised of:

1. Record search and retrieval efforts<sup>3</sup>.
2. Building of Pipeline Feature Lists.
3. MAOP Engineering and Validation.

### Pipeline Feature Lists

After conducting the record search and retrieval PG&E built Pipeline Feature Lists (PFLs) of its transmission system. A PFL is a “detailed list of all pipeline components such as pipe and fittings (e.g., elbows, valves and tees) and their associated characteristics such as pressure rating, diameter, wall thickness, grade of steel, and seam weld types”<sup>4</sup>.

PG&E developed two hierarchical document quality criteria that classify the confidence and reliability of its records in support of its characterization of traceable, verifiable, and complete (TVC) records for its transmission pipeline system. These quality criteria assigned supporting records a “quality code”. The two different tiered quality criteria were developed based on the type of data used to calculate MAOP, as follows:

1. Material Specifications of Pipe, Fittings, Welded components: these specifications are used to calculate an MAOP based on design criteria<sup>5</sup> (MAOP of Design).
  - a. Quality Codes range from Q1-Q7, Q1 being the highest quality.
  - b. Definition of TVC records:
    - i. Single document for Q1-Q3 records.
    - ii. Supporting document necessary for Q4-Q6.
    - iii. Q7 and Q8 are not TVC.
2. Pressure Test specifications: these specifications are used to calculate an MAOP based on pressure testing (MAOP of Test)
  - a. Quality Codes range from Q1-Q13, Q1 being the highest quality.
  - b. Implementation of TVC records:
    - i. Q1-Q7.
    - ii. Q8 through Q13 are not considered TVC records.

To maintain traceability from pipeline specifications in the PFL to the source documents used to support the specifications, an important characteristic of the PFLs, PG&E used

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<sup>3</sup> PSEP Update Testimony Chapter 1, Section C.1. “Records Retrieval” pg. 1-4 through 1-5.

<sup>4</sup> PSEP Update Testimony Chapter 1, “MAOP Validation Project”, footnote 2.

<sup>5</sup> Title 49 CFR § 192.619(a) and 192.105.

markings with feature numbers to identify components in the source documents that were used and attached them to the PFL.

### MAOP Engineering and Validation

This component of the MAOP Validation effort applied an engineering-based review to the data extracted from records by the PFL build process, following certain established methods to resolve unknown specification, and calculate and establish MAOP for the component and the PFL, as follows:

- Validated data entered in the PFL build process.
  - Resolved unknowns by:
    - Applying conservative engineering-based assumptions.
      - Using the Procedure for Resolution of Unknown Pipeline Features (PRUPF, TD-4199-P-01).
      - Applying Sound Engineering Judgment.
    - Field verification of unknown specifications critical to calculating MAOP.<sup>6</sup>
    - Finding additional documents not previously retrieved.
- Determine the component MAOP by:
  - Comparing and selecting the lower of the following three MAOP's, referred to as the "limiting" MAOP:
    - MAOP of Design based on Title 49 CFR §§ 192.619(a) and 192.105.
    - MAOP of Test based on valid<sup>7</sup> pressure test records.
    - MAOP of Record. This is the current MAOP based on Document 086868<sup>8</sup> or operating diagrams.

An MAOP for the PFL was selected based on the weakest component in the PFL, and pressure reductions were conducted as required.

PG&E's characterizes its implementation of MAOP Validation as follows:

#### "1 – MAOP establishment by Strength Test

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<sup>6</sup> PG&E explained that this method was primarily used when the MAOP of Design did not support the MAOP of Record and the operator was fairly certain that field verification would result in confirming stronger component specifications. The PRUPF lays out the guidelines employed for field verifications.

<sup>7</sup> Valid test definition based on PG&E's Draft Utility Procedure TD-4125P-Attachment B "Historical Pressure Test Evaluation" March 10, 2013 and pressure test records with quality codes Q1-Q7, as described in the "instructions" tab of each PFL.

<sup>8</sup> Document 086868 is PG&E's document of record containing actual MAOPs for its transmission system.

2 - MAOP validation by design calculations as an interim safety measure for all un-tested pipelines and eventually conduct pressure tests for all un-tested pipelines in accordance with the CPUC order, D.11-01-017”

PG&E conducted Quality Assurance and Quality Control (QA/QC) efforts to assure the quality of the data as described in Chapter 3 of the PSEP Update Testimony.

## SED Safety Review

### Scope

SED reviewed the MAOP Validation project with the intent to gain a thorough understanding of the criteria, implementation, records, and data used by the operator to validate the MAOP of its transmission system and confirm its alignment with regulatory requirements and expectations.

SED scoped its review to ensure that:

- The MAOP for transmission pipeline components was established and supported by complete pressure test records in compliance with historical regulatory requirements and best practices.
- Material specifications critical to calculating MAOP of pipeline components were supported by existing records – referred to in this report as record-based specifications.
- Conservative engineering-based assumptions were used when those critical material specifications were unsupported by records - referred to in this report as “unknowns” or assumption-based specifications.
- MAOP Validation was conducted in accordance with regulatory requirements and mandates:
  - NTSB Recommendations P-10-02, P-10-3.
  - State Mandates and requirements: D.11-06-017; D.12-12-030, General Order 112-E.
  - Federal Regulations: Title 49, CFR §192.105 (calculation of MAOP); Subpart J, and other applicable requirements, as necessary.
- TVC criteria has been implemented for records supporting validated MAOP.

The main components of SED’s review are addressed in Chapter 1 “MAOP Validation Project” of PSEP Update Testimony, under sections:

- C2: PFL Build
- C3: MAOP Engineering and Validation
  - Resolution of Unknown Specifications
  - MAOP Validation

The methods used to perform the review included:

- Review of applicable proceeding testimony.
- Review of procedures, policies, and supporting records.
- Participation in focused presentations/workshops held by PG&E for SED staff (Staff) on the MAOP Validation Project and its corresponding QA/QC efforts.
- Discussions and interviews with PG&E's MAOP Validation project management and engineers.
- On-site inspection and review of PFLs and supporting documents. Review was conducted at PG&E's facilities.
- Data Requests.

The on-site inspection represents a large portion of SEDs review efforts, which was further complemented by the remaining activities mentioned above. It is important to highlight that this review was not intended to provide a statistically significant assessment of data accuracy of the MAOP Validation project as a whole, but was instead purposed at providing SED with valuable insight on implementation of the process PG&E used to validate MAOP, to identify potential safety issues with that process and its results, if any, and to ensure its alignment with safety-related regulatory mandates and expectations. Finally this review provided SED with a solid foundational understanding of the data used to update the PSEP scope.

#### **On-Site Review**

The PFLs represent the work product of the MAOP Validation project. These contain the component-level material and pressure testing specifications of PG&E's transmission pipeline system critical to establishing the pipeline's MAOP. SED's onsite inspection focused on reviewing a sample of these PFLs and their supporting documents.

On March 21, 2013, PG&E held an all-day workshop to provide Staff with an overview of the MAOP Validation project and its implementation, which was subsequently followed in November by a focused session on the processes and guidelines PG&E employed to build the PFLs, validate MAOP, and undertake the related QA/QC efforts for the project. Beginning on November 12, 2013, a team of six SED engineers conducted a 2-week

inspection of the PFLs at PG&E's facilities. PG&E personnel involved with creating, maintaining, and managing the PFLs and validating MAOP was available to provide clarification and answer SED Staff questions, as necessary. Throughout the inspection PG&E held focused presentations on different subject areas of interest to Staff.

To perform its inspection, Staff used applicable portions of PG&E's PFL Build Quality Assurance procedure<sup>9</sup>, PG&E's MAOP Validation procedures and guidelines, and the applicable state and federal regulations to inspect and evaluate the PFLs:

Specifically, SED evaluated the PFLs for:

- 1) Accuracy of data critical to calculating MAOP of Design, referred to here as "critical<sup>10</sup> material specifications" and TVC of supporting records for:
  - a) Record-based specifications.
    - i) Verified that pipeline feature's critical material specifications entered into the PFL are accurately captured and supported by and traceable to supporting records.
    - ii) Checked that the quality code<sup>11</sup> structure developed by PG&E to represent the level of reliability and TVC of records supporting critical material specifications is accurately captured and implemented in the PFL.
  - b) Assumption-based specifications.
    - i) Verified that critical material specifications which are unknown/do not have supporting records are resolved based on conservative engineering assumptions using one of the three procedures employed by PG&E:
      - (1) Using the Procedure for Resolution of Unknown Pipeline Features (PRUPF, TD-4199-P-01)
      - (2) Using sound engineering judgment.
      - (3) Field verification to ascertain specification properties.
    - ii) Checked that the rationale of these assumptions was traceable and properly documented.
- 2) Accuracy of critical strength testing specifications and validity of supporting test records used to establish MAOP.
  - a) Verified that strength testing data critical<sup>12</sup> to establish MAOP was accurately captured and supported by strength testing records.

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<sup>9</sup> PSEP Update Testimony, Attachment 3B "Quality Assurance Plan for PFL Build" Version 6, dated May 29, 2012.

<sup>10</sup> PSEP Update Testimony, Attachment 3B "Quality Assurance Plan for PFL Build" Version 6, Appendix 1 "Specification Ranking and QA/QC Tolerances" critical material specifications.

<sup>11</sup> Data Source Quality Tiers for Pipe, Fittings, Welded Components, PFL "Instructions" Tab.

- b) Checked that the quality code<sup>13</sup> structure developed by PG&E to represent the level of confidence and TVC of the records it used to support critical strength testing specifications was accurately captured and applied.
- 3) Validation of MAOP consistent with Federal and State regulatory requirements and mandates.
  - a) Verified MAOP calculation for PFL components.
    - i) Checked that the MAOP of Test was calculated based on valid strength test records that met historical pressure test requirements and/or standards in place at the time the test was conducted<sup>14</sup>, as applicable, in addition to PG&E's TVC criteria<sup>15</sup>.
    - ii) Verified that MAOP based on material specifications was calculated per current federal and state requirements (Title 49 CFR 49 Part 192 Section 105).
  - b) Confirmed that the MAOP of Record established for the PFL component does not exceed the MAOP supported by existing pressure test records (MAOP of Test) or the MAOP based on material specifications (MAOP of Design) for the component.
  - c) Confirmed that the MAOP of the PFL inspected is based on the weakest component.

Staff inspected twenty PFLs during the 2-week period. These were, with some limited exceptions, either randomly selected or targeted for containing segments with cancelled PSEP projects per the PSEP Update Application, but which were not included in PG&E's QA Sample<sup>16</sup>. The exception was a couple of PFLs that were in fact selected for being part of PG&E's QA sample. Considering that many of the PFLs inspected by Staff contained up to several thousand features each, Staff selected several features from large PFLs that represented the weakest and/or more vintage components within the route.

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<sup>12</sup> PSEP Update Testimony, Attachment 3B "Quality Assurance Plan for PFL Build" Version 6, Appendix 1 "Specification Ranking and QA/QC Tolerances" critical STPR specifications.

<sup>13</sup> Data Source Quality Tiers for Strength Test Pressure Reports, PFL "Instructions" Tab.

<sup>14</sup> As documented in PG&E's Draft Utility Procedure TD-4125P-AttachmentB "Historical Pressure Test Evaluation" March 10, 2013.

<sup>15</sup> Per PG&E TVC criteria consists of STPR records corresponding to a quality code value of Q7 or higher.

<sup>16</sup> PG&E's QA consultant tested a sample of 1,474 PFLs using Attachment 3B "Quality Assurance Plan for PFL Build" Version 6, Appendix 1.

## Results of On-Site Inspection

Similar to the categorization of defects PG&E developed for its QA process<sup>17</sup>, Staff classified the errors found in the PFLs based on their effect on the calculation of MAOP. These were classified from Type 2 -5 errors, with Type 4 and 5 representing errors that have a negative impact on the MAOP, i.e. cause the MAOP to be less conservative which is a value higher than it would be if the correct value had been used. Type 5 errors will not only cause calculation of an MAOP that is less conservative, but affect the limiting MAOP of the component causing a less conservative MAOP to be established for the PFL. Error types and the number of PFLs inspected by Staff with errors are summarized in the table below.

Table 1: PFLs containing Errors.

Error Type	Description	No. of PFLs
Type 2	Does not affect the MAOP calculation for feature or PFL	9
Type 3	The error affects MAOP, but the input value is more conservative than the correct value	0
Type 4	The error affects MAOP, and the input value is less conservative than the correct value.	7
Type 5	Causes an incorrect feature MAOP that is less conservative than the correct feature MAOP, and causes an incorrect MAOP for the entire PFL.	1*

\* PFL not part of original MAOP Validation on-site inspection review. Error discovered through the PSEP on-site inspection conducted by SED and included herein due to its relevance to the MAOP Validation Project.

Refer to Appendix A for details on the individual errors found.

Of the 20 PFLs reviewed by SED at the on-site inspection, 11 contained at least one error type. Of those 11 PFLs over half consisted of Type 2 errors which have no impact on the MAOP. After the on-site inspection Staff discovered a Type 5 error in another PFL not originally inspected on-site. This PFL error was discovered in connection with Staff's review of the updated PSEP project workbooks conducted on January, 2014. Although that portion of the review is discussed later in this report, due to the Type 5 error's relevance to the MAOP Validation Project, it is included and discussed here.

### **Type 4 and 5 errors**

As described earlier, these errors have some level of impact on the MAOP and result in calculating an MAOP ( of Record, of Test, and/or of Design) that is less conservative.

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<sup>17</sup> Updated PSEP Testimony Attachment B "QA Assurance plan for PFL Build" p. 3-12.

Although Type 4 errors have an impact on MAOP, the error does not actually impact the MAOP of the PFL because it does not affect the limiting<sup>18</sup> MAOP. Seven of the PFLs inspected by Staff contained Type 4 errors. These errors varied from entering incorrect values from supporting records (Results No. 1 and 12, Appendix A), misapplication of the Unknown Pipeline Features (PRUPF) (Results No. 2, 10, and 11 Appendix A– see Findings and Recommendations section), selection of a less conservative value from supporting documents containing conflicting information (Results No. 6 and 14 Appendix A), and utilizing low quality (Q8 and Q12) pressure test documents to support an MAOP of Test (Results No. 1 and 20, Appendix A - see Findings and Recommendations section). These errors resulted in a less conservative MAOP based on design or pressure test information, but did not affect the limiting MAOP for the component nor the MAOP for the PFL. See Appendix A for individual error details.

Only Type 5 errors result in an MAOP for the PFL that is less conservative. Through its review of the updated PSEP application project workbooks Staff discovered one PFL containing such an error (Error 19, Appendix A). In this case the MAOP established for part of the PFL and denoted as the MAOP of Record therein was not the actual MAOP of Record as reflected in Document 086868, PG&E's official record of its Transmission system's MAOPs and operating pressures. PG&E investigated the error and has lowered the MAOP of the line and corrected the PFL. SED is currently reviewing the corrected PFL and supporting documentation.

### **Type 2 errors**

Based on PG&E's own guidelines, traceability is a very important characteristic of PFLs, and Staff agrees. The Type 2 errors found were primarily due to issues dealing with the traceability of feature data to source documents within the PFL, and traceability of the rationale behind the resolution of unknown data.

Although these errors do not affect MAOP, the traceability of data both to the source documents or the rationale behind selection of values is a critical characteristic of the PFLs, one that PG&E appears to have placed a significant emphasis on when creating the PFLs.

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<sup>18</sup> As described earlier, the limiting MAOP is the lower of the MAOP of Design, of Test, or of Record.

## Findings and Recommendations

Below are some of SEDs observations on the process and implementation of the MAOP Validation Project. Refer to Appendix A for individual recommendations on errors found during the on-site inspection.

### 1. General Observations:

- Based on PG&E's own definition, the operator lacks traceable, verifiable and complete records for all components in its transmission system.
- PG&E's transmission system lacks valid pressure testing records to establish an MAOP based on pressure testing for all of the components in its system.
- PFLs have not yet been built for regulator stations and their MAOP not yet validated. PG&E asserts undertaking this effort at present time.
- PG&E excluded taps from calculating MAOP.

### 2. Compliance

#### 2.1. Pipeline Segments Operating "One Class out" 49 CFR 192.611 to Validate MAOP

The MAOP of over 8 miles of pipeline corresponding to approximately 150 features contained in eight of the PFLs inspected by SED was validated by operating "one class out" under 49 CFR 192.611. PG&E's method for validating the MAOP systematically relies on using this section of the code to apply a lower factor of safety for those instances where a feature's MAOP of Design does not support the MAOP of Record and the class location, as installed, is unknown.

This section of the federal regulations allows a pipeline segment that has experienced a class location change to operate "one class out" provided that certain strength test and pipe condition criteria have been met. In those circumstances the pipeline segment may be operated using a lower margin of safety as applicable to one class lower. However, application of 49 CFR 192.611 is premised on occurrence of an actual class location change. PG&E applies that section of the code to validate MAOP when its pipeline component specifications do not support the MAOP of Record irrespective of whether a class location change actually occurred. Such practice also contradicts PG&E's own policy that operating one-class out "does not apply if we discover different pipe specifications or miss aligned pipelines that shift data such that the pipeline is operating out of class"<sup>19</sup>.

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<sup>19</sup> Draft Utility Procedure TD-4125P-Attachment B "Historical Pressure Test Evaluation" March 10, 2013.

Recommendation: PG&E may not validate MAOP based on operating one-class-out absent proof and determination of an actual class location change. Other than as a method of prioritizing work, PG&E must demonstrate that a class location change has occurred in order to validate MAOP based on operating one-class out under 49 CFR 192.611. SED’s efforts to address matters related to PG&E’s pipeline that is operating out-of-class are being orchestrated in coordination with other forums outside of PSEP Update Application proceeding, such as the CPUC’s own Order Instituting Investigation (I).11-11-009 on PG&E’s Class Location issues.

2.2. Post-1970 Pipeline lacking pressure test records

PG&E lacks pressure testing records for some of its pipeline components installed post-1970’s. Example of such an instance, as encountered by SED, include:

PFL	Compliance Finding	Comments
173_MPO.0000-17.5600_02Aug12	Features installed after 1970 with no pressure test data: Feature 153.1 (yr 1986), 318.0 (1974), 322.0 (1974), 324.0 (1974), 326.0 (1974), 355.0 (1974), 357.0 (1974), 359.0 (1974), 361.0 (1974), 1104.0 (1987).	These are not in PSEP. 153.1 - 1 ft of pipe, 318 (3 ft of pipe), 322 (11ft of pipe). 324 (45 ft of pipe),

Recommendation: PG&E must ensure that all transmission pipeline is hydrotested and demonstrate a reasonable plan to achieve doing so.

**3. Engineering Assumptions to Resolve Unknowns**

3.1. Evolution of the PRUPF

PRUPF guidelines have evolved since the inception of the MAOP validation project and several different iterations of the procedure have been used to resolve unknowns. The PFLs have not all been revised to reflect the updates to the PRUPF procedure and assumptions based on that guideline are not all entirely consistent across PFLs. In certain instances, PFLs reflect a less conservative iteration of the PRUPF, as Staff found with Results No. 2, 10, and 11 under Appendix A.

PG&E has indicated that it plans to build the PRUPF into eGIS in order to conduct a systematic update of assumptions that are based on the PRUPF and ensure they are consistently based on the most recent and future revisions to that procedure.

Recommendation: PG&E must update all component assumptions based on the latest and future iterations of the PRUPF to ensure consistency of these assumptions. Building the PRUPF into eGIS and conducting a systematic update appears to be a reasonable and more efficient means of updating

*the component's assumptions. PG&E should provide SED with an estimated timeline and plan for implementation and completion of this effort along with updates of the progress, its completion, and results.*

### 3.2. Assumptions for "Joint Ventures"

The PRUPF lays out a procedure to determine assumptions for unknown specifications based on either 1 -historical practices and standards employed by PG&E for pipeline installed by the operator; or 2- application of "absolute minimums" of commercially available components for pipeline purchased from other companies. The PRUPF applies the absolute minimums to components purchased from other companies due to "lack of evidence to support that other operators adhered to Company standards and practices"<sup>20</sup>. "Joint ventures" are a special case where joint ownership of a pipeline exists and, because of this joint ownership, design and installation of the pipeline are less certain to have been performed in adherence to PG&E's historical standards and practices. Such joint ventures include Standard Pacific Gas Lines Inc (StanPac), which is a joint ownership pipeline with Chevron Pipe Line Company and comprised of approximately 54.6 miles of pipeline. Although PG&E today controls the majority interest of StanPac (six-sevenths) this was not always the case, and in times past, PG&E did not have control over the design and installation of the pipeline. In these cases PG&E appears to have relied on institutional knowledge of historical ownership to determine which assumption method to apply – whether installed by PG&E or purchased from other company - for resolution of unknown specifications.

*Recommendation: PG&E should ensure to document any general institutional knowledge used and guidelines provided to determine ownership of joint ventures that may have been used to determine which method would be applied to resolve unknowns. Any other guidance related to institutional knowledge of these pipelines used to determine feature specification should be documented.*

### 3.3. Unknown Fitting Specifications

The PRUPF specifies that assumptions for unknown fitting specifications should be selected so they "are suitable for the intended pressure at the time of installation"<sup>21</sup>. This approach is premised on the assumption that historical standards and practices for design of components in effect at the time were adhered to and that installation pressures are also known. PG&E conducted a couple of studies to compare field verified feature

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<sup>20</sup> TD-4199P-01 "PRUPF" Section 2.1 "Pipe in Systems Purchased from Other Operators" p. 8.

<sup>21</sup> TD-4199P-01 "PRUPF" Section 1.6, 1.7 and 5 "Unknown Weld Fitting Specifications"

specifications against PRUPF assumptions and actual records. The aforementioned studies did not specifically address fittings or the judiciousness of this assumption approach.

*Recommendation: PG&E should obtain some indication on the level of confidence that this standard practice was historically adhered to in order to ensure that the application of these assumptions do in fact reflect a conservative approach. Considering PG&E's database of field verified data is continually growing, the operator should engage in a focused effort to validate unknown fitting specification assumptions that will provide a greater insight on the level of confidence of PG&E's historical adherence to its own historical standards practices.*

#### **4. Traceable, Verifiable, and Complete**

##### **4.1. TVC of material specifications for components lacking pressure tests.**

PG&E does not require that pipeline specifications gathered from historical records for calculation of MAOP of Design meet its definition of traceable, verifiable, and complete, unlike its policy for strength test records used to establish an MAOP of Test.

- PG&E's testimony suggest that only documents of \*sufficiently high quality\* were used to build the PFL<sup>22</sup>, however, PG&E's policy only suggests *consideration* for not using low quality documents to obtain critical material specifications, but does not advise against nor prohibit their use<sup>23</sup>.
- SED learned that highest quality documents *available* were used, meaning that low quality documents were used in support of material specifications if these were the only records available. For example, features 218.3-218.6 in PFL 173\_MP0.0000-1717.5600\_02Aug12 rely on a Q7 document, the lowest quality of record as these \*represent early design intent\* without an indication of completeness, i.e. design documents.
- It is important that accurate data based on traceable, verifiable, and complete records or the most conservative assumptions be applied, at a minimum, for features without an MAOP established by valid pressure testing records, as an interim safety measure, while testing of all transmission pipelines is completed. This is also critical to design and conduct a safe pressure test.

*Recommendation: PG&E should enforce the use of accurate material specification data based on traceable, verifiable, and complete records or application of conservative assumptions, as an interim*

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<sup>22</sup> Chapter 1 "MAOP Validation Project" (line 17 p. 1-6),

<sup>23</sup> PG&E has responded that these policies reside within tailboard documents conducted with team members of the MAOP Validation Project on a weekly basis.

*safety measure, for components that lack a valid pressure testing record. This approach should be adopted instead of the current practice of relying on data gathered from low quality documents to validate the MAOP for pipeline components that lack a valid pressure test record.*

#### 4.2. Type of data and document quality codes.

PG&E's hierarchical categorization of document quality is a significant step towards characterizing and understanding the historical traceability, verifiability, and completeness of its records. However, the quality codes are based on the document type and do not consider the type of data that is being taken from the document. Higher quality documents may not be reliable for certain data types.

*Recommendation: PG&E should consider capturing the reliability of documents based on the type of data as well as type of document.*

#### 4.3. MAOP to be established based on TVC records.

PG&E's policy enforces its definition of traceable, verifiable, and complete records, based on the hierarchical quality code categorization it developed for supporting strength test documents, to establish an MAOP supported by pressure test. This means it will only use pressure test records to validate MAOP if such records have a quality code of Q1-Q7 (highest quality code being Q1). By discovery of Results No. 4 and 20, Appendix A, SED learned that the program tool PG&E used to ensure that PFL's calculate a test supported MAOP based only on Q1-Q7 pressure test records was not implemented from the inception of the program and it is possible that other PFLs are calculating an MAOP of Test based on low quality records, contrary to PG&E's policy. PFLs are not consistently considering the quality code of pressure test document to determine if a valid test exists in order to calculate an MAOP supported by strength test pressure records.

*Recommendation: PG&E must ensure to undertake a specific effort to correct this inconsistency and ensure correct application of its criteria across all PFLs.*

#### 4.4. Traceability of Rationale

Rationale behind selection of material specifications for each feature is at times untraceable in the PFL for both record-based and assumed specifications. Although PG&E has general

guidelines governing the process, the level of comment detail specific to each feature in the PFL was inconsistently applied and often insufficient to trace the logic behind selection of material specifications.

*Recommendation - Considering the high level of engineering judgment that has been applied on a case-by-case basis, and in the absence of “hard and fast” rules, a more robust and consistent documentation of rationale should have been required and enforced in the PFL. If comments are kept outside of the PFL, it is strongly recommended that these be maintained with the PFL.*

## **5. Continued Improvement**

### **5.1. H-Forms**

H-forms are generally considered a high quality document; however, PG&E has learned that these forms may be historically unreliable for specification of diameters or seamtype. SED encountered such instance for feature’s 200.09 & 200.94 in Line 147 for which the H-Form referenced in the PFL stated a pipe diameter and seamtype found to be incorrect by more recent field verifications.

*Recommendation: PG&E should ensure to review all such specifications gathered from historical H-forms and re-evaluate the accuracy of the data in question.*

### **5.2. MAOP of Record discrepancies**

PG&E’s use of different databases, such as Document 086868 for MAOP of Record and PFLs to validate the MAOP can create inconsistencies in data, as was found through the Type 5 error discovered by SED (Result No. 19 Appendix A).

*Recommendation: As part of its continued improvement of data quality PG&E must develop a method to systematically query the system/PFLs and identify other potentially similar data discrepancies between MAOP of Record in Document 086868 and the MAOP of Record used in the PFLs.*

*Recommendation: PG&E should diligently engage in continued efforts to improve the quality of pipeline data gathered through the PFLs by identifying potential types of data discrepancies and performing systematic corrective actions. PG&E indicated that it has commenced such efforts through its “Data Quality Management” program.*

## Part 2 - Updated PSEP Program Scope

### Background

On August 26, 2011, PG&E filed its original PSEP containing its implementation plan to comply with D.11-06-017 requirements that all in-service natural gas transmission pipeline in California be pressure tested in accordance with Title 49 CFR §192.619, excluding subsection c) in Title 49, CFR §192.619.

The implementation plan was comprised of two major programs:

1. Pipeline Records Integration Program. (A subset of this program is the MAOP Validation Project addressed earlier in this report).
2. Pipeline Modernization Program.

#### Pipeline Modernization Program:

This program was developed by PG&E to comply with the CPUC's requirement that all California natural gas transmission pipeline be pressure tested or replaced. PG&E proposed to carry out the required pressure testing and replacement in two Phases by prioritizing eligible pipeline based on population density, vintage, operating pressures, and construction methods. The prioritization is laid out in the form of a Decision Tree<sup>24</sup> which also includes a methodology to identify and determine the recommended actions to address pipeline segments (pressure test or replace, conduct in-line inspections, reduce operating pressures) based on certain threat categories: manufacturing threats, fabrication and construction threats, and corrosion and latent mechanical damage threats. Other activities were proposed under the Pipeline Modernization Program including automation of shut-off valves and retrofitting for in-line inspections.

Phase 1 of the program was estimated to conclude by the end of 2014.

By D.12-12-030, issued on December, 20, 2012, the CPUC approved PG&E's PSEP and ordered the operator to:

(O.P.11) " ... file an application within 30 days after the completion of its Maximum Allowable Operating Pressure validation and records search to present the results of those efforts and update its Implementation Plan authorized revenue requirements and related budgets, consistent with this decision."

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<sup>24</sup> PSEP Update Testimony Attachment 2A "Pipeline Modernization Program Decision Tree"

Following PG&E's request for a time extension and the CPUC's subsequent approval, pursuant to the above order, PG&E filed the PSEP Update Application on October 29, 2013.

## PG&E Implementation

PG&E's Data Validation Workbooks (project workbooks), submitted in support of its PSEP Update Application, contain the validated pipeline segment attributes based on the MAOP Validation project results, and the decision-making process utilized to determine the updated scope of projects and the pipeline segments to be addressed as part of the PSEP program. The pipeline segment data was validated based on the MAOP Validation project results. PG&E's approach is detailed under Chapter 2 "Gas Transmission Pipeline Modernization Program Update" of the PSEP Update Testimony.

Unlike the August 2011 PSEP filing, which relied on a database of PG&E's transmission system (original PSEP Database<sup>25</sup>) to identify untested pipeline segments, the PSEP project workbooks are the primary tool used to update the PSEP scope. The original PSEP Database was only used as a baseline to create the project workbooks. The scope of each project workbook is primarily based on the projects and segments addressed by each project as originally identified in the August 2011 PSEP filing. The segment data within each project workbook was then validated using the applicable PFL route generated from the MAOP Validation Project, and most current Class location and HCA data contained in GIS 2.0<sup>26</sup>. The validated segment data was re-run through the decision tree to obtain an updated decision tree outcome. PG&E then categorizes the differences between the new decision tree outcome and its proposed action by using a set of 20 different "Deviations"<sup>27</sup>.

The PSEP Update Application workpapers and project narratives were generated from the validated project workbook information. The step-by-step process PG&E followed to create the workbooks is detailed in Attachment 2B "Updated Filing Workpapers Preparation".

PG&E also performed a QA/QC initiative for the PSEP scope update as detailed in Chapter 3: "Quality Assurance" of its PSEP Update Testimony.

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<sup>25</sup> Generated from January 2011 snapshot of data taken from the GIS 1.0.

<sup>26</sup> GIS 2.0 contains the most recent HCA and Class location data from the Class Location study performed in 2011 and 2012.

<sup>27</sup> PSEP Update Testimony Chap. 2 "Deviations Due to Engineering Judgment" p. 2-12 – p.2-18

## SED Safety Review

SED reviewed certain safety-related aspects of PG&E's PSEP Update application. These pertain to the incorporation of MAOP Validation Project results, referred to as "PSEP Data Validation" by PG&E, and adequate application of the approved PSEP Decision Tree to the validated data in order to determine the updated scope of the PSEP program. An Overview of this process, as reviewed by SED, is contained in PG&E's PSEP Update Testimony Chapter 2 "Gas Transmission Pipeline Modernization Program Update" under Sections A-D (excluding Change Management Process).

The 4 major components of SED's review were:

1. Integrity of critical pipeline data used to determine PSEP project scope.
2. Pressure testing criteria and its application.
3. Application of PSEP decision tree to determine project actions and PSEP scope.
4. Deviations from Decision Tree Outcome based on Engineering Judgment, as described in Chapter 2, Section D4, of PG&E's testimony.

The methods used to perform the review included:

- Review of applicable proceeding testimony.
- Review of procedures, policies, and records.
- Participation in focused presentations/workshops by PG&E on update PSEP Scoping, Decision Tree Application, and QA/QC.
- Discussions and interviews with PG&E's PSEP management and engineers.
- On-site inspection and review of project "Workbooks"<sup>28</sup>, and supporting documents. Review was conducted at PG&E's facilities.
- Data Requests.

As with the MAOP Validation Project review, the on-site inspection represents a large portion of SED's efforts for this review, and is complemented by the other activities listed above. Similarly, it is important to highlight that this review was not intended to provide a statistically significant assessment of data accuracy supporting the updated application, but was instead purposed at providing valuable insight on implementation of the processes PG&E used to update the PSEP scope, the potential issues with that process impacting PSEP scope and safety, its alignment with regulatory mandates and expectations, and to

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<sup>28</sup> Included with Workpapers Supporting PG&E's Testimony Chapter 2, Gas Transmission Pipeline Modernization Program Update.

provide a greater level of context to the data presented in support of the updated PSEP application.

### **On-Site Review**

Beginning January 21, 2014, six SED engineers conducted a two-week on-site inspection of the project Workbooks and their supporting documentation. PG&E personnel responsible for creating and managing the Workbooks were available to provide clarification and answer Staff questions, as necessary. Leading up to and throughout the inspection PG&E held focused presentations on the workbook development and quality assurance processes.

The inspection consisted of 1- performing tests of critical steps in the process used to create the project workbooks; 2-reviewing the rationale behind the “deviations due to engineering judgment”; and 3- Identifying potential issues with the process that may have an adverse impact on the updated scope. In SEDs view adverse impact refers to unreasonable exclusion of high priority segments from the PSEP program.

The critical steps tested by Staff, described in detail by the Quality Assurance process contained in Chapter 3 of the testimony, include:

- Test 1 – Incorporation of Baseline Data from Original PSEP Database (QA-3 in Testimony )
- Test 2 - Segment Splits based on PFL pipeline attributes (QA-4 in Testimony)
- Test 3 – Incorporation of PFL Data (QA-4 in Testimony)
- Test 4 – Application of valid PSEP pressure test criteria (QA-4 in Testimony)
- Test 5 – Application of Decision Tree and Outcomes (QA-5 in Testimony)

While not part of PG&E’s QA plan, for each segment addressed under Test 5 Staff also reviewed the corresponding deviations, if any were applied, to ensure these were consistent with PG&E’s categorization description, were justified and reasonable considering their impact on safety and PG&E’s previous commitment to the PSEP program. This last review required a case-by-case assessment of sound engineering judgment employed by PG&E.

A sample of workbooks with revised scope based on cancelled projects and/or containing deviations that represented mileage reductions was selected as the focus of the review.

Staff spot checked supporting documents, such as hydrotest records, PSRS orders, Document 086868 (PG&E’s MAOP document of record), as-builts, and other documentation, as necessary, to verify data used to ascertain decisions. Staff also spot

checked project workbook summaries and descriptions for consistency with the project workbooks.

Staff performed the review by applying PG&E's own procedures and guidelines which permitted Staff with the opportunity to, not only identify errors in execution of the process, but more importantly to understand the impact that PG&E's approach has on the updated scope outcome and the potential safety related issues related to that approach.

Staff noted all perceived discrepancies and potential process issues and considered their ultimate impact on the PSEP scope.

Test 1 (T1) – Confirm that data integrity was preserved when importing the original database segment information into the workbooks. This data served as the basis of the project workbook build.

- Staff verified that pipeline segments and the corresponding specifications from the original PSEP database that affect decision tree outcome were properly imported into the project workbook and consistent with PG&E's process, as outlined in the PSEP Update Testimony Attachment 2B "PSEP Update Filing Workpapers Preparation" process.
  - Staff compared inclusion of route segments and their critical data fields in the workbooks against the original PSEP database.
    - Critical data fields evaluated:
      - ROUTE, SEGMENT\_NO, OD, JOB\_NO, YR\_OF\_INSTALL, FOOTAGE, JOINTEFF, GIRTH\_WELD, LONG\_SEAM, JOINT\_TYPE, SMYS, W\_THICKNESS, TEST\_JOB, TEST\_DATE, TEST\_PRESSURE, TEST\_MEDIUM, TETS\_DUR, MAOP, SMYS MOP, CLASSESENT, and HCA.

Test 2 (T2) – Confirm that segments were properly split based on the different component specifications imported from PFLs and check that the segment lengths and splits lengths add up to the total length represented in the PFLs.

- Staff checked that the length listed for each segment and split contained in the project workbooks is equal to the sum of the length of the corresponding set of features in the PFL that make up the segment or split.

Test 3 (T3) – Ensure that integrity of pipeline data critical to determine PSEP Decision Tree Outcome imported from the PFLs and Gas Map/Gas View 2.0 was preserved and that the data is accurately represented in the project workbook:

- Staff checked that pipeline specifications in the data validation workbook matched the source:
  - PFLs
    - SEGMENT\_NO, OD, JOB\_NO, YR\_INSTALL, FOOTAGE, JNTEFF, GIRTH\_WELD, LONG\_SEAM, JOINT\_TYPE, SMYS, W\_THICK, TEST\_JOB, TEST\_DATE, TEST\_PRESSURE, TEST\_MEDIUM, TEST\_DUR,
  - GasMap/GasView 2.0
    - HCA and Class Location.
  - 086868 Document
    - MOP
- For Workbooks containing a large number of segments and splits a sample size of these was tested using the sample methodology and calculator described in Section 5.3.3.5 (2) and (3).

Test 4 (T4) – Confirm that the PSEP and historical test code criteria for a valid test have been properly applied.

- Based on the workbook data validation tab, Staff verified that PSEP criteria and historical test criteria, as defined in Section 1.4 of the “Update Filing Workpapers Preparation” process, PSEP Update testimony, Appendix 2B, was correctly applied to the data produced by the process reviewed under Test 3.

Test 5 (T5) – Confirm that the approved Decision Tree has been correctly applied to define the updated outcome.

- Staff verified that the Decision Tree contained in Chapter 2 Appendix A “Pipeline Modernization Program Decision Tree” is correctly applied to validated segment data and splits contained in the project workbooks.

Deviations – If deviations were encountered through performing Test 5 these were reviewed for 1- reasonableness based on sound engineering judgment, considering the decision tree outcome, the safety impact of the deviation, PG&E’s commitment to the PSEP program, and the program’s intent; and 2- accuracy to ensure the deviation was properly categorized as described in PSEP Update Testimony Table 2-1 “Deviations due to Engineering Judgment”.

## Results of On-site Inspection

Errors found by SED were categorized based on their effect on Decision Tree Outcome, as follows:

Table 2: Project Workbooks containing Errors.

		<u>Test 2</u>	<u>Test 3</u>	<u>Test 4</u>	<u>Test 5</u>
Type 1	Error utilized a more conservative value. No impact on Decision Tree outcome.	3		2	
Type 2	Error utilized a less conservative value. No impact to Decision Tree outcome.	2	3		
Type 3	Error affects Decision Tree outcome. Error results in a more conservative project outcome.		2	1	
Type 4	Error affects Decision Tree outcome. Error results in a less conservative project outcome for projects requiring Phase 2 action.		1	1	2
Type 5	Error affects Decision Tree outcome. Error results in a less conservative project outcome for projects requiring Phase 1 action.	1*	1		1

\* Potential Type 5.

See Appendix B for detailed results. Type 4 and 5 errors have the most significant effect by resulting in a less conservative Decision Tree outcome. As Type 4 errors address errors affecting Phase 2 segments, which are currently not proposed as part of the current updated application, the discussion below is limited to Type 5 errors.

### **TYPE 5 ERRORS - (affect Decision Tree Outcome, resulting in a less conservative project outcome for Phase 1)**

#### PSEP Workbook - DFM-1816-01 2 TEST 9.17MI MP 8.44-18.25 PH1:

*Type 5 Error<sup>29</sup> - Segment 234.3-1:* The SMYS entered in the PSEP workbook does not match and is less conservative than the SMYS listed in the PFL for this segment. In turn the correct %SMYS = 35 instead of %SMYS =28 as listed in the workbook. Correcting the error results in a segment operating at over 30% SMYS and a PSEP decision tree code = M2 "Reduce Pressure and Strength Test in Phase 1" instead of M2 "Reduce Pressure and Strength Test in Phase 1" as entered in the PSEP workbook. The workbook indicates that this segment is scheduled for testing in 2014.

<sup>29</sup> Appendix B: PSEP Safety Review Results, T3 Data Assurance - Error No. 9 (Segment 234.3-1)

*Recommendation: The PFL indicates this pipeline segment was purchased from another company and installed in 1946 under Job MIR1122. PG&E should review all pipeline installed under Job MIR1122 and re-asses those segments currently scheduled for testing in 2014 for replacement instead of testing. Per the project workbook this segment is currently scheduled for testing in 2014. Breakdown of mileage installed under MIR1122 is as follows:*

	57,664	ft
Total mileage installed under job MIR1122	10.9	miles
Tested in 2012 T-096-12 (PSRS 25890)	14,498	ft
	2.7	miles
To be tested in 2014 (T-95-12 and T-94-12)	44,459.39	ft
	8.4	miles

PSEP WORKBOOK - TAPS-REPL MI PH1: (Route: DREG4872)

Unknown /Potential Type 5 Error<sup>30</sup>: The validated PSEP workbook footage for route DREG4872 appears to be missing 50ft of pipeline from the footage reflected in the PFL. The project workbook indicates that different segments under this route were either replaced in 2011, downrated to distribution, will be replaced in 2014, or require Phase 2 action.

*Recommendation: It is unclear to SED the reason behind this footage discrepancy. Due to the significant difference in validated footage this discrepancy should be addressed and resolved immediately and segments Decision Tree outcomes re-evaluated and addressed accordingly.*

PSEP WORKBOOK - L-300A 1 TEST 58.46MI MP 0.29-502.24 PH1:

Type 4/5<sup>31</sup>: The Decision Tree code reflected in the PFL is incorrect. Although these segments are located in a Class 3, the PSEP workbook incorrectly answered “no” to the question 3B of the Decision Tree “HCA or Class 2-4?” resulting in Decision Tree code C1 “Strength Test & CIS or ILI & CIS Phase 2” instead of the correct C2 Decision Tree code “Reduce Pressure and Strength Test in Phase 1. ILI, or Replace Phase 2”. Because the corrected Decision Tree code provides for Phase 1 or 2 action, this error was categorized as Type 4/5.

However, Staff also found an error<sup>32</sup> with the pressure test duration entered in the workbook for these segments, which resulted in a more conservative Decision Tree code

<sup>30</sup> Appendix B: PSEP Safety Review Results, T2 Segment Split - Error No. 12

<sup>31</sup> Appendix B: PSEP Safety Review Results, T5 Decision Tree - Error No. 2 (Segments 369.051, 369.052, 369.053)

<sup>32</sup> Appendix B: PSEP Safety Review Results, T5 Decision Tree - Error No. 2 (Segments 369.051, 369.052, 369.053)

than the information in the PFL would require. These two errors cancelled each other out resulting in the same Decision Tree code as originally entered.

It is unclear why PG&E designated these segments with a deviation code of “other” commenting that they were “Moved to Ph2 - further engineering assessment necessary”.

*Recommendation:* PG&E should provide SED with more detail on the additional engineering assessment being performed on these segments.

**Other observations:**

*Unable to determine Decision Tree outcome for segments tested in 2011 and 2012.* SED had difficulty reviewing PSEP workbooks for segments that had been hydrotested in 2011 and 2012. In order to determine correct Decision Tree results for those segments, it was necessary to use the pre-2011 pressure test information validated by the MAOP Validation Project. However, in many instances the workbooks reflected post-2011 hydrotest information and used that data to run the segments through the decision tree, resulting in an inaccurate Decision Tree. It is unclear how PG&E intended to reflect pipeline replacement and hydrotest information that occurred in 2011 and after. Although this inconsistency obscures actual Decision Tree outcome, it is not considered an operational safety issue as these segments were tested or replaced.

*Adjusted test pressures* - The PSEP workbooks often failed to use the adjusted test pressure when such data was available in the PFL. The adjusted test pressures must be used as these have been adjusted to account for elevation differences in the tested pipeline and represent the minimum pressure experienced at any point in the pipeline. Adjusted pressures are fundamentally lower than the unadjusted pressure and affect determination of whether a test is valid as outlined in Attachment 2B Chapter 2, PSEP Update Filing Workpapers Preparation (Section 1.4 – Pressure Test Requirements).<sup>33</sup> In addition to other criteria, a valid test pressure must be sufficiently high to meet requirements based on class location and MAOP of the segment.

The adjusted pressure vs. test pressure differences found by Staff ranged from 3psi to 100psi<sup>34</sup>, but did not affect the validity of the test. However, these type discrepancies could have an effect on test validity for segments running with test pressures that are very close or equal to the minimum test pressure requirement.

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<sup>33</sup> PSEP Update Filing Attachment 2B “Workpapers Preparation” Section 1.4, Chart describes the requirements for valid pressure tests based on class location and pressure test data.

<sup>34</sup> Appendix B: PSEP Safety Review Results, T3 Data Assurance - Error No. 4 and Error No. 1 Segment 218.6-1.

Route BD143 and DRIP10897 - "Historical Test Met Code Only" Deviation incorrectly applied.

This deviation code was generally used by PG&E to defer certain segments beyond Phase 1 due to the existing pressure test records meeting historical test requirements even though PSEP test requirements were not met<sup>35</sup>. In PG&E's view, these are lower priority segments.

For the segments and routes listed in the table below, PG&E incorrectly applied the "Historical Test Met Code Only" Deviation based on the premise that the existing pressure test records met historical test code. However, the Updated PSEP database indicates that these segments have no hydrotest records at all. Although the validated phase for these segments indicates C3 Decision Tree code action "Strength Test and CIS or ILI and CIS in Phase 2" the validation comments in the Updated PSEP database indicate that at some point it was decided that these segments would be in Phase 2.

ROUTE	SEGMENT_NO	DV_TESTJOB	T_MET_CODE	DV_PHASE_D
BD143	601-1	NO RECORD	N/A	HISTORICAL TEST MET CODE ONLY
BD143	601-2	NO RECORD	N/A	HISTORICAL TEST MET CODE ONLY
DRIP10987	601	NO RECORD	N/A	HISTORICAL TEST MET CODE ONLY
DRIP10987	602	NO RECORD	N/A	HISTORICAL TEST MET CODE ONLY

Recommendation: PG&E may not defer the segments referenced above based on the deviation category it applied and must demonstrate precisely when and how Phase 2 will address these segments.

## Findings and Recommendations:

### 1. PSEP Scope Update:

- 1.1. PG&E limited the scope of the Updated PSEP Application to only the segments identified in the original filing.

With limited exceptions, the MAOP Validation results were evaluated and incorporated into the PSEP program only for pipeline segments that were part of the original PSEP proposal.

As the MAOP Validation Project has been completed, it is possible that segments exist in PG&E's transmission system which have not been included in the updated application, but that lack valid pressure testing records and potentially met Phase 1 PSEP criteria. PG&E has

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<sup>35</sup> Chapter 2, Table 2-1 "Deviations Due to Engineering Judgment", item 9, PG&E Updated PSEP Testimony

explained that it considers those segments as outside of PSEP scope and indicated that in its 2015 GTS application PG&E is proposing a new set of decision trees to address the pipeline hydrotesting and replacement priorities based on a more holistic risk assessment approach to prioritizing that will not plan PSEP work separately from Base work<sup>36</sup>.

At SED’s request PG&E conducted a preliminary query of the MAOP validation results which indicate that the following miles of pipeline potentially do not have valid test records and are not currently in the Updated PSEP Application:

CL 3&4 and HCA CL 1&2	Miles
1. All segments >30pct SMYS	40.9
2. All segments 20>=SMYS>=30pct <1.0JF	2.2
3. All segments >=20pct SMYS	62.1

Non-PSEP potential Phase 1 = M4 Decision Tree Code (Replacement)	Miles
1.a) Pre 1970’s Segments >30pct SMYS<1.0JF	11.4

Ideally, as the MAOP Validation Project evolved, PG&E should have been continually updating its PSEP database to incorporate and re-prioritize all priority Phase 1 segments,.

For example, instead of replacing certain segments in Phase 1 which did not require Phase 1 action or PSEP action at all, such as the segments listed in the table below for Route 1607-01, for which the updated PSEP database indicate valid pressure records exist and comments indicate that Phase 1 replacement was recommended to increase capacity.

ROUTE	SEGMENT_NO
1607-01	104.2-1
1607-01	104.3
1607-01	104.8-1
1607-01	104.8-2
1607-01	104.8-3
1607-01	104.8-4
1607-01	105.2-2

*Recommendation:* PG&E should be required to demonstrate how and when it plans to address those potential Phase 1 segments included in the tables above. The scope and prioritization of the new programs proposed in the 2015 GTS rate case must be equivalent or more conservative than the one already authorized through the PSEP Decision Tree.

<sup>36</sup> Base work refers to work included and authorized through the Gas Transmission and Storage Rate Cases.

1.2. Phase 2 of PSEP will be incorporated into the 2015 GT&S Rate Case.

Pipeline segments requiring Phase 2 action have been rolled into the 2015 GTS rate case filing. PG&E has indicated that it has developed new prioritization criteria and will not be using the approved PSEP Decision Tree for Phase 2 segments.

Recommendation: As with Phase 1 segments not currently addressed by PSEP, the new prioritization proposed in the 2015 GT&S rate case must be comparable or more conservative than that approved for the PSEP Phase 2 filing.

## 2. Decision Tree Implementation

2.1. PG&E's application of the Decision Tree, as presented in the workbooks, appears to have eliminated a branch of the tree under the Fabrication and Construction Threats outcome.

Decision Tree point 2B was intended to identify the presence of non-standard fittings<sup>37</sup> on pipeline segments, which following an engineering evaluation, could require pipeline replacement in Phase 1 or 2 of PSEP (Decision Tree code F1). PG&E's process for determining PSEP scope assumes that no such pipe fittings exist in its system by systematically answering "no" to point 2F, effectively eliminating the entire branch from PSEP scope.

Recommendation: PG&E should be required to justify this elimination and to demonstrate how it has and how it will continue to address segments that would have fallen under that PSEP outcome. This must be aligned with the approved PSEP Decision Tree.

## 3. Valid Pressure Test

3.1. The PSEP criteria PG&E developed to validate pressure test records is inconsistent with and in some regards less conservative than that applied for MAOP Validation purposes.

Although PG&E's PSEP criteria<sup>38</sup> for a valid pressure test appears to be more stringent than meeting the historical code requirements at the time that the test was conducted, primarily due to requiring a witness for pre-1970's tests, the criteria fails to consider the quality codes assigned to records by the MAOP Validation Project. The quality codes developed and assigned to test records by the MAOP Validation project did not indicate whether test records meet its definition of traceable, verifiable, and complete.

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<sup>37</sup> "Wrinkle Bends, Miter > 3 degrees, Dresser Couplings, Expansion Joints, Non-Standard Fittings, Excessive Pups" Decision Tree point 2B.

<sup>38</sup> Section 1.4 "Pressure Test Requirements", Attachment B, PG&E Updated PSEP Testimony

For example, records with an assigned quality code of Q13 only represent design intent and do not indicate whether a test was actually performed. These documents should not be considered valid pressure tests.

PG&E description of Q13 records:

Q13	Design Packages, Approved for construction	Represents remote or obscure observation
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Example: Workbook WPZ\_TAPS-REPL PN PH1 - Route DFDS3638:

- 24.5ft of pipeline installed in 1968, Class 3 location, with Q13 Strength Test Pressure Report indicating that test met historical code.
- Workbook indicates that projects addressing segments 103-1 and 104-1 were cancelled due to these segments meeting historical code under the “HISTORICAL TEST MET CODE ONLY”<sup>39</sup> deviation.
- Intent to conduct a pressure test does NOT mean that a test was conducted.

PG&E Updated PSEP database for DFDS3638 Segments 102-1,103-1, & 104-1:

ROUTE	SEGMENT	DV_TEST	TEST_PR	MEDIUM	RTEST_DU	FWITNESS	Q_CODE	T_MET_COD	T_MET_PSEP
DFDS363E	102-1	12/5/1968	1175	WATER	24.3	YES	Q13	YES	NO
DFDS363E	103-1	12/5/1968	1175	WATER	24.3	YES	Q13	YES	NO
DFDS363E	104-1	12/5/1968	1175	WATER	24.3	YES	Q13	YES	NO

Recommendation: PG&E should consider document quality in its criteria for validating pressure tests. Low quality documents that do not represent an actual performed test and should not be used as valid test documents (i.e. documents representing intent - design packages). Tests must at a minimum, meet the traceable, verifiable, and complete criteria adopted for validation of MAOP.

#### 4. Deviations

##### 4.1. SED was unable to confirm proposed PSEP Downrates.

In order to reduce the scope of the updated PSEP application, PG&E selected to downrate approximately 14 miles of PSEP covered segments by reducing their pressure to under 60 psi and reclassifying as distribution pipeline<sup>40</sup>. SED did not have the adequate information available to verify the status of these downrates and confirm that these have been performed.

<sup>39</sup> PSEP Update Testimony Chapter 2, Table 2-1 "Deviations Due to Engineering Judgment"

<sup>40</sup> PSEP Update Testimony, Chapter 2 p.2-18.

*Recommendation: PG&E should be required to provide valid documentation verifying the status of all the PSEP transmission pipeline downrates, as indicated in the Updated PSEP database, and to provide a schedule of the downrates it has yet to perform.*

## **Conclusion**

SED reviewed the MAOP Validation Project with the intent to gain an intimate understanding of the criteria, process, implementation, records, and data used by the operator to validate the MAOP of its transmission system and confirm its alignment with regulatory requirements and expectations. This review exposed SED to whole new level of understanding of the massive effort behind PG&E's MAOP Validation efforts, and in turn also gained an in depth understanding of the data used to update the PSEP scope.

Aside from the exceptions detailed in this report, SED learned that PG&E's validation of MAOP was generally consistent with the CPUC's requirements under D.11-11-017, D.12-12-030, and Res L- 410. However, SED has also confirmed that:

- the PFLs utilized to validate MAOP are not a perfect product;
- PG&E does not have traceable, verifiable and complete records for every pipeline component in its transmission system; and
- not every component in PG&E's transmission system has been pressure tested or has records of a valid pressure test, including pipeline installed post-1970's.

These findings come are not surprising, as these have been previously acknowledged by the operator, and as expected by the natural gas pipeline industry and experts, "it is not uncommon for operators to have incomplete or inaccurate data about attributes of portions of their pipeline system .... particularly for systems built prior to 1970<sup>41</sup>". However, PG&E's search and review of over 3.5 million records to support the MAOP of its transmission system and account for almost half a million features contained in over 12,000 PFLs is an unprecedented effort resulting in a substantial improvement over the previous system of record. This effort provides a level of detail not previously available and much can be learned from it. The opportunity for deeper understanding of PG&E's transmission system can greatly contribute towards improved decision-making impacting the safety and integrity of the system beyond validation of the MAOP.

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<sup>41</sup> "Pressure testing and recordkeeping: reconciling historic pipeline practices with new requirements", by Michael J Rosenfeld, Kiefner & Associates, Worthington, OH, USA, and Rick W Gailing, Sempra Utilities, Los Angeles, CA, USA, February

That said, much work still remains to ensure the continued improvement of the data quality gathered through the PFLs to ensure that it accurately reflects the transmission system in the ground. PG&E should diligently engage in continued efforts to improve the quality of pipeline data gathered through the PFLs and ensure the judiciousness of the conservative assumptions applied as an interim measure. SED intends to maintain its close involvement with the process.

In terms of the Updated PSEP scope, SED also learned that:

- the workpapers supporting the application are not error-free;
- updating of the PSEP scope is not entirely consistent with SED expectations; and
- there is Phase 1 PSEP work that has been deferred beyond 2014 by the operator.

However, no imminent safety concerns arose from SED's review. SED's observations should not delay the continuation of the PSEP program especially considering that the program's first Phase is set to conclude at the end of 2014.

Ultimately, there is still a lot work ahead beyond the first phase of PSEP and PG&E must continue working towards operating a transmission system that has been fully pressure tested as mandated by regulation. Much attention must be paid to PG&E's 2015 Gas Transmission and Storage Rate Case, currently before the CPUC, to ensure PG&E's continued progress towards complying with the CPUC and State of California's order ending historic exemptions from pressure testing for natural gas transmission pipeline is consistent with all applicable regulatory requirements and expectations. SED intends to continue its close oversight of the progress and implementation, and expects that PG&E will continue its full cooperation with Staff to ensure a continued safe and efficient implementation of the mandates.

## Appendix A

### SED Safety Review Results: MAOP Validation Project

Result No.	PFL	Feature ID	Feature Type	Error Description/Comment	Category	PFL Impact	Recommendation
1	150_MP4.700-18.09--_16May13	499	Pipe	Test Pressure value was entered incorrectly. STPR documents indicate strength test pressure of 96 psig instead of the 960 psig entered in the PFL. STPR is qualified as Q12 and the PFL considered this record a valid test.	Incorrect Input (test pressure) Incorrect Test Validation	Type 4	PFL must be revised to reflect the corrected test pressure and recalculate the test supported MAOP. STPR was qualified as Q12 which does not meet PG&Es criteria for a valid test and should not be used to validate MAOP, thus error did not affect MAOP. This may raise issues for PSEP.
2	U_DRIP_201202270825_R150_15APR13	15	Pipe	FVE assumed a WT = 0.22" which is less conservative than the assumption of WT = 0.188" that would result from using the PRUPF.	PRUPF Missapplication	Type 4	PG&E asserts that this was based on an old iteration of the PRUPF which suggested a less conservative value. The PRUPF has undergone several iterations and the PFLs have not been updated to reflect changes. PG&E must ensure to update all of the pipeline features in its system based on the latest PRUPF
3	100_MP138.43-150.13_9May13	13863	Field Bend	Source document used to establish seamtype not referenced for this feature. Seamtype was taken from H-form referenced in adjacent feature, which is more conservative.	Untraceable	Type 2	In order to maintain traceability, all documents used to establish feature characteristics must be referenced and included in the PFL.
4		13925	Pipe	Source document used to establish seamtype not referenced for this feature.	Untraceable	Type 2	Seamtype selected is more conservative. In order to maintain traceability, all documents used to establish feature characteristics must be referenced.
5	200A-2_MP0.0000-1.0001_15Jun13	44	Drip-Ext Tap	FVE incorrectly references certain source documents to establish WT and seam type for feature. WT and seam type are not specified in that document.	Untraceable	Type 2	PG&E has indicated that it did not consider taps as part of MAOP validation.
6		49	Pipe	Conflicting documents. A less conservative seam type (seamless) selected although conflicting documents indicated the potential for SSAW. FVE for adjacent feature (No. 47), installed under the same job, identified the document conflict and applied the more conservative seamtype, however, FVE failed to follow the more conservative seamtype selection for this feature.	Conflicting documents - Less conservative value	Type 4	PG&E must ensure to review and select the conservative feature specification, consistent with the remaining features.

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### SED Safety Review Results: MAOP Validation Project

Result No.	PFL	Feature ID	Feature Type	Error Description/Comment	Category	PFL Impact	Recommendation	
7	SP3_MP167.28 02- 198.6800_201 2-09-22	2413	Pipe	Installation date is untraceable to supporting documents referenced for these features.	Untraceable	Type 2	Although installation date is not considered a "critical" feature attribute by PG&E, PRUPF assumptions are fundamentally based on these dates and the traceability of the values is equally critical to other data affecting MAOP calculations. PG&E should designate this a "critical" attribute.	
		2414	Mfg Bend					
		2415	Pipe					
8		SP3_MP167.28 02- 198.6800_201 2-09-22	2416	Pipe	Features contain record-supported WT = 0.26" and OD =26". The minimum recommended wall thickness for 26" pipe suggested by Table 5 of the PRUPF is WT = .281" which is less conservative than the actual WT for these features, indicating that the PRUPF's suggested assumptions for 26" pipe are not sufficiently conservative.	Incomplete PRUPF	Other	PG&E must revise its PRUPF to incorporate consideration of this instance of WT, and thoroughly review its records to ensure all actual minimum values are incorporated into its suggested assumptions.
			2417	Field Bend				
			2418	Pipe				
			2420	Pipe				
9		SP3_MP167.28 02- 198.6800_201 2-09-22	2297	Tee	(1) Conflicting, untraceable, and unsupported resolution of unknowns. FVE rationale indicates that WT and SMYS are based on assumptions (designated by a "1" under SMYS and WT rat'n'l columns) but FVE later contradicts this rationale by stating that the values are record-supported and not assumption based (indicated by "FSD"/Found Supporting Documents under the FVE "category" column) . The records referenced do not support the values established by FVE nor does the PRUPF. (2) Column AW indicates that this component was "purchased from other Company" and installed by Stanpac . The SMYS value of 52,000 psig established for this feature is considerably less conservative than the PRUPF suggested value which, per subsection 2 "pipe in system purchased from others" of the procedure, requires the "absolute minimum value" of 24,000 psi be assumed or that a field assessment be conducted.	Untraceable resolution of unknowns. Less conservative value - resolution of unknowns.	TBD	"FVE must categorize each assumption that is made" (PGE PFL Build QA procedure). SED believes that is an important element to maintain traceability. PG&E must reconcile assumption category and document the rationale used to resolve the unknown specifications of this feature and all other like features in this PFL with untraceable FVE assumptions. PG&E must also ensure that adequate and traceable documentation of the feature-specific rationale is included in the PFLs. PG&E should have required more robust explanation of the feature specific logic behind establishing critical information, for both assumptions and record -based specifications. This is particularly important considering PG&E's "case-by-case" approach to evaluating unknowns that deviate from suggested values contained in the PRUPF, particularly its treatment of pipeline it considers "Joint Ventures" such as Stanpac lines.
10	0618- 05_MP0.0000- MP1.4000_RX6 926_06JAN12	9	Pipe in Road	FVE assumed a WT = 0.188" which is less conservative than the assumption of WT = 0.156" that would result from using the PRUPF.	PRUPF Missapplication	Type 4	PG&E asserts that this was based on an old iteration of the PRUPF which suggested a less conservative value, explaining that PRUPF has undergone several iterations and the PFLs have not been updated to reflect them. PG&E must ensure to update all of the pipeline features in its system based on the latest PRUPF	
11	0618- 05_MP0.0000- MP1.4000_RX6 926_06JAN12	11	Pipe in Road					

## Appendix A

### SED Safety Review Results: MAOP Validation Project

Result No.	PFL	Feature ID	Feature Type	Error Description/Comment	Category	PFL Impact	Recommendation
12	021F_MPO.000 Q- 21.1600_23SE P12	1028.6	Pipe	PFL lists incorrect OD = 12.75". Records support an OD = 16" (41600067s6_DRWG-BOM_30895613_021F.pdf)	Incorrect Input (diameter)	Type 4	PFL must be revised to incorporate the correct OD =16" for this feature and any other feature impacted by that correction. PFL and MAOP per design should be reduced from 1272 psig to 1014 psig. MAOP of R is 500 psig so no impact to validated MAOP is expected.
13		57	Mfg Bend	Feature not called out in supporting STPR documents	Diminished Traceability	Type 2	PG&E should add feature call-out to ensure and maintain traceability of features consistent with its own traceability policy.
14		65	Pipe	Source documents depict conflicting information for SMYS . Less conservative SMYS based on Mtrl Code was selected. Requisition description (1) says 42000 SMYS, design criteria on drawing (2) says 42000, plat map (3) adjoining pipe says 42000 SMYS, but material code spec on the requisition says 52000 SMYS. PFL builder chose 52000, rather than being conservative and using 42000. (1)MAOP03085831.JPG (Q3); (2)386171s4 (Q4) (3)MAOP03085846.JPG (Q3);	Conflicting documents - Less conservative value	Type 4	PG&E should revise PFL to incorporate the more conservative SMYS value of 42,000 psig for this feature and for any other feature where the same less conservative rationale was applied to establish SMYS based on these documents. This is consistent with PG&Es own general policy to select the most conservative value when conflicting documents of same quality exist and guideline 1.9 of AKM-MAOP-415G "Use of Material Historical Material Codes" for conflict between material code and material description in construction drawings. New DP@100% SMYS = 1,647 psi, MAOP-D = 824. No reduction in MAOP necessary as MAOP of R = 500.
		67	Pipe				
		69	Pipe				
	71	Pipe					
		73	Pipe				
15	420_MPO.0000- 0.0273_27DEC 11	1.0	Pipe	Image B-MAOP00190344, incorporated as part of the STPR package referenced for this feature, corresponds to a different pressure test not applicable to this feature.	Incorrect Source Documents	Type 2	PG&E must ensure to remove the incorrect document and include the correct STPR image for this feature.
16	050A_MP2.55 00- 45.0500_07SE P12	274.4	Type B Sleeve	FVE validated MAOP based on documentation ("Hform MP 6.27") that is not included/referenced for this feature. Approximately 790 features in this PFL validate MAOP based on this missing supporting document.	Untraceable	Type 2	PG&E must ensure that document traceability is maintained throughout the P Affects 791 features.

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### SED Safety Review Results: MAOP Validation Project

Result No.	PFL	Feature ID	Feature Type	Error Description/Comment	Category	PFL Impact	Recommendation
17		20.5	Pipe	The PFL says 0.322 WT, but the reference document says .250 WT. It appears that the call out box for Feature 20.5 incorrectly points to Item No 1 instead of Item No 2.	Diminished Traceability	Type 2	In order to maintain traceability, all documents used to establish feature characteristics be correctly referenced.
18	050A-1_MPO.0000-2.8700_06Feb12	87	Pipe	Unable to trace WT denoted as "record-based" to a supporting document. PG&E explained that "in the notes" outside of the PFL the builder assumed that this pipe was a transition to the bends. This rationale is not traceable in the PFL.	Untraceable	Type 2	In order to maintain traceability of specifications critical to establishing MAOP, the rationale and assumptions must be clear in the PFL.
		95	Pipe				
		97	Pipe				
		100	Pipe				
19	181B_MPO-10.8492_9May12	65	Pipe	Incorrect MAOP of R and Class location Strength Test Factor. MAOP of R (400 psi) does not match and is less than the actual MAOP of R for this line based on PGE's document of record for MAOP (Document 086868 ). Class location Strength Test Factor used (1.5) is greater than the code required factor at the time (1.25). Based on correct MAOP of R and strength test factor the MAOP of 500psi cannot be validated and must be reduced to 418 psi.	Incorrect Input (MAOP of R and Class Location Strength test factor)	Type 5	PG&E must reduce the MAOP for this feature and any other feature affected to the limiting MAOP, and revise the PFL in question. PG&E has reduced the MAOP for this portion of Line 181-B, and SED is currently reviewing the pressure reduction, revised PFL, and supporting documentation for the new MAOP. Test Factor also incorrect (more conservative)
20	1013-02_MPO.0000-0.0000_10JUL12	2.0		Q12 STPR was used to establish an STPR supported MAOP of 400 psi (Column EH). Consistent with PG&E policy, these poor quality documents (Q8 and below) are not valid and may not be used to establish MAOP. STPR supported MAOP should be "N/A"	Incorrect Test Validation	Type 4	PFL should be revised to reflect that the STPR is not valid to support MAOP, indicated by should be "N/A" for STPR supported MAOP.
		3.0					
		4.0					

# Appendix B

## SED Safety Review Results - PSEP Update

### Error Summary

Summary of errors T2 - Segment		Summary of errors T3 - Data		Summary of errors T4 - Pressure Tests		Summary of errors T5 - Decision Tree	
Splits	No.	Assurance	No.		No.		No.
Type 1	3	Type 1	0	Type 1	2	Type 1	0
Type 2	2	Type 2	3	Type 2	0	Type 2	0
Type 3	0	Type 3	2	Type 3	1	Type 3	0
Type 4	0	Type 4	1	Type 4	1	Type 4	2
Type 5 (potential to be confirmed)	1	Type 5	1	Type 5	0	Type 4/5	1
Unknown	2						
<b>Total</b>	<b>8</b>	<b>Total</b>	<b>7</b>	<b>Total</b>	<b>4</b>	<b>Total</b>	<b>3</b>
Type 4 and 5	1	Type 4 and 5	2	Type 4 and 5	1	Type 4 and 5	3

Error No.	PSEP Project	T2 (Segment Split) Error		T3 (Data Assurance) Error		T4 (Hydrotest) Error		T5 (Decision Tree) Error	
1	L-300A_2 TEST 21.67MI MP 230.32-490.59 PH1			Did not use Adjusted Test Pressures from PFL (Segs 218.1, 218.6-1, 220.5-1, 250.5-1, 395.31)	Type 2	Test information (Validated TEST JOB, PRESSURE TEST_DATE, MEDIUM, TEST_DURATION) between the workbook and PFL don't match. (Seg 395.6-1)	Type 3		
2	L-300A_1 TEST 58.46MI MP 0.29-502.24 PH1			Workbook Hydrotest duration (6.1hrs) does not match PFL (8.1 hrs). (Segs 369.051, 369.052, 369.053)	Type 3			Incorrect DT Code. Should be C2 instead of C1. C2 may be Phase 1 or 2 action. (Segs 369.051, 369.052, 369.053)	Type 4/5
3	L-300B_1 TEST 59.49MI MP 0.00-502.64 PH1	Footage doesn't match with PFL (PSEP DV = 65' rather than PFL (feature # 24207) = 74.3'). As a result total footage doesn't match. Total PSEP = 169' rather than Total PFL = 178.3'. (Segs 258.1-3)	Type 2					Incorrect DT Code. Should be C4 instead of C7. (Segs 258.6, 258.7, 258.9, 260.12-1, 264.2, 264.4)	Type 4
4	L-131_1 TEST 4.41MI MP 42.35-57.47 PH1	The footage doesn't match with PFL (PFL = 691.2' rather PSEP DV = 690'), as a result the total footage doesn't match (Total PFL = 760.4' rather than Total PSEP DV = 759.2')	Type 2	Test Pressure: PFL = 911 psi PSEP = 914. PSEP did not use adjusted test pressures. (Segs 182-2, 182-5, 192.9, 186.3, 187.7, 190.5)	Type 2				
5	L-118A TEST 1.30MI MP 0.00-58.74 PH1	4 additional splits are necessary due to SMYS and WT differences (Segment 126-2). Unable to determine consequence of error.		Unknown		Length on PSEP workbook does not match PFL, is 2 feet section untested (Segs 200.4)	Type 1	Incorrect DT Code. Should be C5 instead of C6. (Segs 101.507, 200.4, 201.2)	Type 4
6						Marked as validated test in workbook when should not have been. (Segs 200.8, 201.3, 201.6-1, 201.9, 202-1, 202-2).	Type 1		

## Appendix B

### SED Safety Review Results - PSEP Update

Error No.	PSEP Project	T2 (Segment Split) Error		T3 (Data Assurance) Error		T4 (Hydrotest) Error		T5 (Decision Tree) Error
7	L-153_1 TEST 17.35MI MP 0.00-22.87PH1	3 additional splits are necessary because of different SMYS (35k & 50k). Unable to determine consequence of error.(Seg 135.6-4).	Unknown	Validated TEST_DUR_R mismatch between workbook and PFL. Segments tested in 2011 hydrotest.(Segs122.6; 123; 123.2; 123.4; 123.6; 124).	Unknown	Workbook shows this test as having a valid witness but PFL indicates no valid witness. (Segs 142.3-1, 142.3-2, 142.6, 142.9)	Type 4	
8				Incorrectly shows test as meeting code and PSEP criteria. (Segs 123.2; 123.4)			Type 4	
9	DFM-1816-01_2 TEST 9.17MI MP 8.44-18.25 PH1			SMYS doesn't match PFL. (% SMYS PFL=35 but %SMYS PSEP=28). PSEP DT should be = M2 instead of M4. (Seg 234.3-1)			Type 5	
10	L-021F REPL 4.24MI MP 0.00-21.16 PH1	Unnecessary split (Segs101.3-1 & 101.3-2; 150.7-3 & 150.7-4)	Type 1					
11	L-191 REPL 1.97MI MP 0.07-6.47 PH1	12 ft is missed in PSEP as a split by itself, rather included with Seg 130.5. Appears to be a cut out from 2011 Hydrotest (new pipeline). Not a safety concern. (Seg. 130.2-1)	Type 1					
12	TAPS-REPL MI PH1	DREG4872: The footage doesn't match with PFL (PFL=99.5' but PSEP DV=49.5'), hence total length in PSEP is off by 50'. (Total PFL=115.4' & Total PSEP DV=64.5'). Unable to determine the consequence of this error.	Unknown/ Potential Type 5					
13	L-109_2 REPL 4.65MI MP 0.49-16.93 PH1	Unnecessary split (Segs133.6-1 and 133.6-2)	Type 1					
14	L-191-1 TEST 10.07MI MP 9.59-35.83 PH1			PFL lists test pressure as 1041 psi. PSEP lists as 1059 psi. PSEP Did not use adjusted test pressure. (Seg.106)			Type 2	