Quality Management Overview

Background & Purpose:

Quality assurance (QA) and quality control (QC) are essential tools used by Gas Operations in achieving Gas Safety Excellence and complements the overall Gas Asset Management Policy (see Attachment A) that is committed to the safe, reliable, affordable management and operation of PG&E's gas assets for its customers, the public, and its employees. It is an integral part of implementing the "Plan, Do, Check and Act" approach that is foundational in the gas asset management framework associated with PAS 55[1]. The purpose of this document is to describe the Quality Management Framework including QA and QC that is being implemented within Gas Operations at PG&E.

Quality Assurance and Quality Control Defined:

Quality Control (QC): Quality Control of a process provides a secondary check on a specific work task or tasks to ensure the required specifications for that task are met. This enables defects to be identified, corrected, and prevented in real-time.

Quality Assurance (QA): Quality Assurance measures the effectiveness of the Quality Control check points by conducting tests separate from QC after the QC controls are in effect. As an augmentation to QC, the goal with QA is to test (or audit) a process and its output in order to ensure overall results achieve the desired level of product quality. QA also involves assessing the execution activities during the design of a process, in order to identify risks and implement the proper controls and testing.[2]

Quality Management in Gas Operations:

The desired approach for achieving quality is to define quality requirements when a project or process is being developed and incorporating these requirements into a well written procedure. Complementing these requirements is ensuring that sufficient resources of trained and competent employees or contractors are available to perform the work. Adequate controls or QC checks are incorporated into the design including the appropriate quality assurance checks in the form of testing or in the form of

[1] Published by the British Standards Institution, Publicly Available Specification (PAS) 55 is a standard for optimal management of physical assets. This standard gives guidance and includes a 28-point requirements checklist of good practices in physical asset management; typically this is relevant to gas, electricity and water utilities, road, air and rail transport systems, public facilities, process, manufacturing and natural resource industries.

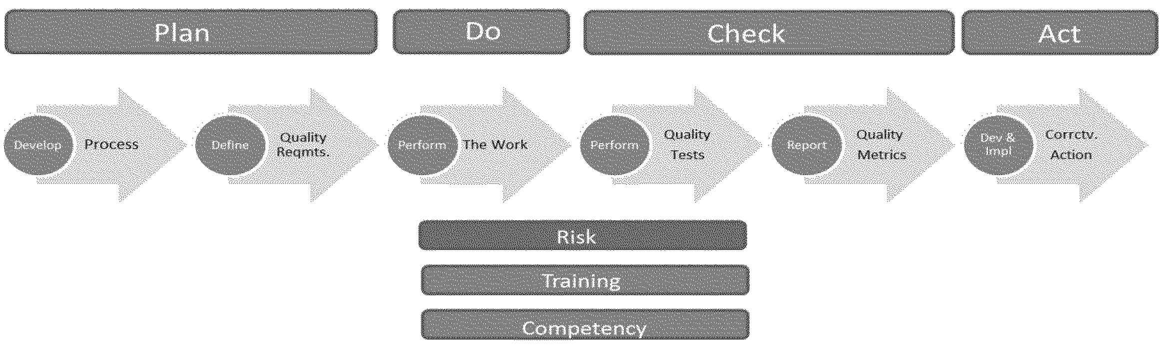
[2] Project Management Institute, Inc., defines QA as: "The process of auditing the quality requirements and the results from quality control to ensure that appropriate standards and operational definitions are used," Project Management Institute (PMI), 5th Edition PMBOK Guide–Chapter 8: Project Quality Management.

audits occur to ensure that the controls are effective. Deficiencies identified are resolved in real time (to the extent possible), minimizing rework, and corrective actions are implemented as continuous improvement. The level of effort and testing requirements is a function of risk and may vary depending upon the process or function. Below is a summary of this approach.

Quality Management Framework

1) Develop clearly written procedures, standards, or processes that are easily understood.
2) Define requirements for quality including testing design for quality.
3) Perform the work including tests for quality.
4) Report results as quality metrics or scorecards.
5) Develop and implement corrective actions based on results.

Implementation is based on risk. Employee and contractor training and competency are foundational requirements for ensuring a quality outcome and are subject to continuous improvement.



Most gas operations processes are existing processes, but we are continually making updates to the standards and procedures that define those processes so that they are clearer, are linked to implementation of qualification and training requirements, and identify controls to ensure that compliance and quality is achieved.

We have also developed Quality Control assessments for the field work for several key high risk areas designed to assess the conformance to specific quality or compliance elements. In addition to scope, objective and approach, the following elements are typically identified for each assessment program:

- Compliance requirements or regulatory commitments.
- Statistical method to employ (statistical quality control or statistical process controls).
- Methods that may be used to select samples for assessment.
- Key QC control points that must be measured during assessment.
- Qualifications, experience, and position of the person performing the assessment.

- Specific tasks that must be performed before and during the assessment.
- Predefined findings that are deemed a major non-conformance, based on risk.
- Equipment required to perform the assessment.
- QC assessment checklist specifically for the process or product being assessed.
- Required documentation.

Attached is an example checklist that describes the items that the QC assessor scores in a QC assessment for the Locate and Mark process (see Attachment B for Locate and Mark QC Checklist). Below are the QC programs that are implemented or in progress:

QC Program	Status	Description
Field Services	Operational since the 1990's	Performs in field quality control reviews of Gas Service Rep completed tags including customer appliance inspections and leak investigations
Leak Survey	Operational since 2009	Measures the quality of the leak survey maintenance process and whether any hazardous leaks were missed
Leak Repair	Operational since 2009	Evaluates completed leak repairs for the presence of gas typically 90 days post repair and checks zero'd out leaks
Locate and Mark	Operational since 2011	Validates and scores quality for completed locate and mark tags including "no conflict' tags
Transmission Construction	Operational since 2011	Focuses on measuring the quality of transmission construction work performed by PG&E employees and contractors as the work is being performed
Distribution Construction (Re-Dig)	Operational since 2013	Focuses on measuring the quality of short cycle distribution installation and leak repair work performed by PG&E employees and contractors after the work has been completed
Distribution Construction	Pilot underway	Focuses on measuring the quality of distribution construction work performed by PG&E employees and contractors as the work is being performed
Rotary Meters	Pilot Completed 2013	Pilot completed Q2 2013 - To be fully implemented by year end 2013
Corrosion Control	Pilot Completed 2013	Pilot completed Q3 2013 – To be fully implemented starting 2014
Regulator Station Maintenance	Pilot starting Q4 2013	Pilot starting Q4 2013 – to be fully implemented starting 2014
Valve Maintenance	Pilot starting Qr4 2013	Pilot starting Q4 2013 – to be fully implemented starting 2014

As additional quality assurance, we are employing an audit program that assesses compliance with requirements for: safety, system reliability, business operations, regulatory compliance and PAS 55-1 (See Attachments C, D, E, & F for Gas Operations Auditing Standard and associated Procedures) where observations or nonconformances are included in Gas Operations' Corrective Action Program (See Attachments G & H for Gas Operations Corrective Action Program Standard and Procedure) and improvements are made to resolve the root causes of the areas identified and often identify the need for additional controls including process change or need for additional training or qualification.

The most distinct example of Gas Operations' implementation of the Quality Management Framework and rigorous QA approach is in a number of new processes that were developed in project implementation including MAOP validation and Pipeline Centerline Survey. The "Quality Assurance Plan for PFL Build" is an example of the plan developed for MAOP Validation (see Attachment I). The team also developed a "Data and Document Migration project QA implementation "Playbook"" (see

Attachment J) that is applied to all data migration and consolidation projects. A detailed description of the QA program design and approach being utilized for these projects is below. This approach will also be expanded so that it is applied to business processes such as Leak Survey, Leak Repair and other relevant processes.

QA Program Design and Implementation Approach:[3]

In order to independently determine whether results meet the desired level of quality, the QA function follows a disciplined approach to design and execute process assessments and associated tests. The process for designing and implementing these quality activities follows the phases summarized below:

- Define Project or Process Requirements for Quality
- Perform Quality Assessment
- Design Quality Testing
- Perform Quality Testing

In order to assess where potential defective outputs are most likely to occur, the process, standard or procedure is reviewed including sequencing and "handoffs" between each step and anticipating where defects are most likely to occur. Checks and testing can be implemented to protect the output from these potential defects.

Define Project or Process Requirements for Quality

This phase focuses on a review of the information that describes the project goal (or mission) or process deliverables or standard requirements. This step consists of the collection of prerequisites associated with the process and tasks that will be executed. These processes describe how personnel will coordinate efforts to achieve the project goals or process deliverables and contains:

- A definition of the process output.
- A description of the activities undertaken to deliver the process output (procedure).
- A depiction of the sequencing, handoffs and quality control points within those processes (process map).

This information serves as a set of prerequisites for quality activities and these details are required for testing and oversight activities to be based on the correct success criteria or expected deliverables.

Perform Quality Assessment

This phase focuses on the assessment of the processes and identification of the potential risk areas where quality testing should be implemented specific to the expected project or process output(s). The QA team reviews the following as they apply to a particular process output:

[3] The elements of this approach were designed and implemented by PG&E for PG&E processes, utilizing elements of other industry standard approaches such as: PDCA (plan-do-check-act) and DMAIC (Define, Measure, Analyze, Improve, and Control). For a similar approach to QA program implementation by other large organizational users, see U.S. Environmental Protection Agency document "Guidance for Developing Quality Systems for Environmental Programs," EPA QA/G1, November 2002.

- The quality standards and policies associated with the project or process.
- The details of the project's success criteria or process output requirements.
- An analysis of the processes to determine where opportunities for defects exist.
- An understanding of the QC control points embedded within the processes.

The results of this assessment form the foundation of understanding the potential exposure to defects, and allows for the appropriate design of a robust QA testing process.

Design Quality Testing:
This phase focuses on the technical aspects of the design and implementation of the QA testing activities. Included within this phase of the activity are the specific testing procedures, the definition of "defect" versus "defective," the sampling approach and rationale, and a definition of the Acceptable Quality Limits (AQL).[4] The design of specific QA test(s) generally follows the process described below:

- Define the step in the process where a requirement is met (or accomplished).
- Define how the process output will be assessed and measured against the success criteria or requirements.
- Use the success criteria to establish the definition of "defect" and "defective."[5]
- Define the steps for identifying the sample populations(s).
- Define specific steps for conducting the test.
- Define the protocol for sharing observations and validating results with the process owners.
- Define the process for reporting results and assessing the "health" of the process. These may be in the form of metrics.

The design of the detailed QA testing procedures completes this phase of activity. The testing procedures include a detailed description of which component of the product will be evaluated, along with a detailed definition of the source data or standard the product will be compared to for accuracy and completeness as appropriate.

Perform Quality Testing:
This phase defines the execution of the QA testing, to include testing procedures, logistics, scheduling, and administrative matters critical to testing success. The overall QA schedule is developed in consultation with the project team to ensure minimal productivity impact to project or work execution, and to ensure availability of key contributors and resources during QA testing. For each scheduled QA test, the test sample is typically calculated using a statistical calculator,[6] and selected from the

[4] As defined by ANSI/ASQ Z1.4-2003, The Certified Quality Engineer Handbook 2nd Edition, Chapter 23 C. Acceptance Sampling, p. 195.

[5] A defective product contains one or more flaws that prevent it from achieving its intended purpose. For example, an ink pen that doesn't write would be considered defective. A product with a defect contains nonconformity or deviation from a standard or specification, but the defect does not prevent the product from achieving its intended purpose. An example of a defect would be an ink pen that writes, but is painted with the wrong logo. "Defective" is often reported as a "failure." A product with a defect is often classified as an "error."

[6] Attributes sampling calculator worksheet based on identified level of confidence.

population of total process output. The QA team tests this sample against project requirements and success criteria. During performance of the QA test, if a QA tester identifies questions, these items are flagged for secondary review with a subject matter expert. Results are verified, recorded and trended throughout the test cycle. Test results that demonstrate any potential issues or defects from each individual test cycle undergo root cause analysis and cumulative test results are available for review on a periodic basis to understand overall trends and process health.

Summary:

Coupled with our implementation of Gas Safety Excellence, Gas Operations is moving toward a proactive approach to quality defined by the Quality Management Framework. The significant challenge is a move to build quality including QA and QC into the basic processes that define the ongoing work that we do, as well as the projects that we implement. We are making sure that we link the resources including training and qualifications with the work and are prioritizing this overall effort based upon risk. We are implementing appropriate measures or metrics and implementing corrective actions so that over time quality including safety and asset performance improves and rework is eliminated.