Powering forward. Together.

SMUD®

September 30, 2019 **DPG 19-119**
RE: **CPF 5-2019-0022M**

Mr. Brad Jones
Manager, Thermal Generation & Gas Pipeline Assets
Sacramento Municipal Utility District
4401 Bradshaw Road
Sacramento, CA 95827

Mr. Dustin Hubbard
Director, Western Region
U.S. Department of Transportation
Pipeline and Hazardous Materials Safety Administration
12300 W. Dakota Avenue, Suite 110
Lakewood, CO 80228

Dear Mr. Hubbard:

This letter is provided on behalf of Sacramento Municipal Utility District ("SMUD") in response to the Notice of Amendment ("NOA") CPF 5-2019-0022M dated September 3, 2019 and received by SMUD on September 11, 2019.

The NOA was issued following inspections conducted by the California Public Utilities Commission, on behalf of the Pipeline and Hazardous Materials Safety Administration ("PHMSA") on July 22-26, 2019 of SMUD's procedures for its natural gas transmission system in Sacramento, California. In accordance with the *Response Options for Pipeline Operators in Compliance Proceedings,* Section II(a), SMUD respectfully submits this letter to notify you that SMUD has revised its procedures to address the items in the NOA.

In the NOA, PHMSA identified the following issue:

1. §192.605 Procedural manual for operations, maintenance, and emergencies
   (a) ...
   (b) *Maintenance and normal operations.* The manual required by paragraph (a) of this section must include procedures for the following, if applicable, to provide safety during maintenance and operations.
(1) ...
(2) Controlling corrosion in accordance with the operations and maintenance requirements of Subpart I of this part.

SMUD's Response:

SMUD has amended the following procedures:

- **GPO-AG-002 – Terms and Definitions** has been amended to add the term 'Prompt Remedial Action (CP)' with the following definition:

    - Under normal conditions, the evaluations, decisions, and actions should be started within a few months, not to exceed twelve months. If deficiencies could result in an immediate hazard to the public, correction will be completed as soon as possible.

      These time frames should consider the population density and environmental concerns of the area that could potentially be affected by released gas. They may also consider climatic conditions, availability of material, workloads, and an estimate of a relative rate of detrimental corrosion.

- **GPO-OM-009 – Corrosion Control** has been amended wherein we have revised section 6.2.2. per below:

    - (previous) - When a deficiency is identified, corrective action shall be initiated immediately to address the problem.
    - (amended) - When a deficiency is identified, Prompt Remedial Action shall be initiated to address the problem. If deficiencies could result in an immediate hazard to the public, correction will be completed as soon as possible.

Attached are hard copies of the two amended procedures, which have been implemented as of September 23, 2019. If you would like them in electronic format, please email me at Brad.Jones@smud.org.

If you require additional information or have questions regarding the amended procedures, feel free to contact me at (916) 732-6325.

Respectfully,

Brad Jones

cc: Frankie McDermott
Joy Mastache
Ross Gould
Jerry Bufford
EDM – Electronic Document Management

PURPOSE AND SCOPE

To establish a uniform method for interpreting and understanding common terms used in gas pipeline operations and maintenance. The content of this procedure is applicable to every procedure in the Gas Pipeline Operations Manual.

RESPONSIBILITY

- Manager, Thermal Generation & Gas Pipeline Assets is responsible for setting specific scope and final approval of this procedure.
- Asset Supervisor, Power Generation is responsible for ensuring the safe operation and maintenance of SMUD's gas transmission pipeline equipment, which includes reviewing and maintaining records and initiating actions to correct any conditions found during operation and maintenance activities.
- GPO Personnel and Contract Personnel are responsible for knowing and applying this procedure, following the steps in the associated job aid, knowing they are qualified to perform any covered task associated with this procedure, and for notifying the Asset Supervisor, Power Generation, if their operator qualification to perform assigned tasks is not current.

FACILITIES COVERED BY THIS PROGRAM

All SMUD gas transmission pipelines, equipment, and documents are covered by this procedure.

REGULATORY CODES & REFERENCES

DOT REQUIREMENTS

- 49 CFR Part 191 – Annual Reports, Incident Reports, and Safety-Related Condition Reports
- 49 CFR Part 192 – Minimum Federal Safety Standards
- 49 CFR Part 199 – Drug and Alcohol Testing
- Controlled Substances Act (21 U.S.C. 812)

APPLICABLE CODES AND STANDARDS

- All applicable codes and standards (i.e. ASME, AGA, API, ASNT, ASTM) incorporated by reference in 49 CFR Part 192. See 49 CFR Part 192.7 for specific references to section number
- AGA Report No. 9 – Measurement of Gas by Multipath Ultrasonic Meters

RELATED PROCEDURES AND FORMS

- All SMUD Gas Pipeline Operations Procedures

DEFINITION OF TERMS

ABANDONED: Permanently removed from service.

ABNORMAL OPERATING CONDITION (AOC): A condition identified by an operator that may indicate a malfunction of a component or deviation from normal operations that may:

- Indicate a condition exceeding design limits; or
- Result in a hazard to persons, property, or the environment.

ABSOLUTE PRESSURE: Gauge pressure plus atmospheric pressure.

AC: Alternating Current.

ACCIDENT: An incident reportable under 49 CFR 191.

ACCOUNTABLE, ACCOUNTABILITY: The "owner" of the work. The person accountable shall sign off or approve when the task, objective or decision is complete. This person must ensure responsibilities are assigned for all related activities.

ACTIVE CORROSION: Continuing corrosion that unless controlled, could result in a condition that is detrimental to public safety.

ACTUATOR RELIEF VALVES: Valves on the pipeline system that protect the accumulator tanks on the actuators on specified main line valves and at the Winters Inter-tie.

ADMINISTRATOR: The Administrator, Pipeline and Hazardous Materials Safety Administration or his or her delegate.

ALARM: An audible or visible means of indicating to the controller that equipment or processes are outside SMUD's defined safety-related parameters.

ANODE: The electrode (positive charge) at which oxidation or corrosion occurs. Antonym: Cathode.

ANODE, SACRIFICIAL: A formed metal, usually zinc, aluminum or magnesium, buried near and connected to a structure of lesser galvanic potential such that the metal corrodes in favor of the structure.

ANODIC PROTECTION: A technique to reduce corrosion of a metal surface under some conditions by passing sufficient anodic current to it to cause the electrode potential of the surface to enter and remain in the passive region.

ARC BURN: Any localized, re-melted metal, heat affected metal, or change in the surface profile of any part of a weld or base metal surface resulting from an arc. Arc burns are considered a form of mechanical damage.

ARC STRIKE: Localized points of surface melting caused by an electric arc.

ASSESSMENT: The use of testing techniques as allowed by code to determine the condition of a covered pipeline segment.

ASTM: American Society for Testing and Materials.

ATMOSPHERIC PRESSURE: The pressure of the atmosphere at any given point on the earth. Atmospheric pressure is commonly measured with a mercurial barometer calibrated in inches of mercury. The atmospheric pressure at sea level is taken to be 30" of mercury or 14.73 PSIA. As the elevation increases, the atmospheric pressure will decrease.

ATS: Anode Testing Station.

BASE PRESSURE: The pressure used as a standard in determining gas volumes. Volumes are measured at operating pressure and then corrected to base pressure volumes. Base pressure is defined in most gas measurement contracts as 14.73 PSIA.

BASELINE ACTIVITY: Refers to the general program elements set forth in Recommended Practice API 1162, Public Awareness Programs for Pipeline Operators. Baseline activities do not take into consideration the unique attributes and characteristics of SMUD's pipeline facilities.

BTU: British Thermal Unit, the energy required to raise the temperature of one pound of water one degree Fahrenheit.

BUILDING: Any structure used for human occupancy in which gas could accumulate.

CANNED SHUTDOWN: Procedures developed in advance to shut down a specific section of the pipeline.

CATHODE: 1) The electrode of an electrolytic cell at which reduction occurs; 2) In a dry cell battery, which is a typical corrosion cell, the carbon electrode serves as the cathode and is known as the "positive terminal". Antonym: Anode.

CATHODIC PROTECTION: A method to control external corrosion by causing electricity to flow onto the pipe from the soil.

CCF: 100 Cubic Feet.

CF: Cubic foot.

CLASS LOCATION: A classification 1 through 4 indicating the population density near the pipeline, with 1 being the least populated and 4 the most heavily populated segments. See 49 CFR 192.5.

CLEARANCE (Underground): The distance between the outer edge of the SMUD pipeline and the nearest underground structure.

CLEARANCE (Work Management): The process by which a section of pipeline is made safe for work in accordance with GPO-OM-006A – Clearance Procedure.

COATINGS, DIELECTRIC: Materials deposited on pipes or other metallic structures, which electrically insulate the metal from the environment and are not sacrificial.

COGENERATION PLANTS: Power plants which produce electric power and provide steam to an external host. Cogeneration plants serviced by SMUD's gas pipeline include the following locations: Carson and Procter & Gamble. The Campbell's plant was designed and built as a cogeneration plant, but now runs in combined cycle plant unit a suitable replacement steam host is identified and available to accept steam.

COMBUSTIBLE GAS INDICATOR (CGI): Leakage detection instrument for subsurface and confined area surveys used to center, pinpoint, and classify a gas leak.

COMBUSTIBLE MATERIAL: A flammable material consisting of organic compounds, such as methane, benzene, etc.

COMPETENT ENGINEER: A member of the SMUD Power Generation Engineering Group or Consultant who possesses and maintains a thorough level of knowledge in the area for which the person is responsible, as demonstrated through an appropriate combination of training and/or experience. See GPO-ED-002 – Competent Engineer Role and Selection, for further information.

CONFINED SPACE: Any structure of sufficient size that could accommodate a person where ventilation, entrance, and exits are limited, and where gas could accumulate, such as vaults or manholes in accordance with Title 8, California Code of Regulations, Section 5157.

CONSTRUCTION DEFECT: Feature that arises during pipe manufacture, transport, or construction of the pipeline, including but not limited to girth weld anomalies, arc strikes, and grinding.

CONTRACTOR: For the purpose of this program, the term "contractor" includes any entity or individual contracted or subcontracted or other non-SMUD (employee) personnel authorized to perform work on the SMUD gas transmission pipelines and associated facilities or equipment or a designated representative thereof.

CONTROL AND DATA ACQUISITION: The process by which data from the pipeline system is transmitted and displayed in the control room.

CONTROL ROOM: An operations center staffed by personnel charged with the responsibility for remotely monitoring and controlling a pipeline facility.

CONTROLLER: A qualified individual who remotely monitors and controls the safety-related operations of a pipeline facility via a SCADA system from a control room, and who has operational authority and accountability for the remote operational functions of the pipeline facility.

CORRECTIVE MAINTENANCE: Process for reporting and correcting problems found in the field. This process requires maintenance work be performed when there is an equipment failure.

CORROSION: Internal and external metal loss caused by an electrochemical process within a gas pipeline or equipment.

CORROSOMETER PROBE: A device to measure the corrosiveness of the natural gas entering the SMUD pipeline.

COVERED EMPLOYEE: A person who performs a covered task or function, who therefore is subject to random or post-incident drug and alcohol testing. May be a Contractor performing covered work.

COVERED SEGMENT: Segment of gas transmission pipe located in a High Consequence Area (HCA).

COVERED TASKS/ FUNCTIONS: An activity identified by SMUD that meets the following four-part test:

- Is the activity performed on a pipeline or pipeline facility?
- Is it an operations, maintenance, or emergency-response task?

- Is it performed as a requirement of CFR 192?

Does it affect the operation or integrity of the pipeline?

CRAFT SERVICES CONTRACT: Contracts typically used for craft labor support with minimal equipment and/or materials involved.

CUSTOMERS: Businesses or facilities receiving gas directly from the pipeline company for end use purposes. Includes power plants, businesses, and industrial facilities.

DAMAGE PREVENTION: Programs designed to minimize third party damage.

DART: Days Away Restricted Time.

DC: Direct Current

DECATHERM: One million BTU, approximately 1,000 SCF.

DENTS: A depression in the pipe wall that produces a gross disturbance in the pipe wall's curvature. A dent is different from a scratch or gouge, which reduces the pipe wall's thickness. The depth of a dent is the distance from the lowest point of the dent to the original contour of the pipe before it was dented. The percentage distortion is defined as the ratio of the depth of the dent to the actual diameter of the pipe, times 100.

DEPT. OF TRANSPORTATION (DOT): Federal government's regulating body that has jurisdiction over Gas Pipeline Transmission and Operations.

DESIGN CHANGE NOTICE (DCN): The process in which changes to Gas Pipeline Configurations are authorized and detail design documentation established. A DCN consists of a cover sheet, which documents the review and approval of the changes and a package of drawings, manuals, etc., which describes and documents the equipment changes to be made.

DESIGN FACTOR: A variable used in the formula to calculate design pressure of a pipe, the value of which is determined by the pipe's class location. See 49 CFR 192.111.

DESIGN PRESSURE: The maximum operating pressure permitted by 49 CFR 192, as determined by a formula which takes into account pipe diameter, wall thickness, material, and location involved.

DESIGNATED HOT WORK AREA: An area approved for ongoing hot work activities. Hot work designated areas are not required to have fire department permits, but shall still meet the requirements of this standard.

DETECTION THRESHOLD: The minimum detectable metal loss.

DETECTO PAK-INFRARED (DP-IR™): Detecto Pak-Infrared (DP-IR™) is a highly advanced technology capable of detecting methane without false alarming on other gases.

DFT: Dry Film Thickness.

DIFFERENTIAL PRESSURE: The difference in pressure between any two points in a closed system.

DIGESTER GAS (DG): Gas that is produced from organic waste principally composed of methane and carbon dioxide.

DIRECT ASSESSMENT: An integrity management assessment method that utilizes a process to evaluate certain threats to a pipeline segment's integrity.

DIRT: Damage Information Reporting Tool.

DOCUMENT TRANSMITTAL: A document that lists the drawings and reference information associated with a DCN.

DOT NON-POSITIVE DRUG TEST: Results of initial, or confirmation testing in accordance with DOT procedures which does not show prohibited substances in a person's system.

DRAWING CHANGE ONLY (DCO): A type of DCN process for making changes to drawings to agree with actual field conditions.

EAP: Emergency Action Plan

EC: Emergency Coordinator

ECC: Energy Control Center - staffed 24 hours a day by Power System Operators; monitors gas system via SCADA.

ELECTRICAL SURVEY: A series of closely spaced pipe-to-soil readings over a pipeline which are subsequently analyzed to identify locations where a corrosive current is leaving the pipeline.

EMERGENCY OFFICIALS: Local, state, or regional officials, agencies, and organizations with emergency response and/or public safety jurisdiction along the pipeline route. Includes fire departments, law enforcement agencies, local planning commissions, emergency management agencies, and other emergency response/public safety organizations.

EMS: Energy Management System - monitors SMUD's energy systems in the ECC by Power System Operators.

ENCROACHMENTS: Activities that are near SMUD's gas pipeline or within SMUD's easements/right of way.

ELECTRONIC DOCUMENT MANAGEMENT (EDM): SMUD's document control repository used to securely store electronic Gas Pipeline records.

EOC: Emergency Operations Center. The EOC is activated only for major emergencies where multiple departments are required to respond to and communicate on the emergency.

GAS PIPELINE EQUIPMENT: An asset that is either portable or moveable such as a valve, regulator, or filter.

EQUIPMENT FAILURE: The lack of ability of a component, equipment, sub-system, or system to perform its intended function as designed.

ETS: Electrolysis Test Station. Terminal used to measure electric currents and potentials of an underground pipe.

EXCAVATORS/CONTRACTORS: Companies and governmental agencies involved in any form of earthen excavation activities, including construction companies, excavation equipment, rental companies, public works departments, public street, road, and highway departments, timber companies, fence building companies, drain tilling companies, landscapers, and well drillers.

EXCAVATION DAMAGE: Any impact resulting in the need to repair or replace an underground facility due to a weakening, or the partial or complete destruction of the facility, including, but not limited to, the protective coating, lateral support, cathodic protection or any other pipeline components.

EXTERNAL CORROSION: Corrosion based deterioration which originates from the outer surface of the pipe.

EXPERIENCE MODIFICATION RATE (EMR): A number used by insurance companies to gauge both past cost of injuries and future changes of risk. The lower the EMR of a business, the lower the worker compensation insurance premiums will be. An EMR of 1.0 is considered the industry average.

EVALS: Computer program used by Gas Pipeline Operations for electronic logging, forms and documenting AOCs.

EVALUATION: Methods used for assessing and documenting an individual's ability to perform a covered task. The evaluation of an individual's qualifications shall be completed by one of the following methods. Observation of on-the-job performance may not be used as the sole method.

- Written Exam
- Oral Exam
- Work Performance History Review
- Observations on-the-job or during simulations

FABRICATION DEFECT: See "Pipe Mill Feature".

FAIL/FAILED A TEST: When submitting to a Drug or Alcohol test, the confirmation test result shows the presence of a prohibited drug in an employee's system.

FBE: Fusion Bonded Epoxy. An epoxy-based powder protective coating.

FEATURE: An indication, generated by nondestructive examination of an anomaly, such as a change in nominal wall thickness, casing, reference magnet, or pipeline fixture/fitting, including tees, off-takes, valves, bends, anodes, buckle arrestors, external supports, ground anchors, repair shells, and CP connections.

FIELD SERVICES DIVISION, CUSTOMER SERVICES: A division within Customer Services responsible for performing incident investigations involving injuries and/or damage to non-SMUD personnel and/or property.

FIRE WATCH: A temporary measure intended to ensure continuous and systematic surveillance of a building or area by one or more qualified individuals for the purposes of identifying and controlling fire hazards, detecting early signs of unwanted fire, raising an alarm of fire and notifying the fire department.

FLAME RESITANT (FR) CLOTHING: SMUD approved FR Clothing whose properties provide protection from ignition when exposed to flames caused by a job involving the potential for exposure to escaping flammable gas or flash fire.

FLAMMABLE MATERIAL: A material capable of being readily ignited from common sources of heat.

FLOWING PRESSURE: The pressure exerted parallel to direction of flow.

FLOW RATE: The quantity of gas moving through any segment of the pipeline system at any given time. Flow rate is expressed in hundreds, thousands, or millions of standard cubic feet per hour.

FOREIGN METALLIC STRUCTURES: Any metallic structure that is not intended as part of a system under cathodic protection.

FUEL SOURCE HAZARD: Any flammable or combustible material in liquid, solid, or gaseous form.

FUNCTIONAL LOCATION: Identifies a fixed asset such as a main line valve station, measurement and regulation station, or pipeline segment. Gas pipeline functional locations are listed in SAP.

GAS: Natural gas, flammable gas, or gas which is toxic or corrosive.

GAS DETECTOR: An instrument capable of detecting and measuring the percentage concentration of combustible gas in air.

GAS FACILITIES: All company operated gas lines and related appurtenances.

GATHERING LINE: A pipeline that transports gas from the commodity's source to a processing facility, refinery or a transmission line.

GAUGE PRESSURE: Pressure above atmospheric pressure as normally measured by a pressure gauge.

GENERAL SERVICES / MAINTENANCE CONTRACT : Contracts typically used for labor, materials and equipment required to maintain and/or repair SMUD-owned or leased real or personal property, or to provide other support services necessary to ensure continued operation of SMUD facilities and equipment.

GIR: Gas Incident Report Form (EPP-1).

GIS: Geographic Information System.

GIRTH WELD DEFECT: Defect in the girth weld or the heat affected zone.

GPO PERSONNEL: All SMUD personnel responsible for maintenance, operations, engineering, and compliance of the SMUD Transmission Gas Pipeline.

GOUGE: Mechanically induced defect, which causes localized, elongated troves or cavities.

GRINDING: Reduction in wall thickness through removal of material by hand filing or power disk filing.

GROUND BED: A ground bed is an array of electrodes, installed in the ground to provide a low resistance electrical path to ground or earth. A ground bed is a component in an earthing system. Each electrode is called a ground rod or an earth electrode.Buried material, which services as an anode for the cathodic protection of a buried structure, such as a buried steel pipeline.

HAZARD TO NAVIGATION: A pipeline where the top of the pipe is less than 12 inches below the underwater natural bottom (as determined by generally recognized and accepted practices) in waters less than 14 feet deep, as measured from the mean low water point.

HAZARDOUS LEAK: A leak that represents an existing or probable hazard to people or property and requires immediate repair or continuous action until the condition(s) is (are) no longer hazardous.

HEAT AFFECTED ZONE: The area around a weld where the metallurgy of the metal is altered by the rise in temperature caused by the welding process. For the purpose of this procedure, it is considered to be within 3inchesA of the weld centerline, where A is geometrical parameter related to the wall thickness.

HIGH CONSEQUENCE AREA (HCA): A populated area, established using methods outlined in 49 CFR 192 Subpart O, where a release of natural gas could have the most significant adverse consequences.

Pipeline operators are required to devote additional focus, efforts and analysis in HCAs to ensure the integrity of pipelines. See GPO-IM-003.

HIGH FREQUENCY ELECTRIC RESISTANCE WELD (ERW) SEAM WELD: A pipe seam weld produced by the electric resistance welding process that uses high-frequency alternating current electricity.

Unless otherwise determined, all ERW pipe produced in 1970 or later can be considered the high-frequency type.

HIGH-VOLTAGE SYSTEM: A system with electrical energy greater than 600 volts.

HOLIDAY: A discontinuity or bare area in a coated surface.

HOOP STRESS: Stress on a pipe wall produced by the pressure exerted against the inside.

HOT WORK: Operations including cutting, welding, Thermit welding, brazing, soldering, grinding, thermal spraying, thawing pipe, installation of torch-applied roof systems or any other similar activity.

HOT WORK AREA: The area exposed to sparks, hot slag, radiant heat, or convective heat as a result of the hot work. This area extends a minimum of 35 feet from the area hot work is being conducted.

IDENTIFIED SITE (IS): Specific site with potential for certain concentrated human occupancy that meets any of the following criteria (49 CFR 192.903):

- An outside area or open structure such as a beach, playground, or shade structure that is occupied by ≥ 20 persons at least 50 days in any 12-month period.
- Buildings occupied with ≥ 20 persons at least 5 days a week for 10 weeks in any 12-month period. (Does not have to be consecutive).

Buildings such as schools, day care facilities, assisted living facilities, prisons, or hospitals that would be difficult to evacuate.

INCIDENTS: A definite and separate occurrence with undesirable and/or unplanned characteristics, involving the SMUD gas system requiring an investigation. See GPO-EP-004 – Incident Investigation and Material Failure.

INHIBITOR:

- As applied to corrosion, a chemical substance or mixture that if added to an environment (usually in small concentration) effectively decreases corrosion.

INSPECTION TOOL: Smart Pig/Magnetic Flux Leakage (MFL) Pig.

INTEGRITY ASSESSMENT (IA): The use of nondestructive testing (as allowed by rule) to ascertain the condition of a covered pipeline segment.

INTEGRITY MANAGEMENT PLAN: Written explanation of the procedures SMUD uses to implement the integrity management program and to ensure compliance with 49 CFR 192, Subpart O. See Integrity Management Manual.

INTEGRITY MANAGEMENT PROGRAM (IMP): A plan to ensure the integrity of its gas pipeline system.

INTEGRITY THREAT: A specific minimum list of threats to the integrity of the pipeline. Threats are described in GPO-IM-004 – Data Integration, Threat Identification and Risk Assessment, and ASME B31.8S, Table 6, Section 2.2, and 49 CFR 192.919.

INTERNAL CORROSION: Corrosion based deterioration originating from the inner surface of the pipe.

INTERNAL-LINE INSPECTION (ILI): An integrity assessment method used to locate and preliminarily characterize indications, such as metal loss or deformation, in a pipeline. This method entails sending through the pipeline internal inspection tool(s) capable of detecting and recording indications.

JEEPED: The process of checking a coated pipeline for holidays, pinholes, or coating flaws. Also referred to as jeeping the pipeline.

JLMSC: Joint Labor Management Safety Committee.

KEY PERFORMANCE INDICATOR (KPI): Quantifiable measure that an organization uses to gage or compare performance.

KSI: Kips per square inch (1,000 psi).

LAND DEVELOPER: Companies involved in land development and planning, including homebuilders, land developers, and real estate sales companies.

LAUNCHER: A trap for inserting an Internal Line Inspection (ILI) tool ("pig") into a pipeline.

LEAK: The unintentional escape of gas from containment.

LEAK DETECTION SYSTEM (LDS): A system that in conjunction with the SCADA system monitors the pipeline on a continuous basis and is capable of detecting leaks as small as 45 MCF/H.

LEAK GRADES:

Grade 1 - A leak that represents an existing or probable hazard to persons or property, requiring immediate repair or continuous action, until conditions are no longer hazardous.

Grade 2 - A leak that is not hazardous to life and property at the time of detection, but requires scheduled repair based on probable future hazard.

Grade 3 - A leak that is non-hazardous to life and property at the time of detection and can reasonably be expected to remain non-hazardous.

LEAK SURVEY: A search for possible gas leakage in any area where gas facilities exist or where a gas leak is reported or suspected.

LEAK TEST: A pressure test to determine the tightness of the system.

LEL (OR LFL): Lower Explosive Limit (or Lower Flammable Limit) - the lowest concentration of gas in air that will burn. Gas/air mixtures below the LEL cannot be ignited. The LEL for natural gas is approximately 5% gas in air.

LINE PACK: In a pipeline system the volume of gas present at any given time. The volume of gas is dependent on the changes in pressure and is expressed in hundreds, thousands or millions of standard cubic feet.

LINE RUPTURE CONTROL SYSTEM (LINE BREAK): A control system installed on main line valves. In the event of a catastrophic failure or line rupture, the valves will close when a predetermined pressure drop occurs in a specified time limit.

LINE SECTION: A continuous run of transmission line between adjacent block valves.

LOCATE REQUEST: A notice from USA (Underground Service Alert) that an excavation might occur near a SMUD pipeline and that SMUD must mark the location of its pipeline in the area of proposed excavation.

LOCKOUT/TAGOUT (LOTO): The authorization officially issued by GPO Supervision to a qualified employee to work on equipment which is inherently too hazardous to work on while in service. It will be issued after the equipment has been isolated from energy sources, deactivated or de-energized in a prescribed manner and placed in a safe condition to be worked on. See GPO-OM-006 – Lockout/Tagout. (LOTO).

LOW FREQUENCY ERW SEAM WELD: A pipe seam weld produced by the electric resistance welding process, using low frequency alternating current electricity. Unless otherwise determined, all ERW pipe produced before 1970 should be considered the low frequency type.

MAINTENANCE PLANS: Established in SAP to automate the creation of PM Orders for preventive or predictive maintenance on a piece of equipment or functional location. Maintenance Plans include task lists, maintenance strategy, planned material, planned labor, maintenance cycle, and technical object to be maintained. Once scheduling of the Maintenance Plan occurs, SAP will automatically generate a PM Order based on the due date of the maintenance cycle.

MAINTENANCE STANDARDS: Maintenance requirements for a particular asset or equipment.

MANUFACTURING DEFECT: See "Pipe Mill Feature".

MAXIMUM ALLOWABLE OPERATING PRESSURE (MAOP): The maximum pressure allowed by the design and testing criteria for the weakest element of the pipeline. This is the maximum pressure at which a pipeline or segment of a pipeline may be operated.

MAXIMUM OPERATING PRESSURE (MOP): The maximum pressure allowed due to operational constraints. For example, if two pipelines with different MAOP ratings are tied together the MOP would be the lower of the two MAOP's.

MCF: 1,000 cubic feet of natural gas.

MEASUREMENT THRESHOLD: The depth of metal loss or remaining wall thickness from which the width (W) and the length (L) of the defect are measured.

MECHANICAL DAMAGE: Damage to the pipe surface caused by external forces. Mechanical damage includes features such as creasing of the pipe wall, gouges, scrapes, smeared metal, arc burns, and metal loss not due to corrosion. Cracking may or may not be present with mechanical damage. Dents in the pipe may or may not be apparent with mechanical damage.

METAL LOSS DEFECT: A defect caused by a reduction in the thickness of the pipe wall.

MVA: Motor Vehicle Accident.

NATIONAL PIPELINE MAPPING SYSTEM (NPMS): The National Pipeline Mapping System (NPMS) is a dataset containing locations of and information about gas transmission and hazardous liquid pipelines and Liquefied Natural Gas (LNG) plants which are under the jurisdiction of the Pipeline and Hazardous Materials Safety Administration (PHMSA).

MODIFIED MERCALLI INTENSITY SCALE: A seismic scale used for measuring the intensity of an earthquake. It measures the effects of an earthquake.

NATURAL GAS CHROMATOGRAPH (NGC): An instrument utilized to identify and quantify gas constituents.

OPERATING RECORDS: Operating Records including but not limited to: all drawings, technical data, instruction manuals, design calculations, test reports, procedures and standards.

OPERATOR: A person who owns or operates pipeline facilities. SMUD is an operator and must comply with 49 CFR parts 191, 192, and 199.

OPS: Office of Pipeline Safety.

PIPELINE AND HAZARDOUS MATERIAL SAFETY ADMINISTRATION (PHMSA): Department of Transportation office charged to ensure the safe, reliable and environmentally sound operation of the nation's pipeline transportation system.

PIG: A device, driven through a pipeline by the flow of air, gas, or fluid that performs various internal activities, such as cleaning and/or inspecting the pipeline.

PIG TRAP: Ancillary pipeline equipment with associated pipe and valves for introducing a pig into a pipeline or removing a pig from a pipeline.

PIPE MILL FEATURE: A feature that arises during the manufacture of pipe, such as a lap, sliver, lamination, nonmetallic inclusion, roll-mark, or seam weld anomaly.

PIPE-TO-SOIL POTENTIAL: The difference in voltage between the pipe and its surrounding soil.

PIPELINE/PIPELINE SYSTEM: A system of pipes and other components used for the transportation of gases or fluids between structures. All components through which gas flows are considered part of the pipeline.

PIPELINE ENVIRONMENT: Includes soil resistivity (high or low), soil moisture (wet or dry), soil contaminants that may promote corrosive activity, and other known conditions that could affect the probability of active corrosion.

PIPELINE FACILITY: New and existing pipelines, right-of-ways, and any equipment, facility, or building used in the transportation of gas or in the treatment of gas during the course of transportation.

PIPELINE MARKER: Device utilized to identify the approximate location of a buried pipeline within the Right-of-Way (ROW), which contains the name of pipeline operator, commodity transported and emergency contact number.

PITS: Cavities in a confined surface area of a metallic surface, which represents a form of corrosion.

PLAIN DENTS: Depressions in the pipe wall that exhibit or contain no creases, mechanical damage, corrosion, or arc burns but do affect the girth or seam welds.

PLAN-DO-CHECK-ACT (PDCA): A four-step cycle model with a principal aim to encourage creating strategies and plans, executing those strategies and plans in line with guidelines, checking those actions for quality, and using those results to adjust the next generation of plans. This cycle is iterative and is maintained to achieve continuous improvement.

PLANT CONFIGURATION: The approved physical installation of equipment. Any changes to the installed equipment which deviates from that shown in approved drawings and manuals constitutes a design change which must be first authorized by the Manager, Thermal Generation and Gas Pipeline Assets, except in the case of an emergency, where plant configuration changes have been made during the response to an emergency, Power Generation Engineering will be notified and a review performed to ensure the viability of the changes. A Design Change Only (DCO) to document changes will then be initiated.

POTENTIAL: The voltage difference between the point concerned and a given reference.

POTENTIAL IMPACT RADIUS: Radius within which the potential failure of a pipeline could have significant impact on people or property. The radius is a function of MAOP and pipeline diameter. For all of SMUD pipelines, this radius has been conservatively chosen to be 660 feet.

POTENTIALLY NON-DUCTILE WELD: Welds known to potentially exhibit non-ductile properties. The following types of long seam welds fall under this classification, unless exempted by Pipeline Engineering: A. O. Smith welds, furnace butt-welds, lap-welds, flash-welds, single submerged-arc-welds, and low frequency ERWs.

Pipeline Engineering may add additional welds on specific lines based on materials testing or other data.

POWER SYSTEMS OPERATIONS (PSO): Power Systems Operations (PSO) is the authority for the approval of outages that affect the gas transmission system. PSO includes System Dispatchers and their supervisors. PSO Operators monitor and control SMUD's electric and gas systems 24/7. These individuals are operator qualified to monitor, control, and operate the SMUD gas transmission pipeline.

PRESENTER: Any individual who has prepared information for presentation regarding general training requirements.

PRESSURE MULTIPLIER: The number used to determine the volume of gas in a pipeline, the pressure multiplier is equal to the gauge pressure plus the atmospheric pressure divided by the atmospheric pressure. Example: The pressure multiplier for 500 PSIG would be: (500 + 14.73) / (14.73) = 39.44.

Note: There are several other factors used when calculating the exact volume of gas. To obtain gas volumes or any related flow calculations, contact a Competent Engineer.

PREVENTATIVE MAINTENANCE (PM) ORDERS: Issued to complete a job. PM Orders indicate the work to be completed, relationships between work activities or "operations", work due dates, and required labor and material assignments. The PM Order is the

primary means of cost collection for maintenance activities, operations activities, and capital projects.

PRESSURE MULTIPLIER: The number used to determine the volume of gas in a pipeline, the pressure multiplier is equal to the gauge pressure plus the atmospheric pressure divided by the atmospheric pressure. Example: The pressure multiplier for 500 PSIG would be: (500 + 14.73) / (14.73) = 39.44.

Note: There are several other factors used when calculating the exact volume of gas. To obtain gas volumes or any related flow calculations, contact a Competent Engineer.

PREVENTIVE AND PREDICTIVE MAINTENANCE: Process of performing planned work on existing SMUD assets. This approach used in maintaining facilities requires that maintenance be performed based on a set of factors (time, operating hours, operating conditions, etc.) determined by industry standards and guidelines or by regulatory authority.

PROBABILITY OF DETECTION (POD): The probability that a feature can be detected by the inspection tool.

PROBABILITY OF IDENTIFICATION (POI): The probability that a feature can be correctly classified by the inspection tool.

PROHIBITED DRUG: Any of the following substances specified in Schedule I or Schedule II of the Controlled Substances Act (21 U.S.C. 812): marijuana, cocaine, opiates, amphetamines, and phencyclidine (PCP).

PROJECT MANAGER: The Project Manager is responsible for leading a project from its inception to completion. This includes planning, execution and managing the people, resources, scope, schedule, risk management and budget of the project.

PROMPT ACTION: Dispatching qualified personnel without delay for the purpose of evaluating and, where necessary, abating the existing or probable hazard.

PROMPT REMEDIAL ACTION (CP): Under normal conditions, the evaluations, decisions, and actions should be started within a few months, not to exceed twelve months. If deficiencies could result in an immediate hazard to the public, correction will be completed as soon as possible.

These time frames should consider the population density and environmental concerns of the area that could potentially be affected by released gas. They may also consider climatic conditions, availability of material, workloads, and an estimate of a relative rate of detrimental corrosion.

PSI: Pressure in pounds per square inch (gauge pressure).

PSIA: Pressure in pounds per square inch absolute (Gauge pressure plus atmospheric pressure).

PSIG: Pressure in pounds per square inch gauge.

PSO TRAINING (PSOT): Training group responsible for providing training for SMUD Power System Operators whom are assigned the duty of monitoring and operating the SMUD gas transmission pipeline.

PUBLIC OFFICIALS: Local, city county, or state officials/staffs having land use and street/road jurisdiction along the pipeline ROW, which includes planning and zoning boards, licensing, permitting, and building departments, City/County managers, elected officials, public utility boards, and local governing councils.

PURGE: To thoroughly displace either gas or air from the piping system.

QMAX: The maximum gas flow rate through the ultrasonic meter that can be measured within the error limits specified under AGA Report No. 9, Measurement of Gas by Multipath Ultrasonic Meters.

QMIN: The minimum gas flow rate through the ultrasonic meter that can be measured within the error limits specified under AGA Report No. 9 Measurement of Gas by Multipath Ultrasonic Meters.

QUALIFIED: An individual that has been evaluated and determined to be proficient and able to properly perform the assigned covered tasks and can recognize and react to abnormal operating conditions.

READING: A repeated measurement of gas indicated on a gas detector.

RECEIVER: A trap for retrieving a pig from a pipeline.

REFERENCE WALL THICKNESS: The undiminished wall thickness surrounding a feature.

RECTIFIER: A device that converts relatively high voltage AC electric power to low voltage DC electric power for the purposes of providing cathodic protection to a structure.

REDTAG® PRO: Computer program used for Lockout / Tagout.

REFUSE TO TAKE, REFUSE TO SUBMIT: Declining to take a drug or alcohol test.

REGULATORY COORDINATOR: Individual reporting to Power Generation who is responsible for all applicable compliance reporting, audit participation, communication with internal and external agencies, and ensures compliance with all applicable codes and regulations.

RELIEF VALVE: A valve designed to open and vent gas into the atmosphere when an overpressure condition exists.

REMEDIATION: A repair or mitigation activity on a covered segment to limit or reduce the probability of an undesired event occurring, or the expected consequences from the event.

REMOTE METHANE LEAK DETECTOR (RMLD): Leakage detection instrument for subsurface and confined area surveys used to center, pinpoint, and classify a gas leak.

REPORTING THRESHOLD: A parameter which defines whether or not a metal-loss feature will be reported. The parameter may be limiting value on the depth of metal loss, or it may be function depth, width, and length of a metal loss feature.

RESIDENTS ALONG ROW: People who live adjacent to the natural gas transmission Right-of-Way, which includes occupants, residents, tenants, farmers, homeowner's associations, and neighborhood organizations.

RESIDENTS NEAR STATIONS: People who live adjacent to or near a station, which includes tenants, farmers, homeowner's associations, and neighborhood organizations.

RESPONSIBLE, RESPONSIBILITY: A duty or obligation to satisfactorily perform or complete a task (assigned by someone or created by one's own promise or circumstances) that one must fulfil, and which has a consequent penalty for failure.

RTR: Request for Technical Review.

RH: Relative humidity.

RIGHT OF WAY (ROW): The strip of land extending to either side of the pipeline where construction and other non-pipeline activities are restricted.

RISK ASSESSMENT (RA): Process for using collected pipeline data to identify location-specific events and/or conditions that could lead to a pipeline failure, and to evaluate the likelihood and consequences of different failure types along covered pipeline segments.

RSTRENG: A computer program for calculating the safe pressure for corrosion damaged pipe, as referenced in 49 CFR 192.

SAP: The SMUD enterprise resource planning software, which includes modules to handle work management and asset management.

SCADA - SUPERVISORY, CONTROL AND DATA ACQUISITION: The process by which data from the pipeline system is transmitted and displayed in the control room. A computer-based system or systems used by a controller in a control room to collect and display information about a pipeline facility and may have the ability to send operational commands back to the pipeline facility.

SCF: The volume of natural gas contained in a one cubic foot space at sea level at zero PSIG.

SF (sf): Square feet.

SIGNIFICANT SEISMIC EVENT: A significant seismic event for the purposes of this procedure is defined as any of the following.

- Earth movement with an instrument level IV on the Modified Mercalli Intensity scale, located within 1.0 mile of a pipeline facility, or
- Earth movement with a Peak Ground Acceleration (PGA) of 0.2g located within 1.0 miles of a pipeline facility.

Any other seismic activity deemed significant by the Manager, Thermal Generation & Gas Pipeline Assets or the GPO On-call Supervisor.

SITS: Safety Incident Tracking System.

SIZING ACCURACY:
- The interval within which a fixed percentage of all features, such as metal loss larger than the reporting threshold, will be sized. This fixed percentage is called the confidence interval.

SLUG: A pipeline section of prescribed length filled with inert material, usually nitrogen, used to avoid creation of an explosive mixture of natural gas and air. The "slug" is the inert material that provides a separation within the pipeline between natural gas and air. Reference GPO-CN-008 - Purging of Pipelines.

SPALLING: Abrasion of the pipe surface resulting in shallow surface laps, and possibly hardening of the material below.

SPECIFIED MINIMUM YIELD STRENGTH (SMYS):
- For steel pipe manufactured in accordance with a listed specification, the yield strength specified as a minimum in that specification; or
- For steel pipe manufactured in accordance with an unknown or unlisted specification, the yield strength determined in accordance with 192.107(b).

STRAY CURRENT CORROSION: Corrosion caused by an electric current through paths other than the intended circuit or by an extraneous current in the earth.

SSPC: Society for Protective Coatings (formerly Steel Structures Painting Council).

STANDING ORDERS: PM Orders issued to track miscellaneous repetitive maintenance and operations activities. Typically, the active life of these orders will be annual – to collect costs over a budget year.

STATIC PRESSURE: The pressure exerted by a liquid or gas when the bodies on which the pressure is exerted are not in motion.

STATIC TEMPERATURE: The stagnation/total/static temperature is constant for compressible fluids.

STATION PIPING: For the purpose of leak surveying, this includes all underground and above ground gas lines and appurtenances within the property lines of valve stations, metering and regulating stations, cross-ties, and other gas operating installations.

STRENGTH TEST: A pressure test to prove the mechanical strength of the system to certify the pipeline maximum allowable operating pressure per 49 CFR Part 192.

STRESS: The magnitude of internal forces that act to change the size or shape of a body.

SPU: Signal Processing Unit, the ultrasonic flow meter (UM) assembly's electronic system, including microprocessor and transducer excitation circuits.

SUBSIDENCE: Sink holes, depressions in the soil and other low spots on the right of way.

SUBSTANCE ABUSE: Use of a drug named in Schedule I or Schedule II of the Controlled Substances Act (21 U.S.C. 812): marijuana, cocaine, opiates, amphetamines, and phencyclidine (PCP).

SUBSTRUCTURE: Any structure, tunnel, passageway or other confined space below ground where gas could accumulate.

SUPPLEMENTAL ACTIVITY: Refers to Integrity Management Program elements that go beyond the baseline elements set forth in Recommended Practice API 1162. Supplemental activities take into consideration the unique attributes and characteristics of SMUD's pipeline facilities.

TEMPORARY MEASURE: Repair techniques that are allowable when a permanent repair is not feasible at the time the defect is discovered. Temporary repairs shall be replaced with permanent repairs as soon as feasible.

TEST MEDIUM: A substance such as water, air, or gas used to exert internal pressure to leak or strength test at a facility.

TEST PRESSURE: The internal fluid pressure specified for testing.

THERM: 100,000 BTU's or approximately 100 cubic feet of gas.

THIRD PARTY DAMAGE: Damage caused by excavation equipment not operated by SMUD or a SMUD contractor.

TRANSMISSION LINE: Pipeline operating at a hoop stress of 20 percent or greater of SMYS. All of SMUD's pipelines are considered transmission pipelines.

TRANSMISSION OUTAGE APPLICATION (TOA): Program used by SMUD PSO that controls all work performed on and the availability of all electric and gas generation and transmission assets within the SMUD system. All GPO LOTO requests are made through the PSO.

TRANSPORTATION OF GAS: The gathering, transmission, or distribution of gas by pipeline.

TREMOR: For purposes of this standard, a tremor is defined as:

- Earth movement with an instrument level III on the Modified Mercalli Intensity scale, located within 1.0 mile of a pipeline facility, or
- Earth movement with a Peak Ground Acceleration (PGA) of 0.1g located within 1.0 mile of a pipeline facility.

Any other seismic activity deemed significant by the Manager, Thermal Generation & Gas Pipeline Assets or the GPO On-call Supervisor.

TUNNEL:	A subsurface passageway in which a person could enter, and gas could accumulate. For purposes of these procedures, "tunnel" also includes sewers, storm drains, pipelines, conduits, and so forth.
TYPE A SLEEVE:	A repair sleeve designed so that welding of the sleeve-ends to the carrier pipe is not required. • Type A sleeves function as reinforcement for defective area, but are not intended to contain pressure and are used only for non-leaking defects.
TYPE B SLEEVE:	A repair sleeve designed so that welding of the sleeve-ends to the carrier pipe is required. Type B sleeves are capable of containing pressure and carrying longitudinal stresses, which may be imposed by lateral loads.
UEL (OR UFL):	The Upper Explosive Limit or (Upper Flammable Limit), expressed as a percentage by volume of gas in air at standard conditions. Gas/air mixtures above the UEL/UFL will not burn. The UEL for natural gas is approximately 15% gas in air.
UM ASSEMBLY:	Completely assembled multipath ultrasonic flow meter consisting of the main meter body, ultrasonic transducers, SPU, two upstream and one downstream pipe spool assemblies, flow conditioner, and spacer ring.
VAULTS:	Regulator pits, valve pits or other underground enclosures with an internal volume of 200 cubic feet or more.
WFT:	Wet film thickness.
WT:	Pipe wall thickness.

METHODS & OBSERVATIONS Please direct any comments or questions regarding the Procedures Manual to the Manager, Thermal Generation & Gas Pipeline Assets.

FREQUENCY A technical review of this procedure shall be performed at least once each calendar year, at an interval not to exceed 15 months. If a significant change is identified prior to the annual review, this procedure will be revised and issued as needed.

DOCUMENTATION Electronic copies of the procedures can be viewed on the SMUD Intranet under Work Group: Power Generation\Gas Pipeline\Gas Pipeline Procedures Manual. All field personnel have access to the manuals via their SMUD issued computers.

VERSION HISTORY

VERSION	CHANGE	BY	DATE
1	Changed title from Manager, Thermal Generation and Gas Pipeline Assets to Manager, Gas Pipeline Assets; Updated Approval/Signature Blocks; Added National Pipeline Mapping System (NPMS) definition; Added Flame Resistant (FR) Clothing definition; Corrected original effective date to January 2016 per memo from Ross Gould (GPO 15-304). .	Shelly Allen	February 2017
2	Added definitions for DPIR, Mercalli Scale, NGC, DG, Evals, Red Tag Pro; Updated Compliance Coordinator to Regulatory Coordinator; Removed reference to Maintenance Planner; Removed Smart Pig; Changed Significant Seismic Event to align with the Mercalli Scale; Changed plant maintenance to preventative maintenance plan; Updated Title from Regulatory Coordinator Generation to Program Manager, Regulatory Compliance in Approved By.	Brad Jones	December 2017
3	Changed definition of Ground Bed, Removed reference to EPPS and EPPS Supplement. Added EAP definition.	Brad Jones	December 2018
4	Added definition for 'Prompt Remedial Action (CP); Updated title Manager, Gas Pipeline Assets to Manager, Thermal Generation & Gas Pipeline Assets.	Brad Jones	December 2019

Procedure Approval

Approved by

JERRY BUFFORD, PROGRAM MANAGER, REGULATORY COMPLIANCE DATE 9-23-19

BRAD JONES, MANAGER, THERMAL GENERATION & GAS PIPELINE ASSETS DATE 9-23-19

PURPOSE AND SCOPE

To establish a uniform procedure for performing corrosion control activities on SMUD's natural gas pipelines. The corrosion control and cathodic protection systems on the SMUD pipelines shall comply with the requirements of Federal Regulations.

RESPONSIBILITY

- Manager, Thermal Generation & Gas Pipeline Assets is responsible for setting specific scope and final approval of this procedure.
- Asset Supervisor, Power Generation is responsible for ensuring the safe operation and maintenance of SMUD's gas transmission pipeline equipment, which includes reviewing and maintaining records, initiating actions to correct any conditions found during operation and maintenance activities, ensuring an SAP work order is issued for all preventative and corrective maintenance, and confirming all maintenance history is accurately captured.
- GPO Personnel and Contract Personnel are responsible for knowing and applying this procedure, following the steps in the associated job aid, knowing they are qualified to perform any covered task associated with this procedure, and for notifying the Asset Supervisor, Power Generation, if their operator qualification to perform assigned tasks is not current.
- Competent Engineer is responsible for the technical content of this procedure.

FACILITIES COVERED BY THIS PROGRAM

All SMUD gas transmission pipelines and associated facilities are covered by this procedure.

REGULATORY CODES & REFERENCES

DOT REQUIREMENTS

- 49 CFR 192, Subpart I
- 49 CFR Part 192 – Appendix D – Criteria for Cathodic Protection and Determination of Measurements

RELATED PROCEDURES AND FORMS

- GPO-OM-001 – System Description
- GPO-OM-014 – Physical Inspection
- GPO-OM-018 – SCADA
- GPO-OM-021 – Digester Gas
- GPO-CN-003 – Underground Clearance
- GPO-CN-010 – Field Application of Protective Coatings
- GPO-QT-001 – Operator Qualification Program
- GPO Form 5201A – Annual Cathodic Protection Survey
- GPO Form 5301 – Excavation Standby/Pipe Inspection Report
- GPO Form 5601 – Aboveground Pipeline Inspection Report
- GPO Form 9001 – Work Notification Request
- JA-OM-009A – Annual CP Survey
- Foreign Pipeline Crossing Database
- Unified Facilities Criteria (UFC) 3-570-06 Operations and Maintenance: Cathodic Protection
- NACE International SP0104 (current edition).

DEFINITION OF TERMS

See GPO-AG-002 – Terms and Definitions.

METHODS & OBSERVATIONS

1. SCOPE

1.1. This procedure describes SMUD's requirements for the protection of its pipelines from external, internal and atmospheric corrosion. [49 CFR 192.451]

1.2. Persons performing the functions under this procedure must be qualified to perform the tasks outlined in this procedure. See GPO-QT-001 – Operator Qualification Program.

2. EXTERNAL CORROSION CONTROL CRITERIA

2.1. SMUD's pipeline system and its design including the pipeline's corrosion protection system are described in GPO-OM-001 – System Description.

2.1.1. Details for installation of the various elements of the pipeline corrosion protection system include: SMUD Drawings GPO-SYS-6001, GPO-SYS-6002, GPO-SYS-E6001, GPO-SYS-6002 and GPO-SYS-6003. (Hardcopies of these drawings can be found at the Gas Pipeline Office).

2.2. Underground Piping

2.2.1. All underground pipelines shall have a protective coating that complies with procedure GPO-CN-010 – Field Application of Protective Coatings [49 CFR 192.455]

2.2.2. On all new, replaced or relocated pipe the cathodic protection system must be installed and placed in operation within 1 year after completion of construction. [49 CFR 192.455]

2.2.3. SMUD's External Corrosion Control Program consists of:

A. Sacrificial anode system type cathodic protection (CP) [49 CFR 192.463]

B. Real time online monitoring of pipe-to-soil potentials through SCADA communication

C. Annual field CP recording and reporting

D. AC mitigation devices

1. SMUD uses a Polarization Cell Replacement (PCR) installation to provide DC decoupling and AC continuity/grounding.

2. Zinc ribbon may also be used for AC mitigation.

2.2.4. All SMUD pipelines shall be cathodically protected with current applied and a negative (cathodic) voltage of at least -850 millivolts DC with reference to a saturated copper-copper sulfate half-cell. [49 CFR 192.463, Appendix D]

2.2.5. All underground piping shall be insulated from any facility that could interfere with the cathodic protection system, such as other underground structures, casings, buildings, etc., unless the pipeline and other structures are electrically interconnected and cathodically protected as a single unit. See GPO-CN-003 – Underground Clearances. [49 CFR 192.467]

A. Typical details for installation for casing insulation are shown on SMUD Drawings GPO-SYS-6001 and GPO-SYS-6002.

2.3. Electrolysis Test Stations (ETS) shall be installed to perform pipe-to-soil checks and troubleshooting. See SMUD Drawings GPO-SYS-6001, GPO-SYS-6002, GPO-SYS-E6001, GPO-SYS-6002 and GPO-SYS-6003. [49 CFR 192.469]

2.3.1. ETS shall be located as follows:

A. Both sides of an insulated fitting

B. At cased crossings

C. At crossings of other underground metallic facilities/pipelines where practical. If a test station cannot be installed to monitor for stray current from a foreign pipeline with cathodic protection, the technician will notify the Asset Supervisor, Manager and/or Competent Engineer for further evaluation.

D. At every valve station

E. Other locations as needed

2.3.2. Test Leads [49 CFR 192.471]

A. All test leads must be securely connected to the pipeline and remain electrically conductive. See SMUD Drawing GPO-SYS-6002 and GPO-SYS-E6002.

1. Test leads shall be attached to the pipeline to minimize stress concentration on the pipe. Installation shall be by a qualified individual in accordance with SMUD drawings and GPO-QT-001 – Operator Qualification Program.

a. All test leads shall be specified in accordance with the requirements of the appropriate ETS station typical drawing for the section of pipe being protected (wire size, insulated, etc.).

b. Exothermic (thermite) welding shall be performed in accordance with weld package manufacturer's recommended cartridge and charge size for wire size, pipe size and material.

c. Size of thermite welding charge shall not exceed a 15 g cartridge.

d. After the exothermic weld is completed and before coating, test lead wires shall be tested for electrical continuity.

e. The point where the bare test lead connects to the bare metallic area of the pipe shall be coated with an electrical insulating material compatible with the pipe coating and the insulation of the test lead. For information about approved coatings for exothermic welds, refer to GPO-CN-010 – Field Application of Protective Coatings.

2.3.3. Current span test stations shall be installed, as needed.

3. EXTERNAL CORROSION CONTROL MONITORING

3.1. Pipe-To-Soil Checks

A procedure for pipe-to-soil checks is included in the Miscellaneous Section of this procedure.

3.2. Operational Monitoring

3.2.1. Transmitters that continuously measure pipe-to-soil potentials are located at the seven main line valve locations and the power plant meter stations.

3.2.2. These transmitters shall be monitored by the Power System Operators (PSO) through the SCADA system on a continuous basis.

A. In the event that a pipe-to-soil reading from the monitoring system becomes less negative than -850 mV or more negative than -1.8 V, the Power System Operator will notify GPO Maintenance by the next working day.

B. The SCADA monitoring system shall be calibrated and/or inspected for accuracy, in accordance with GPO-OM-018 – SCADA.

3.3. Inspection of Exposed Facilities

3.3.1. Any portion of the buried gas pipeline system that is exposed for any reason shall be examined for evidence of external corrosion.

3.3.2. If evidence of corrosion exists, the pipeline will be exposed in either direction to determine if additional corrosion exists and to what extent.

A. If possible, a pipe-to-soil reading should be taken.

3.3.3. The inspection shall be documented on GPO Form 5301 - Excavation Standby/Pipe Inspection Report.

3.4. Annual Cathodic Protection Survey

3.4.1. A complete system Cathodic Protection Survey shall be performed every calendar year, at intervals not to exceed 15 months. [49 CFR 192.465] in accordance with JA-OM-009A – Annual CP Survey. For additional information on testing procedures refer to UFC 3-570-06 Operations and Maintenance: Cathodic Protection.

3.5. Measuring Current Flow on Pipelines

A. Existing 4-Wire Line Current ETS

1. Calibrated Span:

a. If the pipe span resistance is already known and documented, measure the mV difference between the two inside wires. Using the measured span resistance and Ohm's Law, calculate the amount of line current flowing on the pipe between the two inside wires. The digital meter needs to be measuring DC voltage and not AC voltage. Since current flow is from positive to negative, the polarity of the pipe span current should be documented to know which direction the pipe current is flowing.

2. Uncalibrated Span:

a. If the pipe span is not known, attach a battery to the two outside wires and measure the voltage drop on the two inside wires with current applied and off. The difference in voltage (voltage difference with battery connected and disconnected with polarity considered) and the battery current applied is used to calculate the pipe span resistance.

b. If it is not known which are the inside or outside wires do the following: If the current is not applied to the outside wires, the voltage measured will result in measurements that are out of range. To correct this, test the wires until a pipe span resistance is measured that is within acceptable limits. Label which wires are outside and inside after measuring the pipe span resistance.

B. 2-Wire Line Current Measurements

1. Where existing 4–wire ETS are not available, line currents can be measured using connections between 2 ETS locations. A light wire can be extended between two ETS's and the mV drop measured to determine current flow direction. From that mV

drop measurement and knowing the distance between the ETS's and the pipeline correction factor (CF), the magnitude or current can be estimated.

2. The CF for the pipeline are as follows: (4)

   700 A and B CF = 274.35 A/mV/ft

   800C CF = 321.78 A/mV/ft

3. Example: If the measured mV drop is 5mV between two ETS 500 feet apart on the 700A or B lines the current flowing on that span would be 5mV X 274.35 A/mV/ft. divided by the distance 500 feet or 2.74 Amperes.
4. Please refer to the UFC guidelines in UFC 3-570-06 for greater detail on how to complete this testing.

3.6. DC Stray Current Interference Testing, Monitoring and Mitigation

A. Static Stray Current:

1. If during the annual survey there is indication of changes in DC potentials near a foreign pipeline crossing or foreign CP system installation, there may be a need for supplemental testing required to identify any static stray current on the SMUD pipelines. A Close Interval Potentials Survey (CIS) may be performed through that area near the foreign pipeline crossings, to determine if there is current discharge at the foreign crossing from the SMUD pipe back to the foreign pipeline's rectifier.
2. If that is determined, joint DC stray current studies should be performed in conjunction with the with the foreign pipeline operator(s). This would include interrupting foreign pipeline rectifiers and recording pipe-to-soil potentials to determine if an issue exists. If stray current is evident, the following mitigation efforts should be considered.
3. Mitigation of stray current at foreign pipeline crossings may include one of more of the following:
   a. Moving the foreign rectifier and/or the anode bed to a location that will eliminate the interference issue.
   b. Reducing the amount of current output from the foreign rectifier, that is negatively impacting SMUD's pipeline, to a level that has no detectable impact.
   c. Coating the foreign pipeline at the crossing
   d. Installation of a dielectric barrier between the two pipelines at the crossing
   e. Installing magnesium anodes at the foreign pipeline crossing
   f. Installation of a bond between the foreign pipeline and SMUD. Monitoring the bond every two months if its operation is considered to be critical for preventing stray current damage. The bond will be monitored during the annual survey if it is not critical for preventing stray current damage, but only required to improve cathodic protection levels at the foreign crossing.
   g. The installation of a bond at the foreign crossing is to be avoided and only done if there is no other option that is practical from a technical or economic study.

B. Dynamic Stray Current:

1. If there is evidence of dynamic stray DC current from the Sacramento Regional Transit light rail operation, during the Annual Survey, supplemental evaluations should be performed. Placement of data recorders in locations where dynamic stray current is evident. Data recorders will be used to monitor dynamic DC stray currents from the light rail operation by recording DC pipe-to-soil potentials for

longer periods of time (24 to 48 hours). This data will be used to determine where issues exist and if further studies need to be done to mitigate unacceptable levels of dynamic DC stray current. Recorded documentation should be performed a minimum of 3-5 years, to provide comparative analysis of the data and assure that the dynamic stray DC currents are not increasing with time.

2. Please refer to the UFC guidelines in UFC 3-570-06 for greater detail on DC stray current causes and test procedures.

3.7. Mitigation of Buried Piping Metallic Conflicts

A. If a short to a foreign underground pipeline or structure exists, then the conflict can be identified either through calibrated span IR Drop or a locating device. A Tinker Rasor Model PD or other pipe locating devices provide an easy means of identifying a conflict.

B. After clearing the conflict, the pipe-to-soil potential and anode output near the conflict should be re-evaluated to confirm the removal of the conflict. If compliance is not indicated, the pipeline will require resurveying to locate additional conflicts and this process repeated until compliance is met.

3.8. IR Drop Consideration

A. Previous cathodic protection surveys of the pipelines indicate that the fusion bonded epoxy coating is in excellent condition and thus current interruption of the anodes will not result in sufficient depolarization to get polarized (instant off) potentials. To better document and understand the polarized potential on the pipeline, coupons should be installed at key locations to monitor IR Drop and stray currents per NACE International SP0104 (current edition).

4. INTERNAL CORROSION CONTROL CRITERIA

4.1. Gas supply tariffs with PG&E shall call for gas with no more than trace amounts of constituents that could cause internal corrosion.

4.2. Any location where corrosive agents or liquid can enter the pipeline shall have corrosion monitoring equipment installed.

4.3. Whenever any pipe or portions of pipe (as for a tap) are removed from the system, the internal surface shall be inspected for evidence of internal corrosion.

4.3.1. Inspections shall be documented with photographs and all documentation shall be retained in accordance with SMUD records retention policy.

4.3.2. The results of the inspections shall be reviewed with Power Generation Engineering.

4.3.3. If evidence of internal corrosion is discovered in the pipeline, Power Generation Engineering will investigate to determine the cause and the extent of the corrosion, and will provide a timely corrective action plan.

4.4. Internal Corrosion Control Monitoring

4.4.1. If applicable, corrosometer probes shall be checked twice annually at intervals not to exceed 7 months when the California Energy Exchange (CEE) is introducing local California gas into SMUD's pipeline. This location is permanently out of service.

4.4.2. A periodic assessment of the Digester Gas piping should be performed to determine any active internal corrosion.

5. ATMOSPHERIC CORROSION CONTROL CRITERIA & MONITORING

5.1. All aboveground piping and equipment shall be coated in accordance with GPO-CN-010 – Field Application of Pipeline Coatings.

5.2. The aboveground station piping is inspected during patrols and at least annually for atmospheric corrosion and documented on work order.

6. CORRECTIVE ACTION

6.1. These procedures shall be used to identify cathodic protection deficiencies or conflicts for corrective action.

6.2. Notification and Reporting of Deficiencies

6.2.1. GPO Maintenance shall submit the Cathodic Protection Field Report or Annual Survey form to the Power Generation Asset Supervisor for review and approval.

6.2.2. When a deficiency is identified, Prompt Remedial Action shall be initiated to address the problem. If deficiencies could result in an immediate hazard to the public, correction will be completed as soon as possible.

A. Examples of possible cathodic protection deficiencies include but are not limited to:

1. Shorted dielectric fittings
2. Anode fuse open
3. Contacts to foreign structures, above or below ground
4. Anodic or cathodic interference
5. Shorted casing or casing ETS leads
6. Atmospheric corrosion
7. Evidence of foreign CP on SMUD gas pipeline

6.2.3. A Work Notification Request shall be used for corrective maintenance items that cannot be corrected at the time of discovery.

6.2.4. The Work Notification request will be sent to the Asset Supervisor, Power Generation.

6.2.5. The Asset Supervisor, Power Generation or designee shall generate an SAP work order for any unresolved corrective maintenance items.

6.2.6. The Asset Supervisor, Power Generation or designee shall note the work order number on the Cathodic Protection Annual Survey form prior to closing out the SAP order issued for the Annual CP Survey.

6.2.7. The work order shall be used to track the required follow-up action to completion.

FREQUENCY SMUD GPO Maintenance shall perform a cathodic protection survey at least once each calendar year, at an interval not to exceed 15 months. All other CP maintenance frequencies are as described in the body of this procedure.

A technical review of this procedure shall be performed at least once each calendar year, at an interval not to exceed 15 months. If a significant change is identified prior to the annual review, this procedure will be revised and issued as needed.

DOCUMENTATION Alignment sheets showing all of SMUD's cathodically protected facilities shall be kept and maintained for as long as the facility remains in service.

In addition, SMUD shall maintain a record of each test, survey, or inspection required by this procedure. These records must be retained for at least 5 years, except that records related to the annual cathodic protection survey and internal corrosion inspections performed when pipe is removed or replaced must be retained for as long as the pipeline remains in service.

Electronic copies of the procedures can be viewed on the SMUD Intranet under Work Group: Power Generation\Gas Pipeline\Gas Pipeline Procedures Manual. All field personnel have access to the manuals via their SMUD issued laptops.

REFERENCES:

(1) NACE SP0169-2013 Control of External corrosion on Underground or Submerged Metallic Piping Systems; 2013.

(2) NACE SP0177-2014 Mitigation of AC and Lighting on Metallic Structures and Corrosion Control Systems; 2014.

(3) NACE SP0200-2014- Steel Cased Pipeline Practices: 2014

(4) NACE SP0200-2014- Steel Cased Pipeline Practices: 2014-Table B-4

Other Key References

Peabody's –Control of Pipeline Corrosion, Second Edition, Edited By R.L Bianchetti,2001

Cathodic Protection Survey Procedures, W. Brian Holtsbaum, 2009

List of Industry Standard References		
Publisher	Number	Title
NACE	SP0177	Mitigation of Alternating Current and Lighting Effects on Metallic Structures and Corrosion Control Systems
NACE	SP0286	The Electrical Isolation of Cathodically Protected Pipelines
NACE	SP0188	Discontinuity (Holiday) Testing of Protective Coatings
NACE	TM0497	Measurement Techniques Related to Criteria for Cathodic Protection on Underground or Submerged Metallic Piping Systems
NACE	RP0375	Field Applied Underground Coating Systems for Underground Pipeline Application
CSA	Z245.20M	External Fusion Bond Epoxy Coated Steel Pipe
NACE	SP0394	Application, Performance, and Quality Control of Plant-Applied Fusion-Bonded Epoxy External Pipe Coating
NACE	SP0274	High Voltage Electrical Inspection of Pipeline Coatings Prior to Installation
NACE	SP0102	In-Line Inspection of Pipelines
NACE	TM0103	Aboveground Survey Techniques for the Evaluation of Underground Pipeline Coating Condition
NACE/ASTM	G193	Standard Terminology and Acronyms Relating to Corrosion
NACE	SP0207	Performing Close-Interval Potential Surveys and DC Surface Potential Gradient Surveys on Buried or Submerged Metallic Pipelines
NACE	SP0502	Pipeline External Corrosion Direct Assessment Methodology
NACE		Internal Corrosion Direct Assessment
NACE	SP0104	The Use of Coupons for Cathodic Protection Monitoring Applications
Department of Defense	UFC 3-570-06	Operation and Maintenance: Cathodic Protection Systems

VERSION HISTORY

VERSION	CHANGE	BY	DATE
1	Changed title from Manager, Thermal Generation and Gas Pipeline Assets to Manager, Gas Pipeline Assets; Changed Approval/Signature Block; Reference to Maintenance Planner removed; Reference to GPO Form 9001 removed; Corrected original effective date to January 2016 per memo from Ross Gould (GPO 15-304).	Brad Jones	January 2017
2	Added a greater than statement in 3.2.2. A; Added reference to coating damage in Section 3; Added documentation clarification in 4.3.1; Added item 7 in 6.2.2. A Evidence of foreign CP on SMUD gas pipeline; Updated Title from Regulatory Coordinator Generation to Program Manager, Regulatory Compliance in Approved By; Added sections 3.4.2 through 3.4.12.	Brad Jones Dan Stricklin	December 2017
3	Removed job aid reference material (section 3) and ensured steps are in Job Aid JA-OM-009A; Removed reference to GPO Form 5601.	Brad Jones Bryant Ly	December 2018
4	Updated title Manager, Gas Pipeline Assets to Manager, Thermal Generation & Gas Pipeline Assets; Changed Section 6.2.2 from "prompt remedial corrective action" to "Prompt Remedial Action".	Brad Jones Francis Christensen	September 2019

Procedure Approval

Approved by

JERRY BUFFORD, PROGRAM MANAGER, REGULATORY COMPLIANCE — DATE 9-23-19

BRAD JONES, MANAGER, THERMAL GENERATION & GAS PIPELINE ASSETS — DATE 9/23/19