Title: Odorization of Natural Gas

Purpose

Utility Standard S4350 defines responsibilities and procedures for proper odorization of natural gas in Pacific Gas and Electric Company's (the Company's) gas transmission and distribution system to ensure compliance with applicable federal and state laws and regulations. This document identifies the odorants that the Company approved for use and specifies the maintenance, operation, and recordkeeping procedures for odorizers and odorant monitoring instruments.

Safety

Perform all gas odorization activities and related work safely and in accordance with all applicable safety rules, the *Code of Safe Practices*, and Utility Standard Practice (USP) 22, "Safety and Health Program."

Requirements

The requirements and procedures of this standard are detailed under the "Odorization of Natural Gas Requirements" section starting on Page 2.

This standard is the governing document for the following Company work procedures that address additional requirements and procedures for odorization activities:

- Work Procedure WP4350-01, "Natural Gas Odorant Releases and Spills"

  Procedures describing responsibilities and activities to address natural gas odorant releases and/or spills by using approved products for mitigation.

- Work Procedure WP4350-02, "Bulk Odorant Deliveries, Maintenance, and Operating Procedures"

  Responsibilities and activities describing the safe and efficient handling and transportation of natural gas odorant.

Odorization of Natural Gas Requirements

1. General Information

A. All gas in transmission and distribution lines and in gathering lines in Class 3 and 4 locations shall be odorized so that its odor is readily detectable at concentrations of one-fifth of the lower explosive limit (LEL).

B. Proper levels of odorization shall be verified by conducting periodic analyses of the odorized gas and by performing odor intensity tests.

2. Odorant Blends

A. Only the gas odorant blends indicated in Table 1 shall be used.

Table 1. Gas Odorant Blends

Odorant	Description	Recommended Application	Initial Recommended Nominal Rate (lb/MMscf)	Material Code
Odorant 1	50% THT and 50% TBM	System wide	0.15 to 0.60	500020
Odorant 2	100% THT	Farm tap odorizers and other specific applications	0.15 to 0.60	500019

THT – Tetrahydrothiophene
TBM – Tertiary butyl mercaptan
lb/MMscf – pounds per million standard cubic feet

B. Initial odorization rates shall be in accordance with Table 1 above. If high or low odorant or odor levels in the downstream distribution system require that injection rates differ significantly from the recommended nominal rates in Table 1, a thorough field test must be conducted to provide the basis for the deviation from the recommended nominal rates.

C. All odorant purchases must be coordinated through the Purchasing department.

D. Refer to Work Procedure WP4350-02, "Bulk Odorant Deliveries, Maintenance, and Operating Procedures," for detailed procedures concerning the planning, purchase, and coordination of any bulk delivery of odorant by a Company-approved supplier.

3. Odorizers

A. Odorizers must be designed, installed, and maintained so that sufficient amounts of odorant can be introduced into the gas at all operating flows without wide variations in the concentration of odorant in the gas stream. Equipment adjustments may be required if odor intensity readings are outside the specified range.

B. Odorizers shall not be taken out of service without the prior approval of the Maintenance and Construction (M&C) Gas Transmission (GT) district supervisor or the M&C distribution gas Transmission and Regulation (T&R) supervisor. For an extended shutdown period (over 24-hours), a clearance from System Gas Control (SGC) must be obtained.

C. At odorizer inspection and maintenance intervals, the following tasks shall be performed:

(1) Inspect all odorizers, except farm tap odorizers, at least once each month.

(2) Check odor intensity downstream of each odorizer, except for farm taps, at the first readily accessible tap.

(3) Check, test, and service farm tap odorizers at least annually.

(4) Maintain and calibrate odorizer equipment in accordance with the equipment manufacturer's recommendations.

(5) Check the liquid level in the odorant "run" tank and/or storage tank at least once a month to ensure an adequate supply of odorant is available until the scheduled filling date.

(6) Use the M&C GT Pipeline Maintenance (PLM) management system to record calibration details and maintenance repairs performed on odorizers and related equipment maintained by M&C GT. Calibration, maintenance, and repair records for odorizers and related equipment maintained by divisions shall be kept by the local office for the operating life of the equipment. In the event the equipment is removed from service, the local office shall retain records for 5 years after the equipment is taken out of service.

4. Odor Intensity Tests

A. One of the following approved odor concentration test instruments shall be used to perform odor intensity tests:

- Heath Odorator®
- DTEX® Odorant Detection System
- Bacharach Odorometer®

B. Any new test instruments must first be approved by GT&D Gas Engineering.

C. Properly trained operators and technicians with a normal sense of smell shall perform odor intensity tests (see Section 9, "Training," on Page 5 of this document).

D. Odor concentration test instruments shall be calibrated annually in accordance with the manufacturer's instructions.

E. Odor intensity tests must be conducted at the designated distribution and M&C GT sampling points using the testing frequencies listed in Attachment 1, "Odor Intensity Test Schedule for Gas Transmission and Distribution Systems."

F. Gas odor shall be readily detectable at a concentration of 0.6% gas-in-air or less.

G. If gas odor is not readily detectable at 0.6% gas-in-air, the person conducting the test must immediately notify the appropriate supervisor. The supervisor may verify the reading, if appropriate, and shall immediately notify the GT district supervisor and/or the M&C distribution Gas T&R supervisor, who must ensure that immediate and continuing actions are taken to restore adequate odor concentration levels.

5. Sulfur Analyzers

A. Sulfur analyzers are used to monitor the concentration of odorant and/or sulfur compounds in the major sources of out-of-state gas, such as Canadian and U.S. southwest supplies, and in the gas from major underground gas storage fields.

B. In conjunction with odor intensity tests, data from these sulfur analyzers is used to verify proper levels of odorant concentration in the gas. These analyzers also determine when or if supplemental odorization shall be started at strategic locations in the system.

6. Response to High or Low Odorant Concentration

A. In response to reports of high or low odorant concentration levels, immediate action shall be initiated to investigate and take necessary corrective measures.

B. Upon receipt of a report of low odorant concentration, the district shall initiate immediate and continuing actions to restore adequate odorant concentration levels to provide properly odorized gas. SGC and the affected distribution operating employees shall be notified of the situation. SGC will coordinate communication between the GT Gas Quality On-Call Group, M&C districts, and affected distribution locations.

C. When high odorant levels are found, the district shall take corrective action and must immediately notify SGC and the affected distribution locations.

D. If the situation warrants, the California Public Utilities Commission (CPUC) shall be notified of any problems associated with low or high odor intensity levels in the gas system. GT&D will coordinate any CPUC notification relating to odorization.

E. After taking action to correct low odorant concentration levels, an odor intensity test shall be conducted to ensure adequate odorant levels. SGC and the M&C distribution superintendents shall be notified after corrective actions are taken.

7. Odorization Records and Reports

A. Form 62-4650, "Monthly Odorization Report," (Attachment 2) must be completed monthly for all odorizer stations, and is to be used at all odorizer locations, except farm taps.

B. Form 62-4650 (Attachment 2) requires that an accurate method of determining total odorant usage and total gas treated be used. A copy of the completed report indicating the GT district supervisor's or M&C distribution supervisor's review and approval must be forwarded to the manager of GT&D Gas Engineering. The originals of these reports shall be retained in the local distribution office or GT district file for at least 5 years.

C. The odor intensity readings on Form 62-4650 (Attachment 2) can be taken either once at the end of each month (during the final monthly visit) or reported as an average of multiple reads during the month being reported. If a sulfur analyzer is located directly downstream with no other source of gas intermingling and the analyzer continually monitors the concentration of odorant, then the odorant intensity reading is not required.

D. Odor intensity test results, for the sample locations shown in Attachment 1, "Odor Intensity Test Schedule for Gas Transmission and Distribution Systems," must be recorded using Form 62-3480, "Odor Intensity Report," (Attachment 3). For test sample locations, refer to Attachment 1. The original copy of the completed report indicating the review and approval of the GT district supervisor or M&C distribution gas T&R supervisor must be forwarded to GT&D Station Engineering. A copy of this report shall be retained in the local distribution office or GT district file for at least 5 years.

E. The "Comments" section of Form 62-3480 (Attachment 3) shall be used to indicate any corrective actions taken to restore odorant concentration levels, or any other unusual conditions worth reporting.

F. Calibration of odorant concentration test instruments and odorant chromatographs shall be performed annually and properly documented. Documentation shall be maintained on file in the district or division files for as long as individual instruments remain in service.

8. Responsibilities

A. The responsibility for odorization of natural gas shall rest with the M&C distribution gas T&R supervisor and the GT district supervisor who direct the maintenance and operation of facilities and equipment relating to odorization, such as odorizers, odor concentration test instruments, and sulfur analyzers.

B. Gas System Integrity is responsible for communicating with the appropriate government agencies, such as the Department of Transportation (DOT) and the CPUC.

9. Training

Training of GT and M&C gas district and distribution employees on the maintenance and operation of odorizers and odorant monitoring instruments can be arranged through the GT&D Gas Engineering facility engineer assigned to manage odorant operations.

Approved by Robert Howard
Vice President

Implementation Responsibilities

The senior director of Asset Strategy and Planning is responsible for reviewing, approving, and distributing this standard.

The senior director delegates authority to the director of Gas Engineering to revise and reissue attachments to this standard or to approve variances from the requirements in this standard on an exception basis.

The directors, mangers, superintendents, and supervisors of Energy Delivery are responsible for ensuring that the provisions of this standard are followed.

Compliance

Implementation and effectiveness are measured by responsible managers and superintendents. In addition, periodic audits may be conducted by internal Company departments and the CPUC to verify compliance with this standard, the requirements of CPUC G.O. 112-E, "State of California Rules Governing Design, Construction, Testing, Operation, and Maintenance of Gas Gathering, Transmission, and Distribution Piping Systems, and Department of Transportation (DOT), Code of Federal Regulations (CFR), Title 49, Section 192.625, Odorization of Gas."

Definition of Terms

CFR: Code of Federal Regulations.

CPUC: California Public Utilities Commission.

DOT: Department of Transportation.

ED: Energy Delivery.

LEL (lower explosive limit): The lowest concentration of natural gas-in-air that supports combustion. For the Company's natural gas, the LEL is approximately 5% gas-in-air.

Odor intensity test instrument (commonly called an "odorometer"): An instrument used to determine the odor intensity at various gas-in-air concentrations.

Odorant: A chemical compound that is added to natural gas to give it a characteristic scent that warns of its presence.

Odorizer: The equipment used to add odorant to natural gas.

TBM: Tertiary butyl mercaptan, a natural gas odorant.

THT: Tetrahydrothiophene, a natural gas odorant.

Recision

This standard supersedes UO Standard S4350, "Odorization of Natural Gas," issued August 2006.

Reference Documents

CFR, Title 49, Section192.625, Odorization of Gas"

Code of Safe Practices

CPUC G.O. 112-E, "State of California Rules Governing Design, Construction, Testing, Operation, and Maintenance of Gas Gathering, Transmission, and Distribution Piping Systems

Numbered Document N-12, "Typical Pipeline Odorant Injection System Specification"

USP 22, "Safety and Health Program"

Work Procedure WP4350-01, "Natural Gas Odorant Releases and Spills"

Work Procedure WP4350-02 "Bulk Odorant Deliveries, Maintenance, and Operating Procedures"

Attachments

Attachment 1, "Odor Intensity Test Schedule for Gas Transmission and Distribution Systems"

Attachment 2, Form 62-4650, "Monthly Odorization Report"

Attachment 3, Form 62-3480, "Odor Intensity Report"