



## Leak Grading and Response

### Summary

This utility procedure documents how to grade leaks on Pacific Gas and Electric Company (Company) transmission and distribution (T&D) gas facilities. It also describes the grades of gas leaks, criteria for assigning each grade, required actions for each leak grade, and criteria for downgrading a gas leak.

Level of Use: Reference Use

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### Target Audience

- Gas maintenance and construction (M&C) personnel.
  - Gas M&C supervisors.
  - Gas mapping personnel.
  - Gas field service personnel.
  - Gas field service supervisors.
  - Applied technology services (ATS) personnel.
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### Safety

Perform all gas leak survey and facility-related maintenance and operations work safely and in accordance with applicable safety rules.

Hazards impacting this work include but are not limited to the following conditions:

- Dangerous animals.
  - Tripping and slipping.
  - Traffic conditions.
  - Vegetation, including poison oak.
  - Environmental surroundings.
  - Construction sites.
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## Leak Grading and Response

**Before You Start** Personnel implementing this procedure must wear the following personal protective equipment (PPE):

- Hard hat (must be available).
- Traffic vest.
- Proper work footwear (no sneakers allowed).
- Long-sleeved shirt.
- Long pants.
- Gloves (must be available).
- Safety glasses (must be available).

The following are the tools and materials required to perform these procedures:

- Leak survey instruments.
- Impact bar.
- 14-inch adjustable wrench.
- Two pipe wrenches (12-inch and 18-inch).
- Curb valve wrenches as applicable.
- Mobile device.
- Soap solution in a bottle or can.
- Others as applicable.

Any person performing leak grading must be qualified for one of the following operator qualification (OQ) subtasks:

- 09-01, "Conduct Survey"
- 09-02, "Leak Investigation"
- 09-03, "Field Service Leak Investigation"

Any personnel performing leak grading must also be qualified for the appropriate OQ subtasks from the following list before using a specific leak survey instrument:

- 09-04, "Leak Survey – (OMD)"
- 09-05, "Leak Survey – (RMLD)"
- 09-06, "HFI - Heath DP3 & DP4"
- 09-07, "HFI – OVA-88"
- 09-08, "Field Service Leak Grading"
- 09-09 "Leak Survey DP-IR Detecto Pak – Infrared"



## Leak Grading and Response

### Table of Contents

Subsection	Title	Page
1	General Information.....	4
2	Leak Grading.....	5
3	Upgrading Gas Leaks.....	5
4	Downgrading and Clearing Gas Leaks.....	5
5	Grade 1 Gas Leaks .....	6
6	Grade 2+ (Priority Grade 2) Gas Leaks.....	8
7	Grade 2 Gas Leaks .....	9
8	Grade 3 Gas Leaks .....	11
9	Grade 0 Gas Leaks .....	12
10	Identifying and Grading Leaks on Copper Services .....	12
11	Grading Leaks Identified by Aerial Leak Survey Using Differential Absorption Lidar .....	12
12	Grading Leaks with Gas Migration .....	13



## Leak Grading and Response

### Procedure Steps

#### 1 General Information

- 1.1 Grade all gas leaks according to the instructions in this procedure.
- 1.2 Grade all gas leaks with an approved method or instrument.
- 1.3 Unless otherwise specified, all readings in this procedure refer to percent gas-in-air, subsurface readings.
- 1.4 This procedure does not apply to a non-hazardous release of gas at or downstream of the aboveground inlet gas service valve recorded in Customer Care & Billing (CC&B) processes. See Figure 1 below.

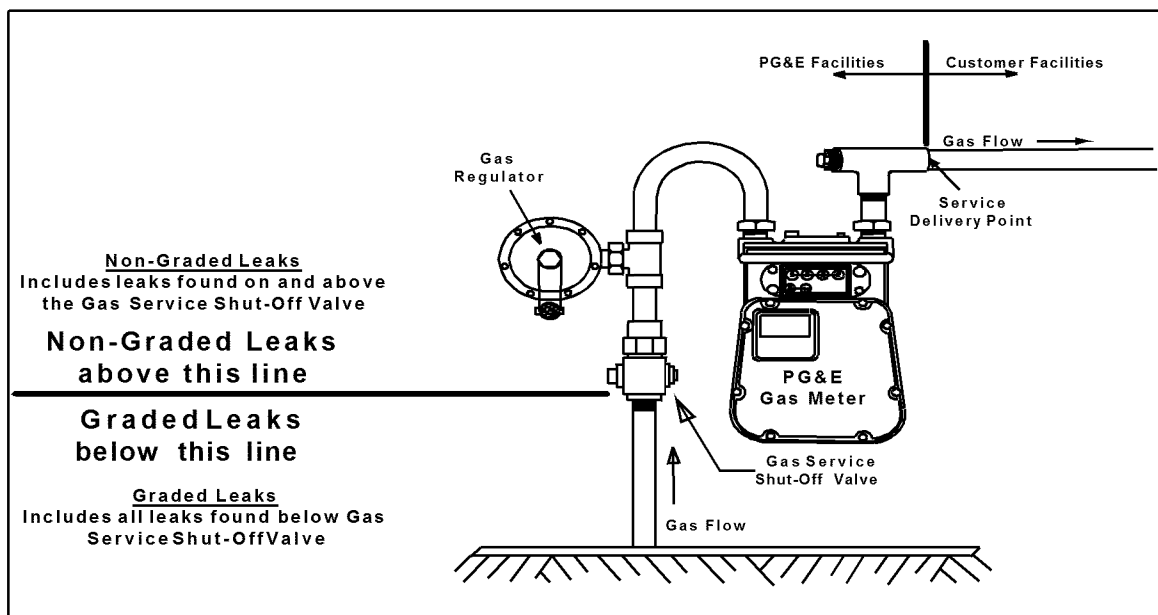


Figure 1. Graded and Non-Graded Leak Locations

#### NOTE

The Leak Survey, Repair, Inspection, and Gas Quarterly Incident Report – Form “A” (62-4060) is required for all Grade 1 leaks below the service valve.



## Leak Grading and Response

### 2 Leak Grading

A leak grade is based upon the severity and location of the leak, the danger the leak presents to persons or property, and the likelihood that the leak will become more serious within a specified amount of time. Table 1 below summarizes the gas leak grades. Also see the attached [Job Aid TD-4110P-09-JA-01, "Gas Leak Grades."](#)

**Table 1. Gas Leak Grades**

Grade	Definition
1	Also referred to as a "hazardous leak." A gas leak that represents an existing or probable hazard to persons or property and requires immediate repair or continuous action until conditions are no longer hazardous.
2+	A gas leak that is non-hazardous to persons or property at the time of detection but requires a scheduled priority repair completed within 90 days.
2	A gas leak that is non-hazardous to persons or property at the time of detection but requires periodic surveillance and a scheduled repair because it presents a probable future hazard.
3	A gas leak that is non-hazardous at the time of detection and can reasonably be expected to remain non-hazardous.
0	No gas leakage is found after investigating a previous reading.

### 3 Upgrading Gas Leaks

IF a graded gas leak worsens,

THEN upgrade it appropriately.

### 4 Downgrading and Clearing Gas Leaks

The following criteria apply when downgrading all leaks:

- Use an approved method to recheck and/or subsequently downgrade a leak to Grade 0.
- Consider the soil type (sand, clay, rock, etc.), soil moisture level, and weather while rechecking a leak. Evaluate a Grade 2+ or Grade 2 leak in clay soil (initially graded during a dry season) during wet seasons carefully before downgrading or clearing a leak.
- IF the original leak grade does not meet the leak grading criteria,  
THEN issue and document the proper leak grade.
- Except as provided below, do not downgrade a leak to Grade 3 more than once.
- IF a leak is determined to qualify to be downgraded to Grade 3 a second time,  
THEN the immediate supervisor of the person recommending the downgrade must investigate the situation to determine whether the second downgrade is warranted based on the readings from the field and previous overgrading of the leak.



## Leak Grading and Response

### 5 Grade 1 Gas Leaks

A Grade 1 gas leak, also referred to as a “hazardous leak,” represents an existing or probable hazard to persons or property and requires immediate repair or continuous action until conditions are no longer hazardous.

#### 5.1 Grade 1 Leak Criteria

When one or more of the following conditions exist, grade the leak Grade 1:

- Any reading of 4% gas-in-air or greater on subsurface gas facilities where gas would likely migrate to within 5 feet (ft.) of the outside wall of a building.
- Any reading of 4% gas-in-air or greater on small substructures (other than gas-associated substructures) where gas would likely migrate to within 5 ft. of the outside wall of a building.
- Any gas reading on subsurface facilities in, at, or under a building; within 5 ft. of a building; or in a tunnel.
- Any reading of 4% gas-in-air or greater in a confined space.
- Gas can be seen, heard, or felt on any aboveground or subsurface gas facility where the presence of gas endangers persons or property.
- Escaping gas ignites or explodes.
- Soap solution applied to an aboveground facility is blown off the facility, providing no opportunity for bubbles to form and “hold.” See the attached [Training Video TD 4110P-09-VID-01, “Above Ground Leak Grading Using a Soap Test.”](#)
- A leak does not meet the above criteria, yet still poses an immediate hazard in the judgment of any of the following personnel:
  - The leak surveyor and/or leak survey supervisor, or
  - A leak repair person and/or leak repair supervisor.

#### 5.2 Actions to Take for Grade 1 Leaks

Take immediate and continuous corrective action until the conditions are no longer hazardous. Such action may include but is not limited to one or more of the following tasks:

1. Evacuate the premises and restrict public access to the area.
2. Ventilate the area by removing manhole covers, bar-holing, installing vent holes, or by other means appropriate to the situation.

#### NOTE

After ventilation, if there are no subsurface gas reads within 5 ft. of the structure, the leak may qualify for a Grade 1 downgrade.



## Leak Grading and Response

### 5.2 (continued)

3. Eliminate hazard sources as follows:
  - Eliminate sources of ignition.
  - If gas is burning, prevent the spread of fire, but do not necessarily extinguish the burning gas.
  - Eliminate the source of gas.
4. Implement the local gas emergency plan as required.
5. Make continuous repair efforts until the leak is repaired or conditions are mitigated enough to downgrade the leak.
6. If the leak meets the criteria for a reportable incident or a safety-related condition (per Utility Standard TD-4413S, "Gas Event Reporting Requirements"), complete the necessary reports.
7. Immediately after a gas event involving fire or explosion and suspected to involve natural gas, perform the following tasks (also see Job Aid TD-4110P-09-JA02, "Obtaining and Analyzing Gas Samples"):
  - a. Obtain a sample of the gas in the line during the course of the event as close as possible to the event location and no later than 24 hours after the beginning of the event.
  - b. Send the sample to a laboratory for analysis for odorant level.
  - c. Perform the following documentation tasks:
    - (1) Attach a copy of the analysis results to the A Form (if applicable).
    - (2) Attach a copy of the analysis results to the event report.
    - (3) File the A Form and the event report in the A Form file.

### 5.3 Downgrading Grade 1 Leaks

When the Grade 1 status no longer applies to a gas leak, downgrade it appropriately, as defined in this section. Note the reasoning behind the downgrade on the leak record. The repair period required for a downgraded Grade 1 leak must be consistent with that of the newly assigned leak grade.

#### 1. Grade 1 to Grade 2+

Downgrade to a Grade 2+ leak if the leak is non-hazardous to persons or property at the time of evaluation, but still requires a scheduled priority repair within 90 days of detection.



## Leak Grading and Response

### 5.3 (continued)

#### 2. Grade 1 to Grade 2

Downgrade to a Grade 2 leak if the leak is non-hazardous to persons or property at the time of evaluation, but still requires a scheduled repair because it presents a possible future hazard. A Grade 2 leak must be repaired within 15 months of the original date the leak is graded as Grade 1.

#### 3. Grade 1 to Grade 3

**Do not** downgrade a Grade 1 leak to Grade 3.

#### 4. Grade 1 to Grade 0

**Do not** downgrade a Grade 1 leak to Grade 0.

IF the leak indication is not a valid leak on Company facilities,

THEN **do not** enter the leak into the Integrated Gas Information System (IGIS). Remove the leak from IGIS if it has been entered.

## 6 Grade 2+ (Priority Grade 2) Gas Leaks

A Grade 2+ leak is non-hazardous to persons or property at the time of detection, but still requires a scheduled priority repair within 90 days or less.

### 6.1 Grade 2+ Leak Criteria

When one or more of the following conditions exist, grade the leak Grade 2+:

- Any leak previously graded Grade 1, based on leak readings and the location of the leak, where the immediate hazard has been eliminated through crew action other than a leak repair (for example, by ventilating the leak), but where the leak still requires priority repair.
- Any leak that is damaging trees, crops, or ornamental plants, excluding lawns.
- Any leak that causes a public nuisance, anxiety, or apprehension.
- Soap solution on an aboveground facility can hold a cluster of bubbles under special circumstances (e.g., when the meter set is in a cabinet).
- A leak does not meet the above criteria, yet still poses a Grade 2+ hazard in the judgment of any of the following personnel:
  - The leak surveyor and/or leak survey supervisor, or
  - A leak repair person and/or leak repair supervisor.





## Leak Grading and Response

### 6.2 Actions to Take for Grade 2+ Leaks

Take the following actions for a Grade 2+ leak:

1. When grading a leak Grade 2+, establish the repair period, not to exceed 90 days from the date reported, to the date.
2. Repair or clear the leak, as designated by the operating department, in a time period not to exceed 90 days, to the date, from the date reported or before the ground freezes or other adverse changes in venting conditions occur.

### 6.3 Downgrading Grade 2+ Leaks

When the Grade 2+ status no longer applies to a leak, downgrade it to the appropriate grade as defined in this section. Note the reasoning behind the downgrade on the leak record.

#### 1. Grade 2+ to Grade 2

Downgrade to Grade 2 if the leak's status changes to meet Grade 2 criteria.

#### 2. Grade 2+ to Grade 3

Downgrade to Grade 3 if the leak's status changes to meet Grade 3 criteria.

#### 3. Grade 2+ to Grade 0

IF the leak indication is not a valid Grade 2+ leak or if no leak is found,

THEN perform the following tasks:

- a. Grade it Grade 0.
- b. Note the action taken or the reasoning behind the downgrade on the leak record.
- c. Consider the conditions to determine if a recheck is necessary.

## 7 Grade 2 Gas Leaks

A Grade 2 leak is non-hazardous to persons or property at the time of detection but still requires a scheduled repair because it presents a probable future hazard. Grade 2 leaks must be repaired within 15 months.



## Leak Grading and Response

### 7.1 Grade 2 Leak Criteria

When one or more of the following conditions exist, grade a leak Grade 2:

- Any reading of 4% gas-in-air or greater in a well-ventilated Class 3 or 4 location, such as a pipeline right-of-way, station yard, or a non-wall-to-wall paved area, where the leak does not otherwise qualify as Grade 1 or 2+.
- Any reading of 2% gas-in-air or greater in a wall-to-wall paved area where the leak does not otherwise qualify as Grade 1 or 2+.
- Any reading between 2% gas-in-air and 4% gas-in-air in a substructure where gas would likely migrate and create a probable future hazard.
- Any reading between 2% gas-in-air and 4% gas-in-air in a confined space.
- Soap solution on an aboveground facility can hold a cluster of bubbles.
- A leak does not meet the above criteria, yet still poses a Grade 2 hazard in the judgment of any of the following personnel:
  - The leak surveyor and/or leak survey supervisor, or
  - A leak repair person and/or leak repair supervisor.

### 7.2 Actions to Take for Grade 2 Leaks

Take the following actions for a Grade 2 leak:

1. For leaks found 12/31/2010 or earlier and not found during an accelerated gas transmission leak survey (GTLS), repair or clear the leak no later than 18 months, to the date, from the date reported or before the ground freezes or other adverse changes in venting conditions occur.
2. For leaks found 1/1/2011 or later or during GTLS, repair or clear the leak at the earliest of the following dates:
  - No later than 15 months from the date reported, to the date.
  - By the end of the calendar year following the calendar year in which the leak is found.
  - Before the ground freezes or other adverse changes in venting conditions occur.
3. Repair or clear all leaks on mains under street pavement and associated service lines before known street overlay work or known street reconstruction begins.
4. Recheck Grade 2 leaks before repair at intervals of 6 months, not to exceed the last day of the 7<sup>th</sup> month, to the date.



## Leak Grading and Response

### 7.3 Downgrading Grade 2 Leaks

When Grade 2 status no longer applies to a leak, downgrade the leak to the appropriate classification as defined in this section. Note the reasoning behind the downgrade on the leak record.

#### 1. Grade 2 to Grade 3

Downgrade the leak to Grade 3 if it is non-hazardous and can reasonably be expected to remain non-hazardous.

#### 2. Grade 2 to Grade 0

IF the leak indication is not a valid Grade 2 leak or if no leak is found,  
THEN perform the following tasks:

- a. Grade it Grade 0.
- b. Note the action taken or the reasoning behind the downgrade on the leak record.
- c. Consider the conditions to determine whether a recheck is necessary.

## 8 Grade 3 Gas Leaks

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

### 8.1 Grade 3 Leak Criteria

When one or more of the following conditions exist, grade the leak Grade 3:

- Any reading less than 4% gas-in-air in a well-ventilated Class 3 or 4 location, such as a pipeline right-of-way, station yard, or non-wall-to-wall paved area, where the leak does not otherwise qualify as Grade 1, Grade 2+, or Grade 2.
- Any reading less than 2% gas-in-air in a wall-to-wall paved area, where the leak does not otherwise qualify as a Grade 1, Grade 2+, or Grade 2.
- Soap solution on an aboveground facility foams small bubbles.
- Any other leak that is non-hazardous, can reasonably be expected to remain non-hazardous, and has not previously been downgraded to Grade 3.

### 8.2 Action to Take for Grade 3 Leaks

1. For leaks found 12/31/2011 or earlier and not during GTLS, recheck at the first scheduled recheck AND subsequently recheck at 15 months to the date from the previous recheck or during the next scheduled survey, whichever comes first.



## Leak Grading and Response

### 8.2 (continued)

2. For leaks found or rechecked 1/1/2011 or later or during GTLS, recheck at 15 months to the date or during the next scheduled survey, whichever comes first.

### 8.3 Downgrading Grade 3 Leaks

IF the leak indication is not a valid Grade 3 leak or if no leak is found,

THEN perform the following tasks:

1. Grade it Grade 0.
2. Note the action taken or the reasoning behind the downgrade on the leak record.
3. Consider the conditions to determine if a recheck is necessary.

## 9 Grade 0 Gas Leaks

IF a leak indication is not a valid leak or no leak is found,

THEN grade it Grade 0.

## 10 Identifying and Grading Leaks on Copper Services

Always grade any leak suspected to be on a copper service as Grade 1, Grade 2+, or Grade 2, but never as Grade 3 or Grade 0.

If a leak initially suspected of being on a copper service is not on a copper service, re-evaluate its designation as suspected copper via the following process:

1. Gas M&C personnel submit a request to the process owner proposing that the suspected copper designation be removed from the leak.
2. After critical review, the process owner authorizes and requests the change through IGIS administrators.
3. If the change is made in IGIS, local Company personnel update and initial all relevant local leak records with the new leak data.

## 11 Grading Leaks Identified by Aerial Leak Survey Using Differential Absorption Lidar

Where aerial surveys are permitted for gas transmission and gathering lines, verify a gas leak identified by an aerial leak survey using an approved subsurface leak detector and in accordance with [Utility Procedure TD-4110P-12 "Subsurface Leak Grading."](#) Then, grade the leak according to this procedure.



## Leak Grading and Response

### 12 Grading Leaks with Gas Migration

IF different readings are found in multiple locations and the readings and conditions indicate that there is actually only one leak with gas migration,

THEN assign only one leak number and report the most severe conditions.

#### END of Instructions

#### Definitions

**Blowing gas:** A gas leak which can be heard, seen, or felt, in accordance with the following definitions:

- **Heard:** A gas leak that makes a “blowing or hissing” sound.
- **Seen:** A gas leak that does not hold foam or soap solution or a leak that blows visible dust or dirt into the air. Bubbles coming through water may be included.
- **Felt:** A gas leak that is detectable by touch.

**Building:** Any structure normally or occasionally entered by humans for business, residential, or other purposes in which gas can accumulate. The one exception is Company-owned structures whose sole purpose is to protect pipeline facilities from the environment (such as meter houses and regulator station houses).

**CGI:** This acronym has the following two definitions, easily distinguished by the context in which they are used:

- **Can't Get In:** A location where there is presently no access to perform maintenance work.
- **Combustible gas indicator:** A type of leak survey instrument capable of detecting and measuring gas concentrations (of transported gas) in the atmosphere.

**Confined space:** Any subsurface structure (e.g., vault, tunnel, catch basin, or manhole) of sufficient size to accommodate a person and in which gas could accumulate.

**Gas facilities:** All Company-operated gas lines and related appurtenances.

- **Aboveground:** Exposed gas piping, fittings, and assemblies, including aboveground meter set assemblies and gas facilities within boxes, vaults, and pits.
- **Subsurface:** Buried gas piping, fittings, and assemblies.



## Leak Grading and Response

**GTLS:** Gas transmission leak survey, an accelerated leak survey of gas transmission lines in the second half of 2010.

**IGIS:** Integrated Gas Information System, an electronic system of record for gas leaks and other gas system information.

**Leak:** The unintentional escape of gas from containment.

**Leak grade:** The classification of a leak based on leak readings, public exposure, and location.

**Leak recheck:** Any leak survey performed with an approved instrument in the area of an existing Grade 2+, Grade 2, or Grade 3 leak.

**Leak repair:** An action to restore a gas facility to sound condition by eliminating a gas leak.

**Leak survey:** A patrol for gas leakage in any area where Company gas facilities exist or where a gas leak is reported or suspected.

**Operator qualified:** Personnel evaluated and qualified in accordance with Utility Standard S4450, "Operator Qualification Program."

**Process owner:** The engineering person responsible for managing the leak survey process.

**Small substructure (other than gas associated substructures):** Any subsurface structure that is of insufficient size to accommodate a person (e.g., telephone and electrical ducts and conduit or non-gas-associated valve and meter boxes) and in which gas could accumulate or migrate.

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

**Tunnel:** A subsurface passageway into which a person could enter and gas could accumulate.

**Venting:** Drilling a hole or holes or excavating above and/or around a leak to allow gas to dissipate or vent.

**Wall-to-wall:** An area is considered to have wall-to-wall pavement when either of the following conditions exists:

- There are buildings on both sides of the street with essentially uninterrupted pavement from the building walls on one side of the street to the building walls on the other side of the street.
- A gas main is under continuous pavement from its position to the nearest buildings and the distance from the gas main to the buildings is less than the distance to any other areas that allow significant venting.



## Leak Grading and Response

**Implementation Responsibilities** Gas M&C personnel perform leak survey and response measures in accordance with this procedure.

Gas field service personnel obtain gas samples in accordance with this procedure.

Gas mapping personnel provide documentation in support of this procedure.

Gas superintendents provide resources to perform the work described in this procedure.

**Governing Document** Utility Standard S4110, "Leak Survey and Repair of Gas Transmission and Distribution Facilities"

**Compliance Requirement/  
Regulatory  
Commitment** Code of Federal Regulations (CFR), Title 49, "Transportation,"  
Section 192.703(c)  
CPUC Commitment GE&O-2011-380

**Reference Documents** **Developmental References:**

NA

**Supplemental References:**

Division Gas Emergency Plans

Gas Numbered Documents:

- M-53, "Portable Combustible Gas Indicator Specification"
- M-53.1, "Portable Combustible Gas Indicator Operations and Maintenance Instructions"
- M-53.2, "Portable Hydrogen Flame Ionization Gas Detector"
- M-53.3, "Verifying the Calibration of Portable Combustible Gas Indicators, Hydrogen Flame Ionization Units, and OMDS"
- M-53.4, "Mobile Leak Survey – Hydrogen Flame Ionization"



## Leak Grading and Response

- M-53.5, “Mobile Leak Survey – Optical Methane Detection”
- M-53.6, “Remote Methane Leak Detector”
- M-53.7 “Remote Methane Leak Detector Operating Procedures”
- M-53.8 “Heath Detecto Pak-Infrared Leak Detector (DP-IR)” (proposed)
- M-54.1, “Impact Bar Probe”
- O-16, “Corrosion Control of Gas Facilities”

*Gas Piping Technology Committee (GPTC) Guide for Gas Transmission and Distribution Piping Systems, Material Appendix G-192-11, “Gas Leakage Control Guidelines for Natural Gas Systems” – Available through DOT Gas Regulations at [http://www/TechLib/default.asp?body=all\\_go\\_reqs.htm](http://www/TechLib/default.asp?body=all_go_reqs.htm)*

Leak Survey, Repair, Inspection, and Gas Quarterly Incident Report – Form “A” (62-4060)

Utility Procedure TD-4110P-12 “Subsurface Leak Grading”

Utility Standards:

- TD-4413S, “Gas Event Reporting Requirements”
- S4450, “Operator Qualification Program”
- TD-6434S, “Gas Leak and Odor Response”

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### Appendices

NA

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### Attachments

Job Aid TD-4110P-09-JA01 , “Gas Leak Grades”

Job Aid TD-4110P-09-JA02, “Obtaining and Analyzing Gas Samples”

Training Video TD-4110P-09-VID-01, “Above Ground Leak Grading Using a Soap Test”

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### Document Revision

This utility procedure supersedes Utility Procedure TD-4110P-09, “Leak Grading and Response,” Rev 1, publication date 09/28/2010.





## Leak Grading and Response

Approved By

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Document Owners

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Document  
Contact

[REDACTED]

### Revision Notes

Where?	What Changed?
Attachment 1	New
Target Audience	Added M&C supervisors, gas field service personnel and supervisors, and ATS personnel.
Safety	Deleted references to the Code of Safe Practices and USP 22.
Before You Start	Changed "EZ Tech cellular phone" to "mobile device." Added OQ subtasks for the various leak survey instruments used.
Several locations	Changed "life and property" to "persons and property."
Section 4	Added provision for second downgrade to Grade 3 upon supervisor investigation.
Section 5.1	Added small non-gas substructure and confined spaces.
Section 5.2.7	Added gas sampling requirement.
Section 5.3.2	Changed repair date for leak downgraded from Grade 1 to Grade 2 to 15 months from original Grade 1 found date.
Section 7.2	Changed Grade 2 repair date criteria depending on when the leak is found.
Section 8.2	Changed Grade 3 recheck criteria depending on when the leak is found.
Section 11	Removed the word "Vegetation" from the aerial survey and clarified language.
Definitions	Clarified "Aboveground" and "Subsurface." Added "Confined space," "GTLS," and "Small substructures."
Reference Documents	Added proposed M-53.8 for the DP-IR. Removed Code of Safe Practices and USP22.
Approved By	Changed to [REDACTED].
Document Owner	Changed to [REDACTED].
Document Contact	Changed to [REDACTED].