

# TR 2017-02 – Natural gas and Petroleum Gas Vapor

*2021 – May – Review by GPTC Secretary - **ReBallot***

Letter Ballot LB1-2020 had a Disapproved vote (Bob Naper) and Task Group made changes to address the Disapproved vote - Bob Naper emailed that he approves TR with these changes. Discussed status with 2<sup>nd</sup> Vice-Chair and Editorial Section Chair and decided TR 2017-02 should be sent to Re-Ballot for final approval with changes shown in blue highlight below. Discussion of letter ballot vote to Disapprove follows.

Ballot	Naper
LB1 - 2020	D

1) LB1-2020 Disapprove vote by Bob Naper to change “blend” to “mixture”. Task Group and Editorial Section approved change, plus other editorial changes to address votes of Approved with Comments. Email received from Bob Naper on 11/4/2020:

RE: My previous negative vote.  
Ladies and gentlemen,  
Please be informed that I now vote to accept this TR with the latest changes.  
With respect,  
Robert C. Naper

*2020 – July 16 – Editorial Section*

Editorial Section approved following additions/deletions to G-192-11 and G-192-11A. **Ready for Publication.**

PRIMARY: G-192-11, G-192-11A

PURPOSE: To revise GMA G-192-11 and G-192-11A to align appendices for all but technical differences due to difference in properties of the gas.

ORIGIN/RATIONALE: Philip Sher - See document attached to TR Package.

**Editorial notes:** 1) Editorial revisions from 2<sup>nd</sup> LB (LB1-2020) are highlighted.

2) Unable to show changes within Table 1 in both appendices, see Publication notes at each Table 1.

3) Sections 6 and 7 are identical in both GMA, so not shown in G-192-11A.

## GUIDE MATERIAL APPENDIX G-192-11

(See guide material under §§192.3, 192.503, 192.557, 192.615, 192.703, 192.706, 192.723, and 192.941)

### GAS LEAKAGE CONTROL GUIDELINES FOR NATURAL GAS SYSTEMS (METHANE)

(See Guide Material Appendix G-192-11A for petroleum gas systems)

#### 1 SCOPE

These guidelines provide criteria for the detection, grading, and control of gas leakage and related records for systems transporting natural gas.

#### 2 GENERAL DISCUSSION

(a) A separate set of guidelines for natural gas system leakage surveys has been developed because of the differing physical properties of petroleum gases and natural gas.

- (b) When considering gas leakage detection and control, the two most significant differences between natural gas and petroleum gas vapor are their specific gravities and flammable limits. The specific gravity of natural gas is approximately 0.6 which is, therefore, lighter than air. This property facilitates the venting and dissipation of natural gas leakage into the atmosphere.
- (c) The flammable range of natural gas is approximately 5% to 15% gas in air, compared to approximately 2% to 10% gas in air for petroleum gases.

SIGNIFICANT PHYSICAL PROPERTIES OF NATURAL GAS	
Formula	Blend
Normal State @ atmospheric pressure @ 60 °F	Gas
Specific Gravity (Air = 1)	0.6
Flammability Limits	
Lower limit % Gas in Air	5
Upper limit % Gas in Air	15

TABLE 1

**[Publication note: "Blend" needs to be changed to "Mixture" in Table 1.]**

### 3 DEFINITIONS (Applicable to Guide Material Appendix G-192-11 Only)

...  
*L-E-L* is the lower explosive limit of the gas being transported.  
 Natural gas is a **mixture** of gases, that is primarily methane, and ~~that~~ is lighter than air.  
 ...

### 4 LEAKAGE DETECTION

#### 4.1 Qualification of personnel.

For leak surveys, use personnel who are qualified (see Subpart N) in the type of survey being performed. These personnel should be familiar with the characteristics of the gas in the system and trained in the use of leak detection instruments.

#### 4.2 Reports from outside sources.

#### 4.3 Odors or indications from foreign sources.

When leak indications (e.g., gasoline vapors, natural, petroleum, sewer or marsh gas) are found to originate from a foreign source or facility, or customer-owned piping, prompt actions should be taken where necessary to protect life and property. Potentially hazardous leaks should be reported promptly to the operator of the facility, and, where appropriate, to the police department, fire department, or other governmental agency. When the operator's pipeline is connected to a foreign facility (e.g., the customer's piping), necessary action should be taken to eliminate the potential hazard, such as disconnecting or shutting off the flow of gas to the facility.

#### 4.4 Leak surveys and test methods.

For leak surveys, ...

##### (a) Surface Gas Detection Survey.

##### (b) Subsurface Gas Detection Survey.

(1) *Definition.* The sampling of the subsurface atmosphere with a combustible gas indicator (CGI) or other device capable of detecting 0.5% gas in air (10% of the LEL) at the sample point.

##### (2) *Procedure.*

(i) The survey should be conducted by performing tests with a CGI in a series of available openings (confined spaces and small substructures) or barholes over, or adjacent to, the gas facility or both. The location of the gas facility and its proximity to buildings and other structures should be considered in the spacing of the sample points. Sampling points should be as close as possible to the main or pipeline, and never further than 15 feet laterally from the facility. Along the route of the main or

pipeline, sampling points should be placed at half the distance between the pipeline and the nearest building wall, or at 30 feet, whichever is shorter, but, in no case need the spacing be less than 10 feet. The sampling pattern should include sample points adjacent to service taps, street intersections, and known branch connections, as well as over or adjacent to buried service lines at the building wall.

(ii) Underground conduit and sewer structures ...

...

(c) Vegetation Survey.

..

(d) Pressure Drop Test.

(1) *Definition.* ...

(2) *Procedure.* ...

(i) Test Pressure. ~~A test conducted~~ The pressure used to perform a pressure drop test on existing facilities solely for the purpose of detecting leakage should be performed at a pressure at least equal to the operating pressure. A pressure test conducted for the purpose of line qualification or uprating must be performed in accordance with the requirements of Subparts J or K.

(ii) ...

(3) *Utilization.* ...

(e) Bubble Leakage Test.

(1) *Definition.* The application of a soap-water or other foam-forming solutions on exposed piping to determine the existence of a leak.

(2) *Procedure.* The exposed piping systems should be reasonably cleaned and completely coated with the solution. Leak detection solution should not be harmful to gas piping. Leaks are indicated by the presence of bubbles.

(3) *Utilization.* ...

4.5 *Selecting an instrument for the detection of gas.*

4.6 *Maintenance of instruments.*

4.7 *Calibration of instruments.*

## 5 LEAK INVESTIGATION AND CLASSIFICATION

..

5.3 *Procedure – Outside underground leak.*

(a) ...

**(l)**

Based on the leak location, extent of migration, and leak magnitude, assign a leak classification to the leak area. See Tables 3a, 3b, and 3c.

{Publication note: (l) is changing to (m) per TR 14-29 that is also Ready for Publication.}

5.4 *Procedure – Inside leak or odor complaint.*

(a) It may be necessary to investigate a reported leak or gas odor inside a structure. These investigations may result from the following.

(1) Gas migration.

(2) Indications of gas readings inside a building while performing routine leak surveys.

(3) Odor complaints.

(b) Leaks may originate on customer-owned piping or equipment.

(c) ...

...

(h) Using a CGI, test around the entry door for gas indications. Do not ring the ~~doorbell~~door bell; knock on the door to get the attention of occupants. Upon entry do not operate any lights, but do take appropriate precautions to prevent accidental ignition. Immediately sample the inside atmosphere for the presence of a combustible gas. Natural gas is lighter than air and will accumulate near ceilings or in higher floors.

*Note:* If gas is detected, the applicable portions of the operator's emergency procedures need to be implemented.

...

5.5 *Leak grades.*

5.6 *Leak classification and action criteria.*

5.7 *Temporary mitigative measures for Grade 1 leaks.*

5.8 *Follow-up inspection.*

The adequacy of leak repairs should be checked before backfilling. The perimeter of the leak area should be checked with a CGI. Where there is residual gas in the ground after the repair of a Grade 1 leak, a follow-up inspection should be made as soon as practical after allowing the soil atmosphere to vent and stabilize, but, in no case later than one month following the repair. In the case of other leak repairs, the need for a follow-up inspection should be determined by qualified personnel.

5.9 *Reevaluation of a leak.*

**6 RECORDS AND SELF-AUDIT GUIDELINES**

**7 PINPOINTING**

<p align="center"><b>G-192-11A GAS LEAKAGE CONTROL GUIDELINES FOR PETROLEUM GAS SYSTEMS</b></p>
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**GUIDE MATERIAL APPENDIX G-192-11A**

(See guide material under §§192.3, 192.11, 192.503, 192.557, 192.615, 192.703, and 192.723)

## GAS LEAKAGE CONTROL GUIDELINES FOR PETROLEUM GAS SYSTEMS

(See Guide Material Appendix G-192-11 for natural gas systems)

### 1 SCOPE

These guidelines provide criteria for the detection, grading, and control of gas leakage and for related records for systems ~~handling~~ ~~transporting~~ petroleum gases or petroleum gas/air mixtures that are heavier than air.

### 2 GENERAL DISCUSSION

- (a) A separate set of guidelines for petroleum gas system leakage surveys has been developed because of the differing physical properties of natural gas and petroleum gases.
- (b) When considering gas leakage detection and control, the two most significant differences between natural gas and petroleum gas vapor are their specific ~~gravity~~ ~~gravities~~ and flammable limits. ~~The specific gravity of natural gas is approximately 0.6 which is, therefore, lighter than air. This property facilitates the venting and dissipation of natural gas leakage into the atmosphere.~~
- (c) ~~Petroleum gas vapor has a specific gravity range of 1.6 to 2.0 that is heavier than air. Therefore, when petroleum gas vapor escapes, it tends to settle in low places, and to move along the bottom of ditch lines and substructures unless dissipated by substantial air movement. It does not readily vent to the surface under normal conditions. When conducting tests for leakage on buried petroleum gas systems, it is essential that samples be taken at or near the pipe, in the bottom of ditch lines and at the low point of substructures.~~
- (c) Hazardous concentrations of petroleum gas can develop rapidly because of the relatively low LEL. The flammable range of natural gas is approximately 5% to 15% gas in air compared to ~~approximately~~ 2% to 10% gas in air for petroleum gases. Therefore, when conducting a petroleum gas system leak survey, it is essential to remember that the lower explosive limit can be as low as 1.9% gas in air. It is essential that Combustible Gas Indicator (CGI) instruments used to conduct petroleum gas leak surveys be properly calibrated. ~~This is especially important when a CGI calibrated for natural gas or methane is used in conjunction with conversion curves for detecting concentrations of other gases.~~ CGI instruments are discussed in more detail in 4.5, 4.6, and 4.7 below.

#### **Publication notes:**

- (1) *Table 1 needs to be moved from bottom of section 3 in existing Guide to bottom of section 2 as shown here, to match Table 1 position in G-192-11.*
- (2) *“Blend” needs to be changed to “Mixture” in Table 1.*

SIGNIFICANT PHYSICAL PROPERTIES OF FOUR TYPICAL HYDROCARBON GASES NORMALLY FOUND IN DISTRIBUTION AND PIPE LINE SYSTEMS (See Note 1)				
	Natural Gas	Propane	Propane / Air 40/60 Percent	Butane
Formula	Blend	C <sub>3</sub> H <sub>8</sub>	C <sub>3</sub> H <sub>8</sub> / Air	C <sub>4</sub> H <sub>10</sub>
Normal State @ atmospheric pressure @ 60 °F	Gas	Gas	Gas	Gas
Specific Gravity (Air = 1)	0.6	1.6	1.2	2.0
Flammability Limits				
Lower Limit Percent Gas in Air	5	2	See Note 2	2
Upper Limit Percent Gas in Air	15	10	See Note 2	9
Notes:				
1 Other mixtures may have significantly different physical properties. Each operator should evaluate the gas in his distribution system and react accordingly.				
2 The explosive limits refer to percent gas in air and are the same shown for propane.				

TABLE 1

### 3 DEFINITIONS (Applicable to Guide Material Appendix G-192-11A Only)

...  
*Confined space* is any subsurface structure (e.g., vaults, tunnels, catch basin, manholes) of sufficient size to accommodate a person, and in which gas could accumulate.  
 ...

*L-E-L* is the lower explosive limit of the gas being transported.  
*Natural gas* is a blend mixture of gases that is primarily methane and is lighter than air.

### 4 LEAKAGE DETECTION

#### 4.1 Qualification of personnel.

For leak surveys, use personnel who are qualified (see Subpart N) in the type of survey being performed. ~~They~~ These personnel should be familiar with the characteristics of the petroleum gas in the system and trained in the use of leak detection instruments.

#### 4.2 Reports from outside sources.

...

#### 4.3 Odors or indications from foreign sources.

...

## 4.4 Leak surveys and test methods.

For leak surveys, see the limitations under §§192.706 and 192.723 regarding leak detection equipment. The following gas leak surveys and test methods may be employed, as applicable, in accordance with written procedures.

- Subsurface Gas Detection Survey (including barhole surveys)
- ~~Bubble Leakage Test~~ Pressure Drop Test
- ~~Pressure Drop Test~~ Bubble Leakage Test

Other survey and test methods may be employed if they are deemed appropriate and are conducted in accordance with procedures that have been tested and proven to be at least equal to the methods listed in this section.

The Surface Gas Detection Survey and Vegetation Survey methods used for natural gas systems are not recommended for use on petroleum gas systems. Petroleum gases are heavier than air and will frequently not come to the ground surface or cause surface indications in the vegetation. However, the Surface Gas Detection Survey, when properly conducted by taking into account that the gas is heavier than air, may be used adjacent to above ground facilities.

### (a) Subsurface Gas Detection Survey.

(1) *Definition.* The sampling of the subsurface atmosphere with a combustible gas indicator (CGI) or other device capable of detecting 0.2% gas in air (10% of the LEL) at the sample point.

### (2) *Procedure.*

(i) The survey should be conducted by performing tests with a CGI in a series of available openings (confined spaces and small substructures) or barholes immediately adjacent to the gas facility ~~and in available openings (confined spaces and small substructures)~~. The following should be considered when selecting the placement of barholes and sample points.

(iA) The location of the gas pipelines and proximity to buildings or other structures.

(iB) Approximate depth of buried gas piping.

(iC) Extent of pavement.

(iD) Soil type and moisture content.

(iE) Available subsurface openings (e.g., valve boxes, catch basins, manholes).

(iF) Underground conduit and sewer structures ...

Barhole sample points should be placed along or adjacent to the pipeline, to the approximate depth of the pipeline, and at intervals of 20 feet or less. The sampling pattern should include tests at the building wall at the service riser or point of service line entrance. ...

(ii) When testing available openings for petroleum gas, readings should be taken at both the top and bottom of the structure. When testing larger confined spaces or basements, ...

### (3) *Utilization.* ...

### (4) *Precaution.* ...

### (b) Pressure Drop Test.

(1) *Definition.* A test to determine if an isolated segment of pipeline loses pressure due to leakage.

(2) *Procedure.* Facilities selected for pressure drop tests should first be isolated and then tested. The following criteria should be considered in determining test parameters.

(i) Test Pressure. The pressure used to perform a pressure drop test on existing facilities solely for the purpose of detecting leakage should be at least equal to the operating pressure. A pressure test conducted for the purpose of line qualification or uprating must be performed in accordance with the requirements of Subparts J or K.

(ii) Test Medium. The test medium used must comply with the requirements of §192.503(b).

(iii) Test Duration. The duration of the test should be of sufficient length to detect leakage. The following should be considered in the determination of the duration.

(A) The volume under test.

(B) The time required for the test medium to become temperature stabilized.

(C) The sensitivity of the test instrument.

(3) *Utilization.* Pressure drop tests should be used only to establish the presence or absence of a leak on a specifically isolated segment of a pipeline. Normally, this type of test will not provide a leak location. Therefore, facilities on which leakage is indicated may require further

evaluation by another detection method in order that the leak may be located, evaluated, and graded.

~~(b)(c)~~ Bubble Leakage Test.

- (1) *Definition.* The application of a soap-water or other ~~bubble-foam~~ forming solutions on exposed piping to determine the existence of a leak.
- (2) *Procedure.* The exposed piping systems should be reasonably cleaned and completely coated with the solution. Leak detection solution should not be harmful to gas piping. Leaks are indicated by the presence of bubbles. ~~The bubble-forming solution should not be used on piping unless it has been determined by investigation or test that the piping is adequately resistant to direct contact with the solution.~~
- (3) *Utilization.* This test method may be used for the following.
  - (i) Testing exposed aboveground portions of a system, such as meter set assemblies or exposed piping on bridge crossings.
  - (ii) Testing a tie-in joint or leak repair that is not included in a pressure test.

~~(c) Pressure Drop Test.~~

- ~~(1) *Definition.* A test to determine if an isolated segment of pipeline loses pressure due to leakage.~~
- ~~(2) *Procedure.* Facilities selected for pressure drop tests should first be isolated and then tested. The following criteria should be considered in determining test parameters.
 
  - ~~(i) *Test Pressure.* A test conducted on existing facilities solely for the purpose of detecting leakage should be performed at a pressure at least equal to the operating pressure. A pressure test conducted for the purpose of line qualification or uprating must be performed in accordance with the requirements of Subparts J or K.~~
  - ~~(ii) *Test Medium.* The test medium used must comply with the requirements of §192.503(b).~~
  - ~~(iii) *Test Duration.* The duration of the test should be of sufficient length to detect leakage. The following should be considered in the determination of the duration.
 
    - ~~(A) The volume under test.~~
    - ~~(B) The time required for the test medium to become temperature stabilized.~~
    - ~~(C) The sensitivity of the test instrument.~~~~~~
- ~~(3) *Utilization.* Pressure drop tests should be used only to establish the pressure or absence of a leak on a specifically isolated segment of a pipeline. Normally, this type of test will not provide a leak location. Therefore, facilities on which leakage is indicated may require further evaluation by another detection method in order that the leak may be located, evaluated, and graded.~~

4.5 Selecting an instrument for the detection of gas.

...

4.6 Maintenance of instruments.

...

4.7 Calibration of instruments.

~~(a) When to calibrate.~~

Each instrument used for leak detection and evaluation should be calibrated at the following times in accordance with the manufacturer's recommended calibration instructions.

- ~~(1)(a)~~ After any repair or replacement of parts.
- ~~(2)(b)~~ On a regular schedule giving consideration to the type and usage of the instrument involved. HFI and CGI instruments should be checked for calibration at least once each month while in use.

- ~~(3)(c)~~ At any time it is suspected that the instrument's calibration has changed.

~~(b) Conversion curves.~~

~~It is not essential that instruments used to conduct petroleum gas system leak surveys be calibrated specifically for the gas being distributed. However, it is essential that the instrument be properly calibrated for the gas specified by the manufacturer and that conversion curves for the appropriate petroleum gas be obtained from the manufacturer or be developed by the operator. Without proper calibration and the appropriate conversion curves, the operator cannot interpret meter readings or determine concentrations. For example, hot-wire CGI instruments calibrated for methane or natural gas will read true for propane on the LEL scale (2.0% propane in air will read 100% LEL on the meter). On dual-scale instruments calibrated for natural gas, a 100% propane concentration will not read 100% gas.~~



## 5 LEAK INVESTIGATION AND CLASSIFICATION

### 5.1 Scope.

...

### 5.2 Procedure – General.

...

### 5.3 Procedure – Outside underground leak.

- (a) Using a barhole device and CGI, barhole in the area of leak indication along and adjacent to operator's mains and service lines, paying close attention to valves, service tees, fittings, stubs, connections, ~~and~~ risers, or service entry points to buildings. See 4.4(a) above.

*Note:* Use caution when barholing to avoid damage to operator facilities or other underground structures.

- (b) ...

...

### 5.4 Procedure – Inside leak or odor complaint.

- (a) ...

...

- (g) If there is an outside meter set, observe its dial for excessive flow or movement.

- (h) Using a CGI, test around the entry door for gas indications. Do not ring the ~~doorbell~~ door bell; knock on the door to get the attention of occupants. Upon entry do not operate any lights, but do take appropriate precautions to prevent accidental ignition. Immediately sample the inside atmosphere for the presence of combustible gas. Remember, petroleum Petroleum gas is heavier than air and will accumulate in the lower atmosphere.

*Note:* If gas is detected, the applicable portions of the operator's emergency procedures need to be implemented.

- (i) ...

...

[LB Note: Sections 6 & 7 are same in both GMA, so not repeated here.]