TR Number	**2021-26**
Primary Reference	GMA G-192-11 and GMG-192-11A
Purpose	(Review and revise GM as necessary) to address negative ballots (LB3-2018) from TR 16-23 regarding the properties of propane, (propane/air), and natural gas supplemented by propane in Section 3 (and Table 1) of GMA G-192-11 and G-192-11A, and provide a definition for UEL in GMA G-192-11.
Origin/Rationale	TR 16-23 was originally to address changes to the GM caused by changes in the definitions of NFPA 58 and 59, and to define a UEL value for propane. During balloting, several disapproved based on the lack of information regarding the properties of natural gas supplemented by the use of propane or propane/air combination. The existing guidance in GMA G-192-11 and GMA G-192-11A should reviewed and modified, if needed, to address the issues raised by the three disapprovals of TR 16-23. *Note: Disapproved votes that are origin of this TR are available for review in LB3-2018 results and were copied at end of 1st LB in LB1-2023.*
Assigned to	O&M/OQ Task Group

Note: *Revisions are shown in yellow highlight and red font.*

Section 192.11

1 ...

...

4 LEAKAGE CONTROL GUIDELINES

For natural gas systems where petroleum gas or petroleum gas/air mixtures are used to supplement the natural gas, see Guide Material Appendix G-192-11.

For petroleum gas systems, see ~~See~~ Guide Material Appendix G-192-11A.

GMA G-192-11

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)

CONTENTS

{Page return}

[Letter Ballot note: Green font is added from TR 17-02 approved for next Addendum (Addendum 3).]

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 handling 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. However, this range will vary based on the composition of the gas ~~blend~~mixture. The higher the BTU content of the gas, the lower the LEL. ~~For example, p~~Pipeline quality gas is usually a ~~blend~~mixture consisting predominantly of Methane with varying concentrations of Ethane, Propane, Butane, and other gases (e.g., Carbon Monoxide, Argon, other trace ~~compounds~~ gases). When concentrations of gases from various sources change the overall ~~blend~~mixture, either increasing or lowering the BTU content, the LEL and UEL will also shift.

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

Note:
1 Other ~~blends~~mixtures including natural gas ~~blended~~mixed with petroleum gas/air, and gases such as renewable natural gas, might have significantly different physical properties. The operator should evaluate the gas being transported and react accordingly (e.g., gas detector selection, modification of procedures).

TABLE 1

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

Barhole is a ...

...

Combustible gas indicator (CGI) is a device capable of detecting and measuring gas concentrations (of the gas being transported) in the atmosphere.
~~*L.E.L.*~~ *LEL* 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.
...
Tunnel is a ...
UEL is the upper explosive limit of the gas being transported.

4 LEAKAGE DETECTION

4.1 Qualification of personnel. [LB note: Editorially added 4.1 here to match with G-192-11A change.]
For leak surveys, use personnel who are:
(a) ~~q~~Qualified ~~(see Subpart N) in the ty qualified~~ (see Subpart N) in the type of survey being performed. ~~These personnel should be familiar~~
(b) Familiar with the characteristics of the gas in the system. ~~and trained~~
(c) Trained in the use of leak detection instruments.

4.2 thru 4.6 ...

4.7 Calibration of instruments.
...

4.8 CGI Usage.
(a) Operators are cautioned that a CGI instrument is an indicator, not a combustible gas analyzer. The intent of a CGI is to identify a hazard for the first responder or leak detection technician to take appropriate action necessary to render a hazardous condition safe as quickly as ~~possible~~ practicable.
(b) The use of a CGI ~~appropriate~~ calibrated for the gas or vapor being tested is essential for accurate readings.

5 LEAK INVESTIGATION AND CLASSIFICATION

5.1 thru 5.3

5.4 Procedural Guidance – Inside leak or odor complaint.
(a) ...
...
(j) If the building has a basement, enter it while continuously ~~constantly~~ sampling with a CGI. Proceed to check the following with the CGI.
...
...
...

GMA G-192-11A

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)

CONTENTS

4.1 thru 4.6 ...
4.7 Calibration of instruments.
4.8 CGI Usage.

5 LEAK INVESTIGATION AND CLASSIFICATION

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{Page return}

[Letter Ballot note: Green font is added from TR 17-02 approved for next Addendum (Addendum 3).]

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. ...

(c~~d~~) 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.

[Letter Ballot note: Per TR 17-02 as approved to next Addendum, Table 1 moved to end of Section 2 to match with Table 1 location in GMA G-192-11.]

SIGNIFICANT PHYSICAL PROPERTIES OF ~~FOUR~~ TYPICAL HYDROCARBON GASES NORMALLY FOUND IN DISTRIBUTION AND PIPELINE ~~LINE~~ SYSTEMS (See Note 1)

	~~Natural Gas~~	Propane	Propane / Air 40/60 Percent	Butane
Formula	~~Blend~~	C_3H_8	C_3H_8 / Air	C_4H_{10}
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	2 ~~See Note 2~~	2
Upper Limit Percent Gas in Air	~~15~~	10	10 ~~See Note 2~~	9

Notes:
1 Other mixtures ~~may blends~~ including petroleum gas blended with air, natural gas and gases such as renewable natural gas, might have significantly different physical properties (refer to Guide Material Appendix G-192-11, Section 2). ~~Each~~ The operator should evaluate the gas in ~~his the~~ distribution system and react accordingly (e.g., gas detector selection, modification of procedures).
~~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)

Barhole ...

...

Combustible gas indicator (CGI) is a device capable of detecting and measuring gas concentrations (of the gas being transported) in the atmosphere.

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

...

~~*L.E.L.*~~ *LEL* 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.

...

Tunnel is a ...

UEL is the upper explosive limit of the gas being transported.

4 LEAKAGE DETECTION

4.1 Qualification of personnel.

For leak surveys, use personnel who are:

(a) ~~q~~Qualified (see Subpart N) in the type of survey being performed. ~~They These personnel should be familiar~~

(b) Familiar with the characteristics of the petroleum gas in the system. ~~and trained~~

(c) 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.

...

(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) *Procedural Guidance*.

(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.

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

(B)~~(ii)~~ Approximate depth of buried gas piping.

(C)~~(iii)~~ Extent of pavement.

(D)~~(iv)~~ Soil type and moisture content.
(E)~~(v)~~ Available subsurface openings (e.g., valve boxes, catch basins, manholes).
(F)~~(vi)~~Underground conduit and sewer structures can provide unobstructed and interconnected (or exclusive) migration paths toward buildings. If readings are found in these structures, further investigation should follow. See 5.3(i) below.

(ii) Barhole sample points should be placed along or adjacent to the pipeline, to the approximate depth of the pipeline, and at interval ls 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. Consideration should be given to threaded or mechanical joints that have had a history of leakage. Available subsurface openings adjacent to the pipeline should be tested. Where the piping system passes under pavement for a distance of 20 feet or less, barholes should be made at the point of entrance and exit of the paved area. Where the paved area over the pipeline is 20 feet or greater in length, sample points should be located at intervals of 20 feet or less. In the case of extensive pavement, permanent sample points should be considered.

(iii) 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, the floor areas, including floor drains, should be thoroughly tested because petroleum gases can lie temporarily in pockets containing explosive mixtures. Since migrating gas may not enter at the pipeline entrance, a perimeter survey of the floors and walls is recommended. When conducting the survey, all barholes should penetrate to the pipe depth, where necessary, in order to obtain consistent and worthwhile readings. This includes penetrating through capping materials such as paving, concrete, frost, or surface sealing by ice or water. The required depth of the barhole will also depend upon the soil conditions, the depth of and pressure in the pipeline, and the type of instrument being used. The readings should be taken at the bottom of the bar. The probe used should be equipped with a device to preclude the drawing in of liquids. When conducting the survey, the inspector should use the most sensitive scale on the instrument, watching for small indications of combustible gas. Any indication should be further investigated to determine the source of the gas. Care should be taken to avoid damaging the pipe or coating with the probe bar.

(3) *Utilization*. This survey method ...
(4) *Precaution.* When placing barholes for testing, ...

(b) ...
(c) ...

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 ...

~~(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.~~

4.8 CGI Usage

(a) Operators are cautioned that a CGI instrument is an indicator, not a combustible gas analyzer. The intent of a CGI is to identify a hazard for the first responder or leak detection technician to take appropriate action necessary to render a hazardous condition safe as quickly as ~~possible~~ practicable.

(b) The use of a CGI ~~appropriate~~ calibrated for the gas or vapor being tested is essential for accurate readings.

5 LEAK INVESTIGATION AND CLASSIFICATION

5.1 Scope. ...

5.2 Procedural Guidance – General.

(a) ...

...

(g) Barholing should be a part ~~apart~~ of the leak investigation. See 5.3 below for guidelines for barholing.

5.3 Procedural Guidance – Outside underground leak. ...

5.4 Procedural Guidance – Inside leak or odor complaint.

(a) ...

...

(j) If the building has a basement, enter it while continuously ~~constantly~~ sampling with a CGI. Proceed to check the following with the CGI.

...

...

...