



NFPA 715, Standard for the Installation of Fuel Gases Detection and Warning Equipment: Past, Present, and Future

Presented by:
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Presenter

- Stephen Olenick

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Combustion Science & Engineering, Inc.

Chair, NFPA Fuel Gases Warning Equipment TC

Professional Interests include fire and gas detection, fire and gas research, and forensic fire and explosion investigation and analyses



Disclaimer

- I do not represent NFPA
- I do not represent the Technical Committee
- Thoughts and opinions in this presentation are my own



Outline – The Journey

- Past – Motivation through first version of NFPA 715 (2023)
- Present – Second version of NFPA 715 (2026)
- Future – Technical issues and adoption/reference



Motivation

Past

- Why are we talking about fuel gas detection?
 - Possible aging fuel gas infrastructure
 - 23 fatalities in 2023¹
 - Between 2012 and 2016 an estimated average of 4,200 U.S. home structure fires per year started with the ignition of natural gas²
 - 2018-2022 average of almost 16,000 structure fires where first material was natural gas³
 - Natural gas or LP-Gas leaks have generally been increasing since 2007²



¹ Pipeline and Hazardous Materials Safety Administration (PHMSA)

² NFPA – Ahrens and Evarts, 2018

³ NFPA – McGree, 2024

Motivation

Past



Credit - WBALTV

- Baltimore, Maryland, 2020
— 2 deaths



Motivation

Past

- Columbia, Maryland, 2019
— No deaths



- Other notable incidents:
 - East Harlem, New York – March, 2014
 - Silver Spring, Maryland – August, 2016
 - Dallas, Texas – February, 2018
 - Merrimack Valley, Massachusetts – September, 2018
 - Farmington, Maine – September, 2019
 - Lebanon, New Hampshire – December, 2019
- Just these 8 incidents – 15+ deaths, 150+ injuries





- Fuel gases usually contain odorant, but odorant can fade and/or be scrubbed out
 - Need for an additional level of protection
- Gas detectors/alarms operate and detect without reliance on person being present
 - And can provide odorant detection confirmation
- Listed fuel gas detectors/alarms exist but no installation standard
 - Can only rely on individual manufacturer recommendations
- Firm requirements needed for installation of fuel gas detection in residences and other occupancies
 - To be referenced by occupancy codes and municipalities



Motivation

Past

- NTSB Report
 - Conducted an investigation of a building explosion and fire that took place in 2016 in Silver Spring, Maryland
 - Seven people were killed and 65 were sent to the hospital
 - The report's findings included 13 recommendations to seven different interest groups
 - One of the recommendations was for code-making bodies to implement fuel gas detection requirements
 - Has since been mentioned in other NTSB meetings and/or reports



Applicable Product Standards

Past

- UL 1484 – Standard for Residential Gas Detectors
 - Title changing to Standard for Fuel Gas Alarms
 - This is the standard for single and multiple station fuel gas alarms
 - Sometimes called combustible/flammable/explosive gas alarms
- UL 2075 – Standard for Gas and Vapor Sensors and Detectors
 - This is the standard for system connected (monitored) fuel gas detectors
 - Also is the standard for CO detectors
- NFPA 715 requires compliance with either UL 1484 or UL 2075
- These apply to products, but there was no installation standard



NFPA 715 Inception

Past

- NFPA Standards Council was petitioned to create a standard
- NFPA 715: *Standard for the Installation of Fuel Gases Detection and Warning Equipment*
 - Technical Committee formed in 2019
- FPRF simultaneously petitioned to provide technical support on the location requirements



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The NFPA Process

Past

- ANSI accredited
- Technical Committee (TC) comprised of knowledgeable people and organizations/stakeholders
- Each member has a classification (User, Special Expert, Manufacturer, etc.)
 - And each member encouraged to have an alternate
 - And each member has 1 vote
- No member classification can have more than 30% membership of the TC
 - Keeps interests balanced for consensus



The NFPA Process

Past



- For a typical cycle:
 - Document opens for Public Input
 - Voted on at the meeting and then paper ballot as well
 - Document then opens for Public Comment
 - All Public Comments are considered/discussed by the TC and acted on
 - It then goes to the NFPA membership where membership can make a motion about something the TC did, and then it is typically issued by the Standards Council
 - This entire process takes 3 years. So each edition comes out every 3 years.

The First Edition Timeline

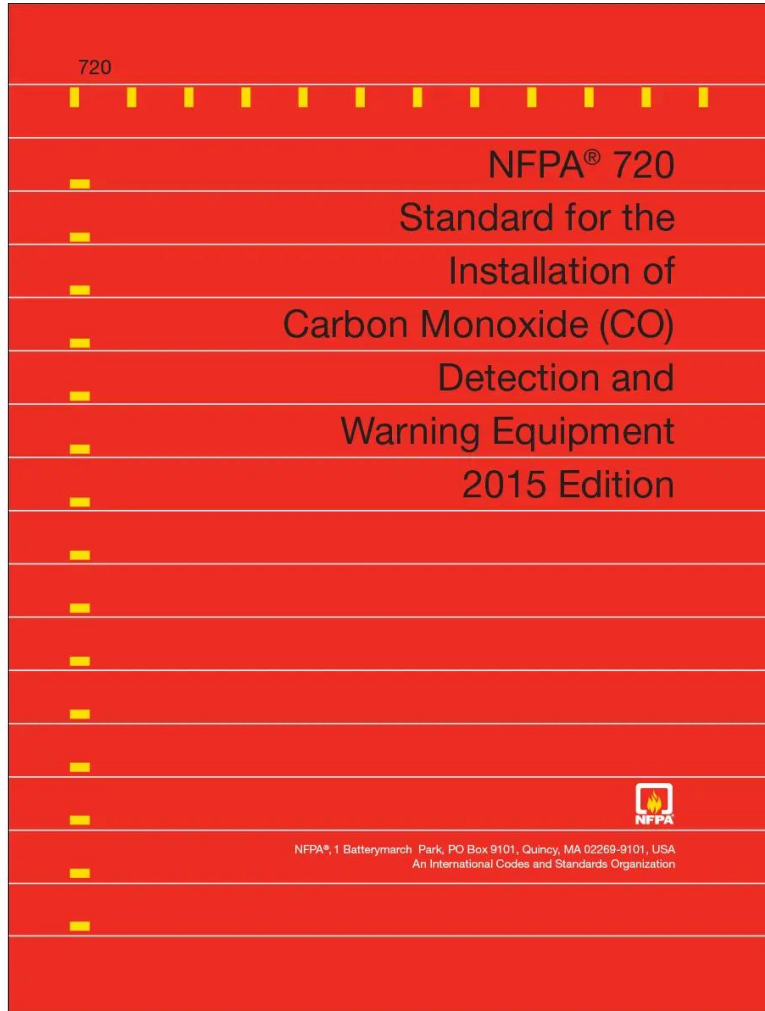
Past

- Started in 09/2019 with not a word on paper
- Pre-first draft completed (02/2020) and submitted to Standards Council
- Put on custom fast track
 - Opened for PI in late summer, 2020
 - Gexcon FPRF project final report released 08/2020
 - FDM late 2020
 - SDM late 2021
 - Presented at C&E 06/2022
 - Document released shortly after with 2023 date (basically a 2 year cycle)



The Structure

Past



- NFPA 720
 - Good starting point
 - Separate chapters for protected premises (commercial systems) and residential
 - Needed some update as NFPA 720 was retired and CO requirements merged with NFPA 72 in 2015
 - Old extracts
 - Some outdated information



The Research – NYSEARCH/FRA

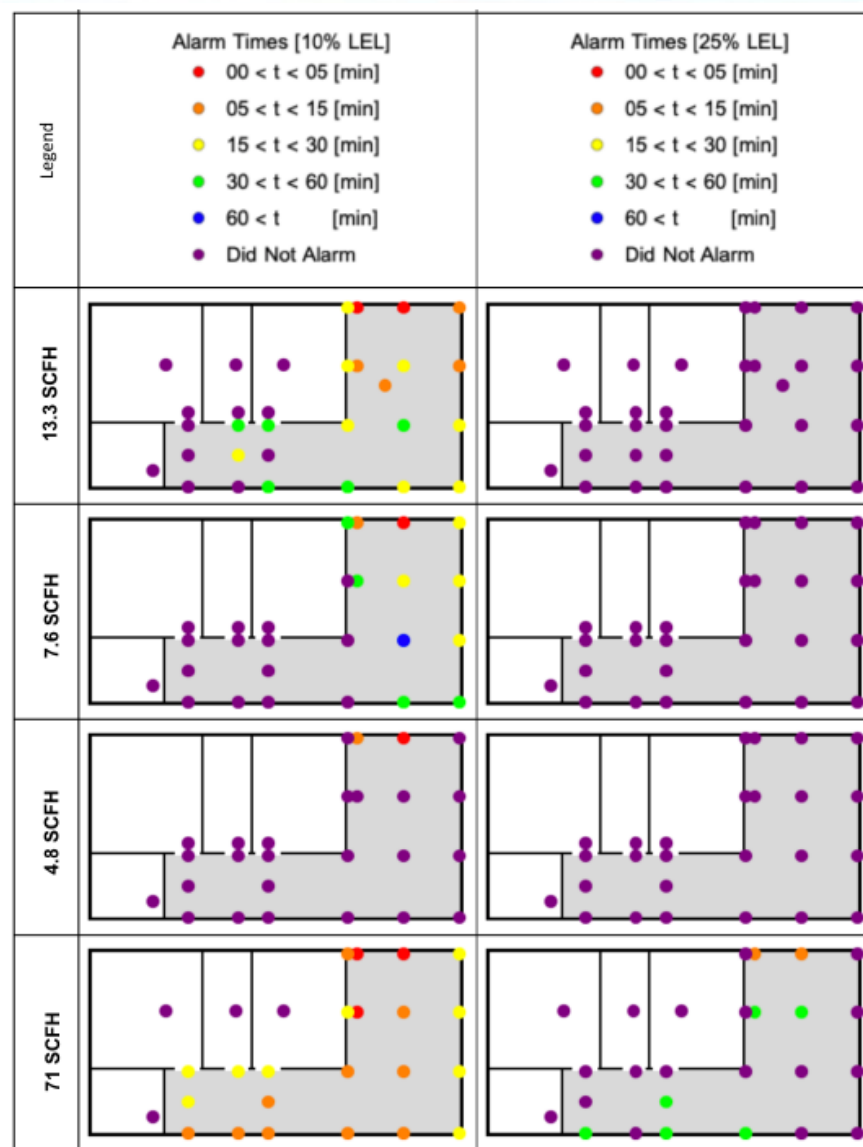
Past

- Natural gas full-scale experiments
- Conclusions
 - Sensors should be in same room as fuel gas appliances
 - Sensors should be within 19 inches of the ceiling
 - Sensors should be set to a sensitivity of 10 %LEL for adequate and reliable detection
- They have since done further work
 - Testing with HVAC systems as a variable
 - Computer modeling component



The Research – NYSEARCH/FRA

Past



FIRE & RISK
ALLIANCE

NYSEARCH



The Research – FPRF/Gexcon

Past

- Computer modeling
 - Used FLACS software
- Focused on residential occupancies
 - Did some mixed-use
 - Did three different residential occupancies
 - Split level
 - Colonial
 - Townhouse
- Different leak scenarios
 - Un-impinged
 - Severely-impinged – low momentum

GEXCON
US



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The Research – FPRF/Gexcon

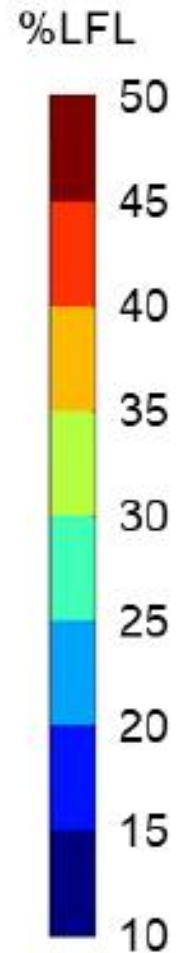
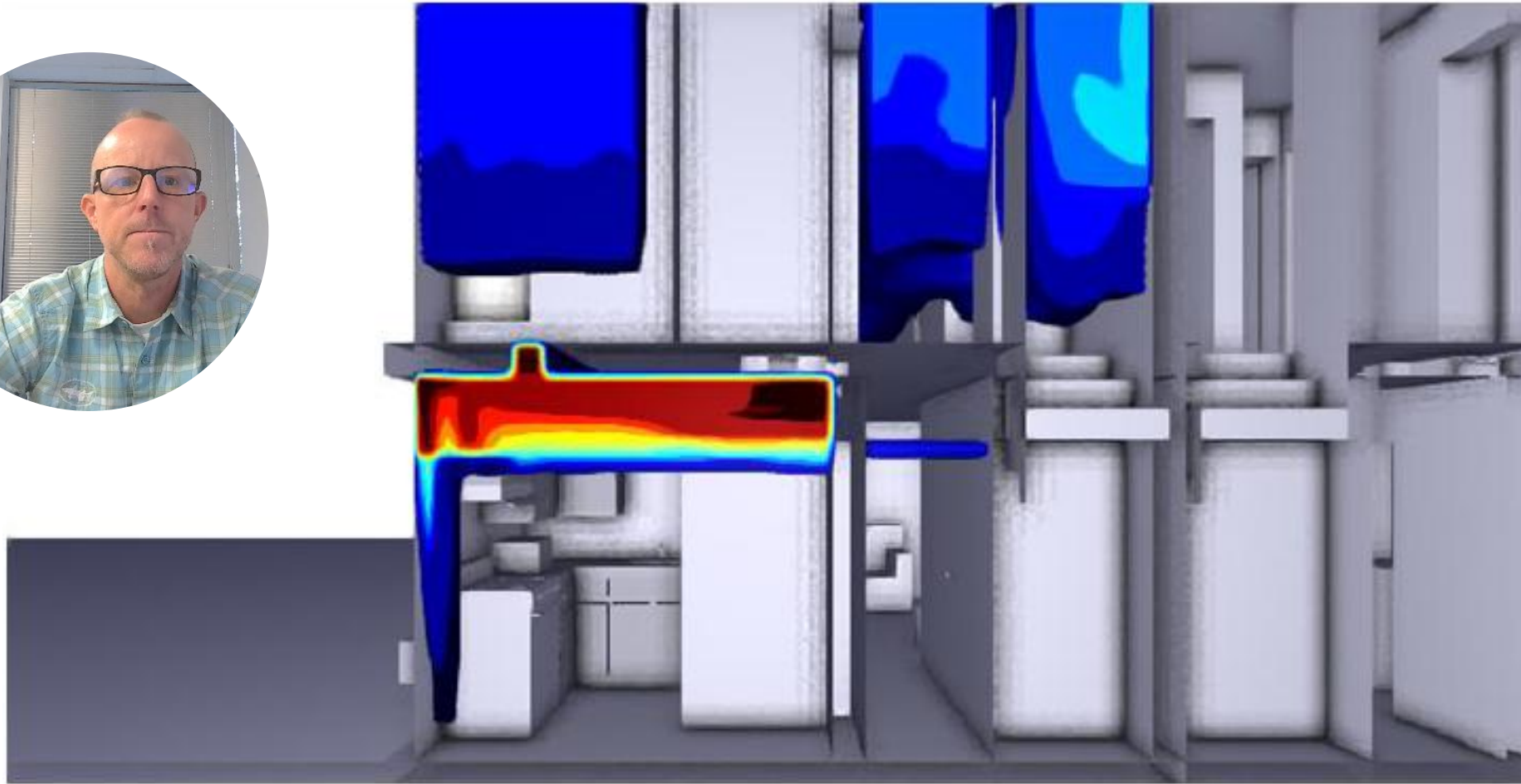
Past

- Natural gas and propane
- Varied leak rate
- Moved leak location around
- Varied air leakage rate
- Sometimes varied doorway/opening heights
- Ran over 250 simulations
- Compliments the NYSEARCH/FRA experimental work



The Research – FPRF/Gexcon

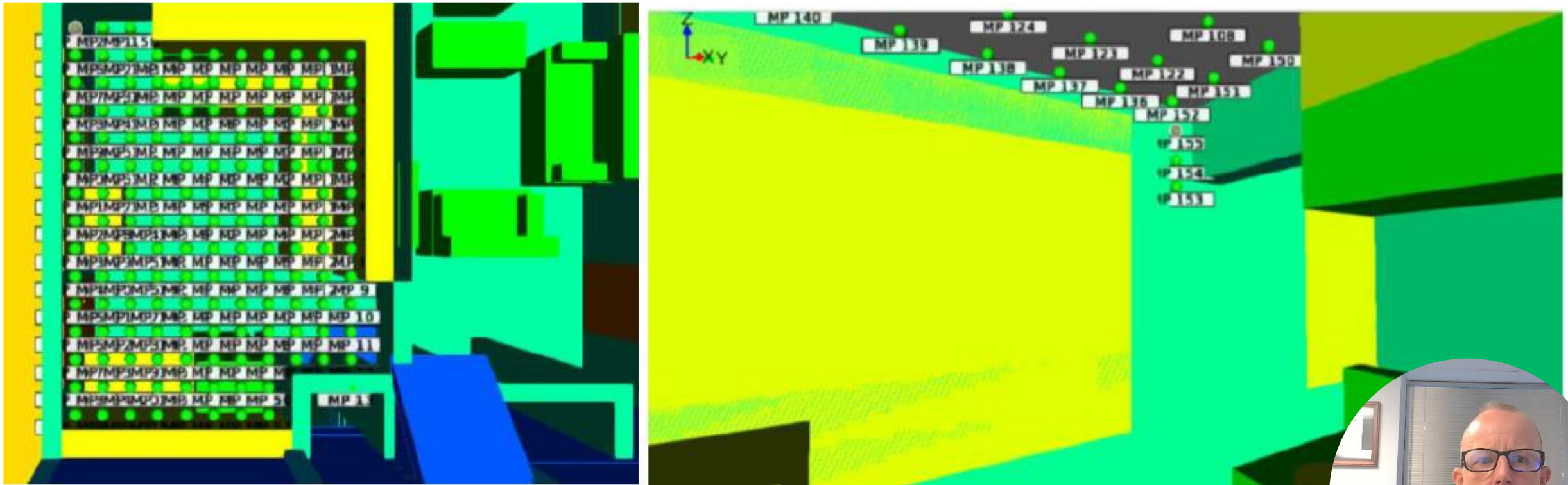
Past



The Research – FPRF/Gexcon

Past

- Modeling allows for many sensors to vary location and sensitivity



The Research – FPRF/Gexcon

Past

- Hazard thresholds
 - 10 ft³ at 100 %LEL
 - Non-negligible but likely to not cause significant damage
 - 350 ft³ at 40 %LEL
 - Not ignitable yet but if not detected/discovered, could have very significant consequences
- Performance criteria
 - Criteria #1 – Did it detect before hazard threshold(s) reached
 - Binary – yes/no
 - Criteria #2 – How much earlier did it detect, if it did?
 - Time to detection divided by time to hazard



The Research – FPRF/Gexcon

Past



- Examples of % that did not activate and normalized time to detection

Detector Alarm Threshold - 10%					
Distance from floor (m)	Distance from leak (ft)				
	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10
4	0.0%	0.0%	0.0%	0.0%	0.0%
6	0.0%	0.0%	0.0%	0.0%	0.0%
8	0.0%	0.0%	0.0%	0.0%	0.0%
10	0.0%	0.0%	0.0%	0.0%	0.0%
12	0.0%	0.0%	0.0%	0.0%	0.0%
14	0.0%	0.0%	0.0%	0.0%	0.0%
16	0.0%	0.0%	0.0%	0.0%	0.0%
18	0.0%	0.0%	0.0%	0.0%	0.0%

Detector Alarm Threshold - 10%					
Distance from floor (m)	Distance from leak (ft)				
	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10
4	1.1%	3.0%	2.2%	3.8%	18.2%
6	1.0%	3.1%	2.2%	3.8%	18.3%
8	1.0%	3.1%	2.2%	3.8%	18.5%
10	1.0%	3.3%	2.2%	3.8%	18.7%
12	1.0%	3.3%	2.2%	3.9%	18.9%
14	1.0%	3.5%	2.2%	4.3%	19.1%
16	0.9%	3.8%	2.4%	4.4%	19.2%
18	0.9%	3.9%	2.5%	4.9%	19.7%

Propane – 10% LEL – high leak location – high mixing (free jet)

The Research – FPRF/Gexcon

Past

- Example of % that did not activate and normalized time to detection

Detector Alarm Threshold - 25%					
Distance from ceiling (m)	Distance from leak (ft)				
	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10
0	0.0%	0.0%	0.0%	0.0%	0.0%
6	0.0%	0.0%	0.0%	0.0%	0.0%
12	50.0%	49.5%	7.1%	66.7%	66.7%
18	100.0%	83.5%	47.1%	100.0%	100.0%

Detector Alarm Threshold - 25%					
Distance from ceiling (m)	Distance from leak (ft)				
	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10
0	2.8%	6.5%	6.7%	14.0%	28.7%
6	9.3%	10.4%	18.5%	15.8%	41.3%
12	59.5%	62.6%	28.2%	83.3%	76.0%
18	N/A	13.8%	11.9%	N/A	N/A

Natural gas – 25% LEL – high leak location – low mixing (impinged)



The Research – FPRF/Gexcon

Past

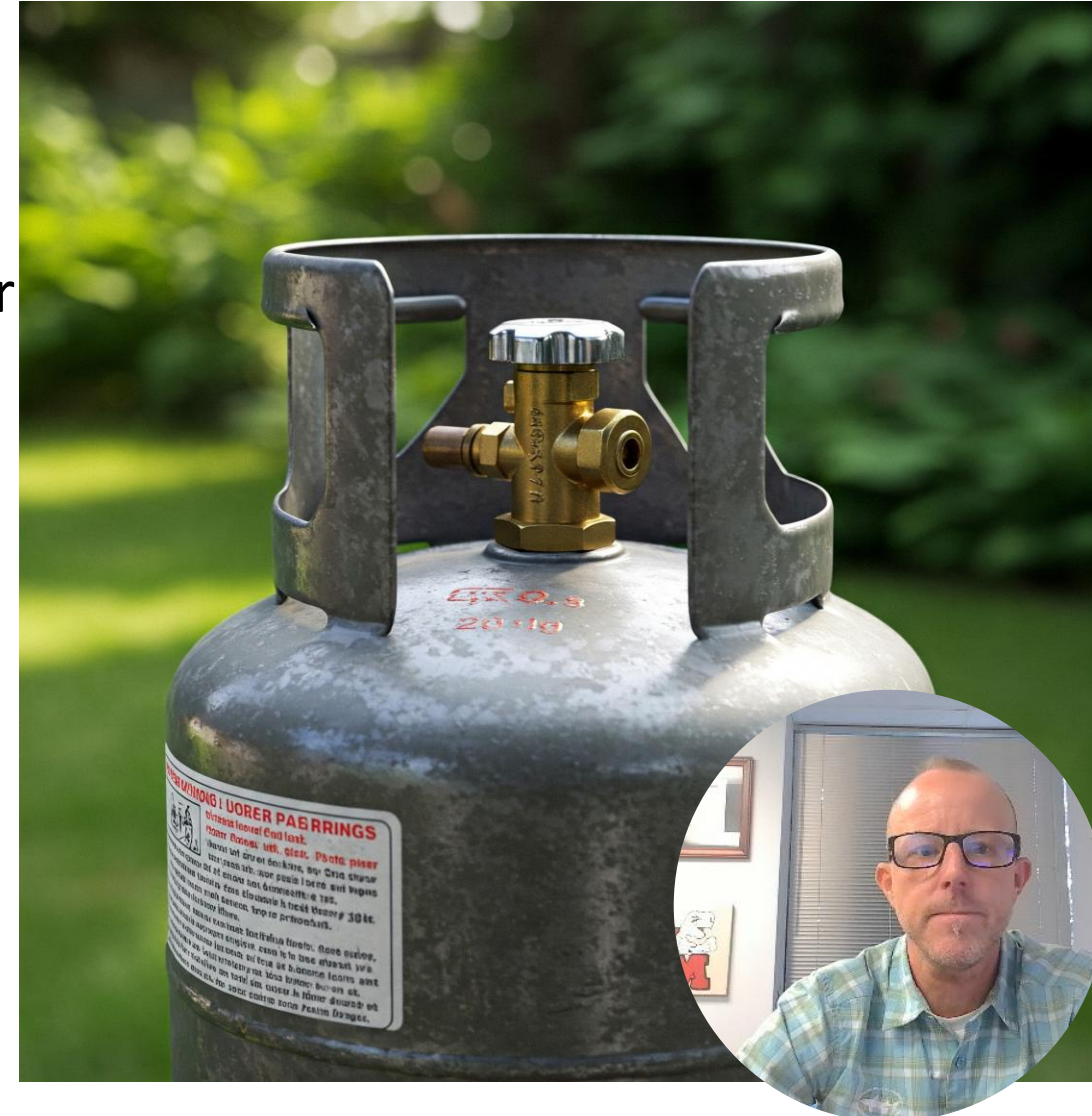
- Conclusions
 - Better performance when sensor is located closer to the leak
 - With unobstructed path
 - Meaningfully better performance at 10 %LEL vs 25 %LEL
 - Poorer performance
 - Near HVAC supply vents
 - Near passive openings like doors and windows
 - Near openings to adjacent areas (doors/stairwells/etc.)



The Research – FPRF/Gexcon

Past

- Conclusions
 - Natural gas
 - Closer to the ceiling, the better
 - Within 6" of ceiling regardless of 10 %LEL or 25 %LEL
 - At least above highest door opening
 - Propane
 - Closer to the floor, the better
 - Closer than 8-10 feet from a possible leak location
 - No more than 6" off floor if 10 %LEL
 - No more than 4" off floor if 25 %LEL



NFPA 715 First Edition Key Issues

Past

- Location location location
 - Between 3 and 10 feet horizontal flow path from permanently installed fuel-gas-burning appliances
 - Balances nuisance alarms with recommendations from research
 - In basements where delivery is below grade
 - In garages where delivery is present or appliances are present
 - Not in airstream of supply or return registers or above doorway openings
- Interconnect in new residential occupancies
 - And place one outside of each sleeping area



NFPA 715 First Edition Key Issues

Past



- Placement placement placement
 - Natural gas: ceiling or wall within 12 inches
 - Likely locates it above height of standard openings during building of layer or cloud per research
 - Balances possible use of crown molding and other construction features
 - Annex material to recommend on or as close to ceiling as possible
 - Propane: entire alarm within 18 inches of the floor
 - TC evaluated balancing research vs. practicality of installation considering construction features and use of outlets
 - Also possible issues with knocking with cleaning equipment and/or floor cleaner nuisance alarms if lower
 - Annex material to recommend as close to floor as possible

NFPA 715 First Edition Key Issues

Past

- Sensitivity 10 %LEL vs. 25 %LEL detector/alarm sensitivity
 - Emerged as the key issue
 - Gexcon and FRA works support 10 %LEL
 - Gas delivery industry support for 10 %LEL
- Ultimately, the latest edition of the standard no longer specifies the sensitivity
 - Instead, it must be listed and the listing standard (UL) now (or soon will) require 10 %LEL



NFPA 715 Second Edition

Present

- Was released summer 2025 with 2026 date (issued 4/12/2025)
- Key changes:
 - Scope
 - Clarified that not intended to apply to industrial or process-oriented activities unless determined to by the AHJ
 - Annex indicates intention was to apply to residential, commercial, and mixed residential/commercial occupancies
 - Location/placement
 - Reduces number of alarms to one every 600 ft² or no more than 30 ft from a gas appliance
 - To potentially reduce cost for larger areas with multiple gas appliances
 - Uses terminology of “location” for rooms and areas, and “placement” for requirements regarding distances from floors and ceilings etc.
 - Sensitivity
 - Removed requirement of 25% LEL and instead referenced the product standard(s) which have already been changed to 10% LEL



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NATIONAL FIRE PROTECTION ASSOCIATION
The leading information and knowledge resource on fire, electrical and related hazards

CODES & STANDARDS

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NFPA 715

[Choose another Code/Standard](#) 

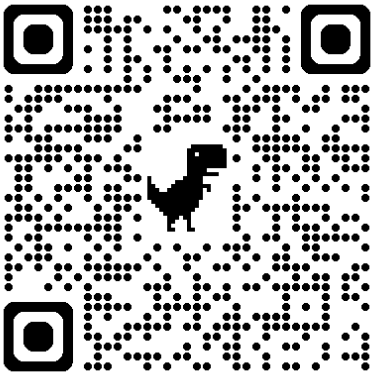
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Standard for the Installation of Fuel Gases Detection and Warning Equipment

To review the NFPA 715 preliminary draft and make suggested changes, select the link below titled, "Submit a Public Input for the Next Edition".

Current Edition: Proposed Standard



NFPA.ORG/715

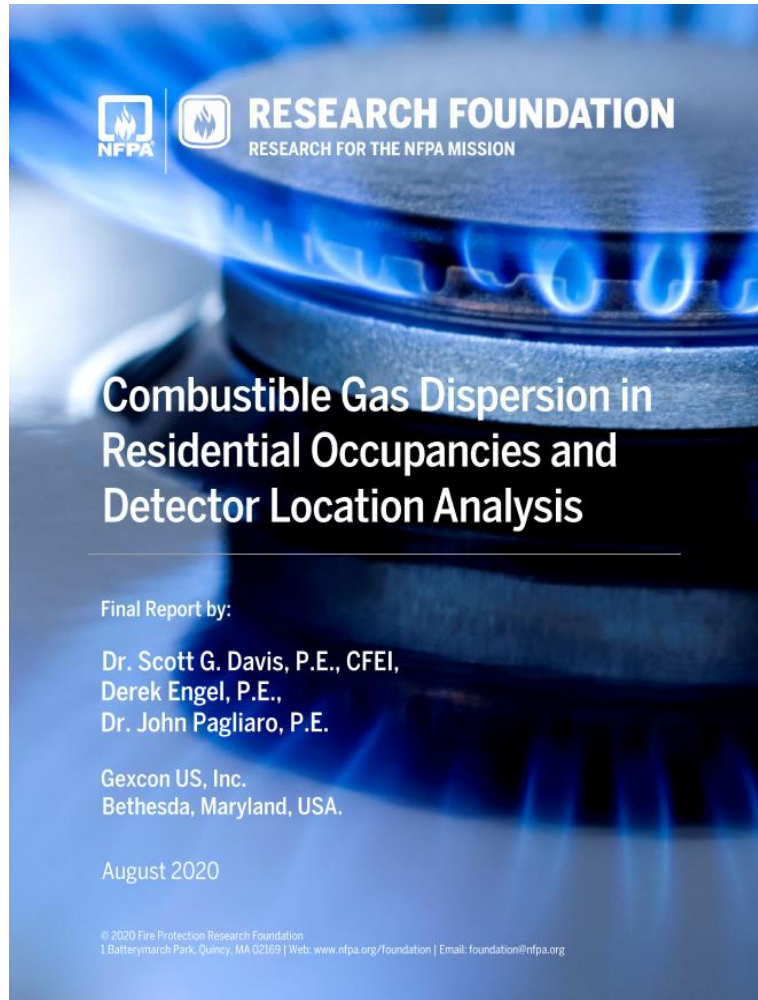
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715

Standard for the
Installation of Fuel Gases Detection
and Warning Equipment

2023







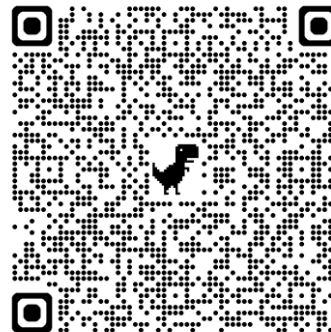
**RESEARCH FOUNDATION**
RESEARCH FOR THE NFPA MISSION

Combustible Gas Dispersion and Detector location Analysis in Residential Occupancies

Presenter:
Scott G. Davis, Ph.D., P.E., Gexcon US and
Stephen Olenick, P.E. Combustion Science & Engineering, Inc.

March 10, 2021

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- NFPA Journal article and podcast
— Nov/Dec 2020

NFPA
JOURNAL

PERSPECTIVE

Early Warning

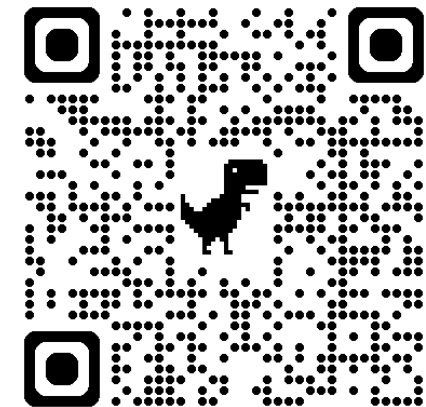
As gas leaks become more frequent, the risk of deadly explosions increases. A new NFPA standard—NFPA 715, Standard for the Installation of Fuel Gases Detection and Warning Equipment—aims to address the problem.



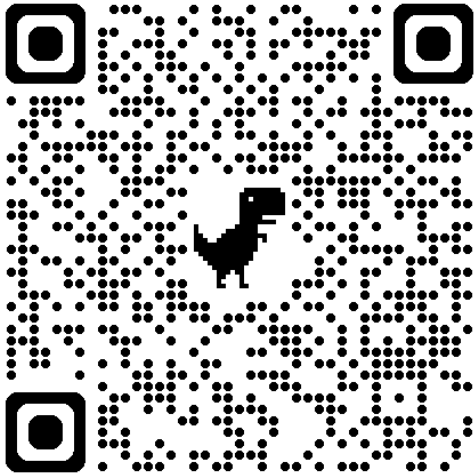
By Angelo Verzoni | 01-Nov-2020



Listen to an NFPA Podcast about gas explosions and NFPA 715.



- NFPA staff blog
— Shared on social media



Household Propane and Natural Gas Detection and Alarms

By Shawn Mahoney | 13-Feb-2025

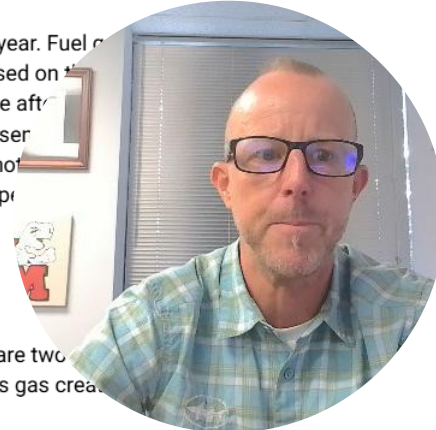
Fuel gases including natural gas and liquefied petroleum gases (LP-Gas) such as propane and butane are used to supply many pieces of equipment within households such as stoves, portable space heaters, ranges, furnaces, water heaters, clothes dryers, gas refrigerators, gas lamps, and fuel-gas-burning fireplaces. Fuel gases can be piped into the structure from a distribution network, or they can be stored on site in cylinders.

Fuel Gas Leak Hazards

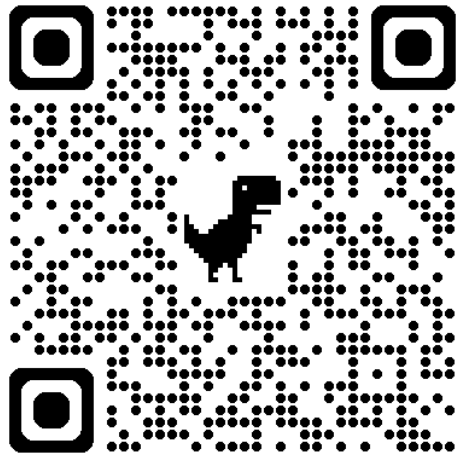
Due to the combustible nature of these gases, leaks within residential structures continue to cause fires and explosions every year. Fuel gas is often scented with mercaptan, which is a harmless but distinct-smelling chemical which enables someone to detect a fuel gas leak based on the type smell created. However, studies have shown that the human smell succumbs to a phenomenon known as olfactory fatigue after two of being exposed to the same odor, meaning you can no longer smell it and, if a leak occurs underground, the earth can absorb the mercaptan out of the gas. Additionally, if the occupants are either sleeping or not in the home at the time of the leak, they will not smell. This is why it is important to have fuel gas detection and a way to warn the occupants of a leak so they can take the proper action which includes evacuating the home and calling either the fire department or fuel gas supplier.

Carbon Monoxide vs Fuel Gas Detection

I often see people confusing combustible fuel gas detection with carbon monoxide (CO) detection, when the case is that they are two types of detection and two different types of hazards. Often called the invisible killer, carbon monoxide is an odorless, colorless gas created by the incomplete combustion of carbon-containing fuels.



- NFPA Fact Sheet



FACT SHEET

RESIDENTIAL FUEL GAS ALARMS

Explosions involving fuel gases such as natural gas or propane have been a major problem worldwide. NFPA® released the first edition of NFPA 715, *Standard for the Installation of Fuel Gases Detection and Warning Equipment*, in 2023 to help users select the right gas leak detection equipment and identify how and where to install it.

Requirements in Chapter 9 cover the location and placement of residential fuel gas alarms (sometimes referred to as fuel gas detectors, explosive gas detectors, or single- and multiple-station fuel gas alarms) to detect natural gas and liquefied petroleum gases (LP-Gas) such as propane and butane outside of the fuel gas appliance or distribution network that is the result of malfunctioning equipment or a leak. This fact sheet covers some of the requirements for the selection, location, and placement of single- and multiple-station fuel gas alarms in residential occupancies such as one- and two-family houses and apartments.

ALARM SELECTION

Fuel gas alarms, which are intended to detect the presence of fuel gas and warn occupants in time to escape or take other action, are required to be tested, listed, and labeled by a third party recognized laboratory to stringent product standards such as UL 1484, *Residential Gas Detectors*. The fuel gas alarm must be designed to detect the type of fuel gas being used in the building.



SAFETY TIP

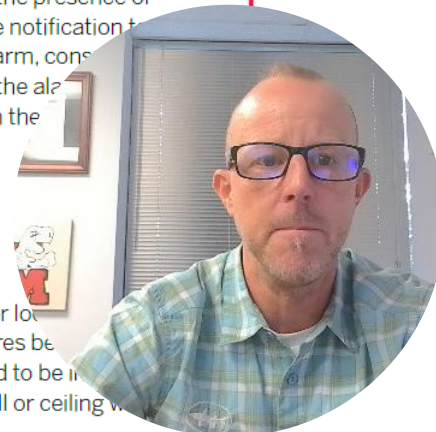
Make sure that the alarm you are buying was tested, listed, and labeled (shown on packaging and on the label of the alarm) by a recognized testing laboratory such as Underwriters Laboratories (UL) or Intertek.

ALARM LOCATION AND PLACEMENT

Fuel gas alarms need to be placed to detect the presence of a fuel gas within the atmosphere and provide notification to the occupants. Before installing a fuel gas alarm, consult the manufacturer's instructions that came with the alarm. NFPA 715 requires fuel gas alarms to be installed in the following locations:

- Near fuel burning appliances
- In basements with a fuel gas entry point
- In attached garages with a fuel entry point
- Outside of sleeping rooms for notification

Fuel gas alarms may also be required in other locations depending on what is required in a jurisdiction. The figures below show these locations in which fuel gas alarms need to be installed, as well as placement of those alarms on the wall or ceiling.



- NFPA Fire Protection Handbook Chapter (21st Edition)



FIRE PROTECTION HANDBOOK, 21ST EDITION

SKU: FPH23

List Price: USD \$749.00
For Members: USD \$674.10

Edition

2023

Chapter 14-10 Fuel Gases Detection



- National Electrical Manufacturers Association publication
 - NEMA BS 30004-2023: White Paper on Fuel Gas Detection
 - www.lifefiresafety.org

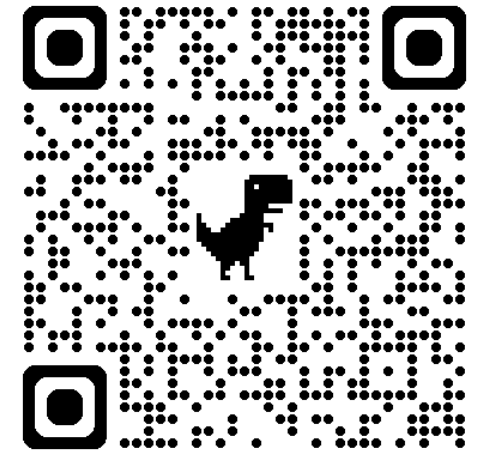
Life Fire Safety



Publications

Readers who design, build, and buy fire safety products will find the following documents as an invaluable tool in ensuring safe safety installations.

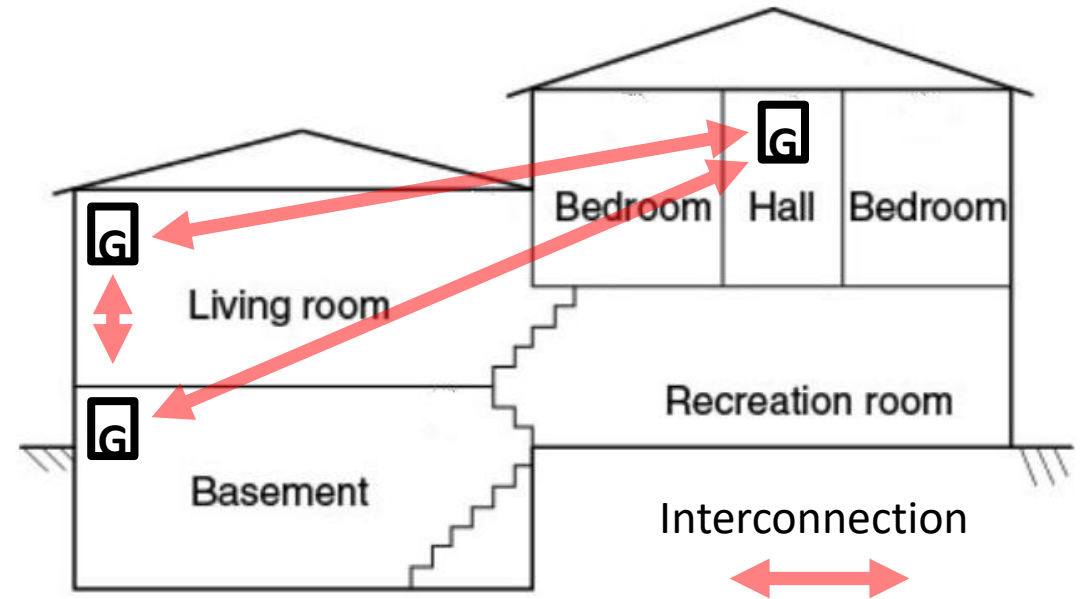
[Guides](#) | [White Papers](#) | [Position Papers](#) | [En Espanol](#)



Future Editions Technical Issues

Future

- Guidance for Occupants/Emergency Responders
 - Instead of just internet references
- Diagrams
- More coordination between NFPA 72 and NFPA 715
- Advanced detection (<1% LEL)
 - If product standard(s) create new class of product



Assumes gas stove in kitchen, gas fireplace in living room, and gas utility penetration or gas appliance in basement.





- Model Codes

- Currently, neither ICC (IBC, IFB, IRC) nor NFPA (1, 101, 5000) model codes require fuel gas detection in any occupancy
- Proposals have been made to require fuel gas detection in specific occupancies
 - So far, most proposals have been rejected
 - But for the 2027 edition of NFPA 101 and NFPA 5000, revisions were approved to require fuel gas detection in new hotels, dormitories, and apartment buildings
- But there may be motivation now or in the near future to act given recommendations from NTSB after incidents as well as states/municipalities acting on their own



- State and Municipality Legislation
 - Maine
 - Effective date: 2022
 - Requires the installation of fuel gas detection
 - Requirement applies to owners of multifamily occupancy buildings; fraternity houses, sorority houses, and dormitories
 - New York City
 - Natural gas alarms must be installed in private dwellings, class A multiple dwellings, and class B multiple dwellings by May 2025
 - Must comply with NFPA 715
 - Other fuel gas legislation (past and in-progress):
 - Illinois (2024)
 - Massachusetts
 - Tennessee
 - New Jersey
 - New York State
 - Others have had public consideration



How Can You Contribute?

Future

- Performance in the field as adoption proceeds
 - What is working? What is not?
- Participate in the NFPA 715 standards process
 - Public input for 2029 edition closes June 3rd, 2026
 - Its free to sign up on NFPA website to make a Public Proposal or a Public Comment
- NGA is represented on the Technical Committee
 - Bob Wilson, Principal Member



Summary

- Fuel gas detection requirements in NFPA 715 complement traditional odorant detection
- NFPA 715 has been created to provide technically-substantiated requirements for proper fuel gas detection installations
- NFPA 715 is now beginning to roll out through adoption into other laws, codes, and standards
- There are many resources available to help understand and communicate regarding fuel gas detection and NFPA 715



Questions?

- Stephen Olenick

Principal Engineer

Combustion Science & Engineering, Inc.

Chair, NFPA Fuel Gases Warning Equipment TC

