

**LINE OF DUTY
DEATH REPORT**
VISUAL EXTENSION



F2019-16 ME

Captain Killed and Six
Firefighters Injured at a Propane
Explosion in an Office Building-
Maine



Summary

- On September 16, 2019, a 68-year-old captain was killed in a propane explosion and six firefighters were injured.



Destruction of the propane explosion. This photo shows Side Alpha/Side Delta of the building. The white debris is insulation and papers from the building.
(Photo courtesy of the Fire and Rescue Department)



Summary

- (0750 hours) A maintenance employee was moving table from the 1st floor to the basement. After trips to the basement, the maintenance employee became light-headed. He mentioned this to the maintenance supervisor.
- (0805 hours) The maintenance supervisor looked at the propane tank, which was located outside near the Side Bravo/Side Charlie corner of the building. There was frost on the bottom of the tank and the ground.
- (0806 hours) The maintenance supervisor called the fire chief and requested the fire and rescue department respond to the facility due to a possible propane leak in the building.
- (0807 hours) The fire chief called the county dispatch center. He requested the fire and rescue department be dispatched to the facility for a possible propane leak.
- (0808 hours) The fire and rescue department was dispatched to an office building for a possible propane leak.
- Car 1 (PAR 1), Engine 2 (PAR 3), and Tower 3 (PAR 3) dispatched.



Summary

- (0817 hours) The captain of Tower 3 was in the basement with the maintenance supervisor, the firefighter from Tower 3, and the chauffeur from Engine 2 when the explosion occurred.
- Car 1 and the captain from Engine 2 were on the 1st floor of the office building on Side Charlie.
- (0818 hours) A sergeant from the police department arrived on scene and informally assumed Command.
- (0821 hours) A mass casualty response was dispatched.
- (0829 hours) The captain of Engine 2 was pronounced deceased by EMS personnel.
- (0858 hours) All patients were transported by EMS.
- One firefighter was treated and released. The other five firefighters were transported by air or ground to various hospitals throughout the state.



Contributing Factors



- Lack of locating and marking of underground utilities prior to digging or excavation.
- Installation of vertical protective posts (bollards) that severed the propane supply line.
- Lack of pressure testing an empty tank by the propane company.
- Odorant fade or scrubbing of ethyl mercaptan by soil and concrete.

Photo. The bollards (red circles) that were placed to protect the air conditioning units in the parking lot on Side Bravo of the office building. When the bollards were driven into the ground, one of the bollards severed the propane supply line.

(Photo courtesy of the Maine Office of the State Fire Marshal)



Contributing Factors

- Lack of scene size-up and risk assessment
- Lack of incident management
- Lack of understanding a multi-gas monitor's capability
- Improper gas sampling, monitoring, and detection
- Lack of hazardous materials training and recertification

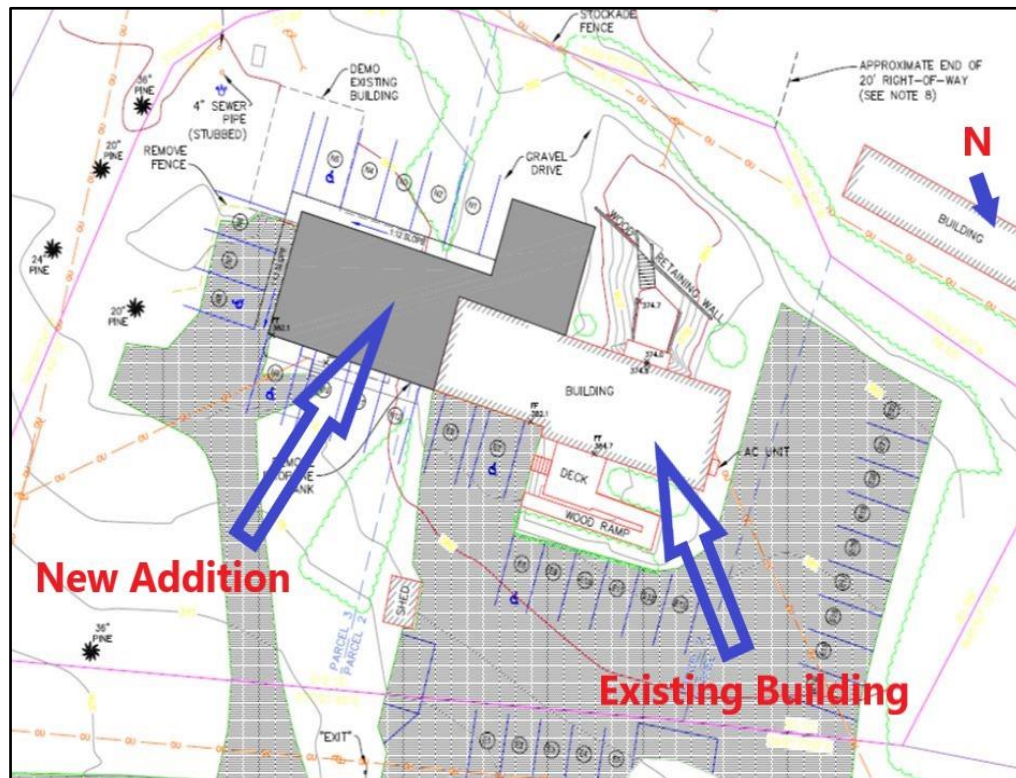


Diagram shows the changes that were made to the structure during the renovation project.

(Diagram courtesy of the Maine Office of the State Fire Marshal)



Recommendations



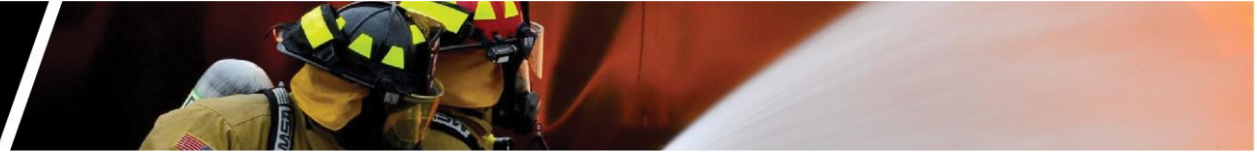
- Fire departments responding to a hazardous materials incident should ensure that a scene size-up and initial risk assessment are performed. In addition, fire departments should establish isolation zones and ensure a continuous risk assessment is conducted throughout the incident.

The ambulance is located at the triage, treatment, and transportation unit after the explosion. All patients were transported to the hospital from this location.
(Photo courtesy of the Maine Office of the State Fire Marshal)



Recommendations

- Fire departments should ensure incident commanders initiate a defensive strategy and communicate the incident action plan (tactics) during initial operations of a hazardous materials incident. The strategy and IAP are revised based upon the tactical objectives taken to mitigate the hazard.
- Fire departments should ensure firefighters are trained to understand the scrubbing or odorant fade of ethyl mercaptan from propane. This training includes the use of multi-gas detectors to determine if a potentially explosive atmosphere is present



Recommendations

- Fire departments should ensure that firefighters wear proper PPE including SCBA when entering an IDLH environment involving propane and natural gas.
- Fire departments should have a SOP/SOG (standard operating procedure/standard operating guideline) for conducting sampling, detection, and monitoring at propane and natural gas emergencies.
- Fire departments should ensure that firefighters are properly trained and certified to understand the capabilities of the department's multi-gas detectors, especially catalytic LEL combustible gas sensor performance.



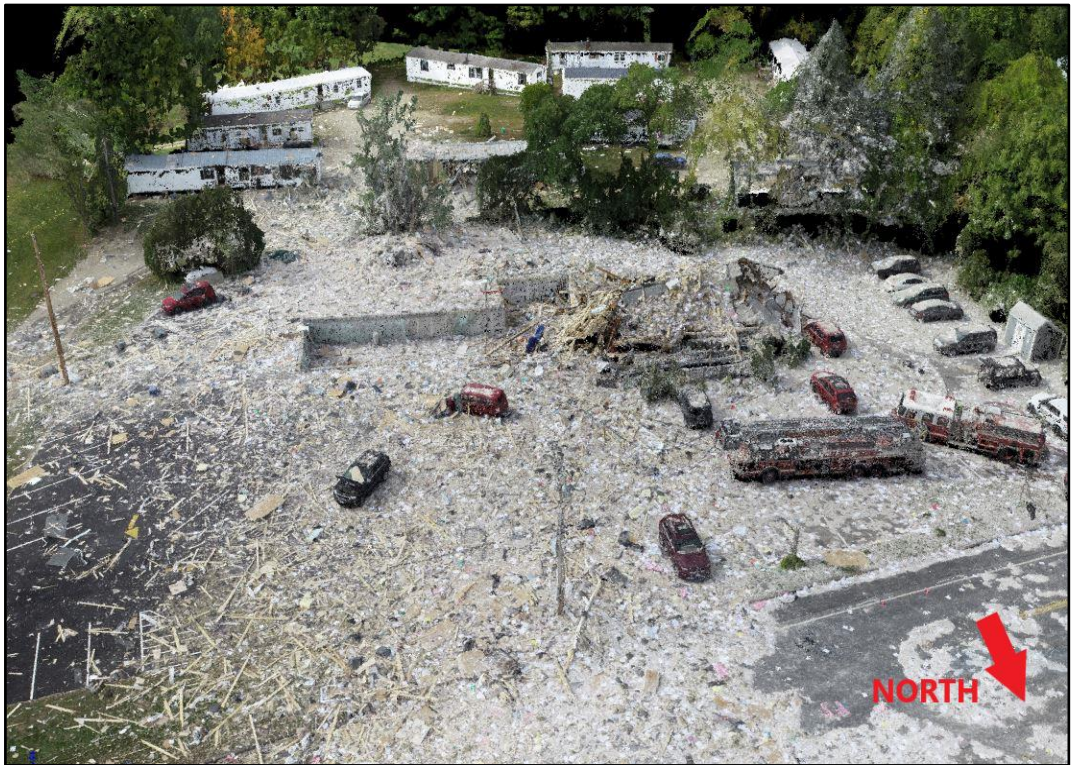
Recommendations

- Fire departments should ensure that multi-gas detectors are properly maintained per the manufacturer's recommendations.
- Fire departments that respond to propane and natural gas emergencies should comply with the requirements of 29 CFR Part 1910.120, *Hazardous Waste Operations and Emergency Response*.
- States should ensure anyone (including homeowners) using power tools or other digging equipment that will penetrate the ground call "811 or 811 Dig Safe" three business days (72 hours) prior to digging to identify if any buried utilities are present and mark their location(s).



Recommendation

- Local and state enforcement agencies should ensure that a leak test of the piping system is conducted in accordance with the requirements of NFPA 54, *National Fuel Gas Code*, and NFPA 58, *Liquefied Petroleum Gas Code*, whenever propane service is initiated or restored.



Drone footage of the office building and surrounding area after the explosion. A mobile home park was located to the south of the building property.
(Photo courtesy of the Maine Office of the State Fire Marshal)



NIOSH FFFIPP Safety Advisory



Odor Fade in Natural Gas and Propane

RECOMMENDATIONS

The NIOSH Fire Fighter Fatality Investigation and Prevention Program (FFFIPP) recommends that fire departments ensure all firefighters responding to natural gas or propane incidents:

- ❑ use gas detection equipment and do not rely upon their sense of smell to determine if propane or natural gas is present
- ❑ understand that the odorant in natural gas or propane can fade
- ❑ are trained on the proper calibration, maintenance, and use of gas detection equipment to determine if a potential explosive atmosphere is present
- ❑ recognize that the lack of odor can result from the natural gas or propane contacting soil, concrete, and a wide variety of building materials such as drywall, wood, and new piping storage tanks



Propane tank involved in the explosion described in the FFFIPP Investigation
Photo courtesy of Maine Fire Marshal

FFFIPP INVESTIGATION

On September 16, 2019, a fire department responded to a propane leak at a newly renovated office building. Several firefighters entered the building. The propane gas ignited and caused an explosion. The blast resulted in a line of duty death of a firefighter and the hospitalization of six other firefighters. The NIOSH FFFIPP investigated this incident and identified the odor fade of mercaptan as a key contributing factor. During this investigation, NIOSH FFFIPP investigators learned that some fire departments may not fully understand odor fade. They also may not recognize the subsequent explosion hazard that exists when responding to natural gas and propane incidents where there is not enough odorant in the released material to alert firefighters to its presence.

QUESTIONS & ANSWERS on p. 2

Odor Fade in Natural Gas and Propane

The odor of ethyl mercaptan fades or is scrubbed due to oxidation, adsorption, or absorption. Leaking natural gas or propane from underground lines loses the odor of ethyl mercaptan as it passes through soils and concrete. Materials such as drywall, plywood, and new piping for natural gas or propane will also adsorb the odor until the material becomes saturated.



ICS 208 HM

Site Safety and Control Plan

Responders take direction action on the material, container, or equipment involved. This is a hazmat technician level operation, and a Site Safety Control Plan (ICS 208 HM) must be completed.

SITE SAFETY AND CONTROL PLAN ICS 208 HM															
1. Incident Name:			2. Date Prepared:			3. Operational Period Time:									
Section I. Site Information															
4. Incident Location:															
Section II. Organization															
5. Incident Commander:				6. HM Group Supervisor:				7. Tech. Specialist - HM Reference:							
8. Safety Officer:				9. Entry Leader:				10. Site Access Control Leader:							
11. Asst. Safety Officer - HM:				12. Decontamination Leader:				13. Safe Refuge Area Mgr:							
14. Environmental Health:				15.				16.							
17. Entry Team: (Buddy System)						18. Decontamination Element:									
Name:			PPE Level:			Name:			PPE Level:						
Entry 1						Decon 1									
Entry 2						Decon 2									
Entry 3						Decon 3									
Entry 4						Decon 4									
Section III. Hazard/Risk Analysis															
19. Material:		Container type	Qty.	Phys. State	pH	IDLH	F.P.	I.T.	V.P.	V.D.	S.G.	LEL	UEL		
Comment:															
Section IV. Hazard Monitoring															
20. LEL Instrument(s):						21. O ₂ Instrument(s):									
22. Toxicity/PPM Instrument(s):						23. Radiological Instrument(s):									
Comment:															
Section V. Decontamination Procedures															
24. Standard Decontamination Procedures:												YES:	<input type="checkbox"/>	NO:	<input type="checkbox"/>
Comment:															
Section VI. Site Communications															
25. Command Frequency:				26. Tactical Frequency:				27. Entry Frequency:							
Section VII. Medical Assistance															
28. Medical Monitoring:		YES:	<input type="checkbox"/>	NO:	<input type="checkbox"/>	29. Medical Treatment and Transport In-place:		YES:	<input type="checkbox"/>	NO:	<input type="checkbox"/>				
Comment:															

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[FFFIPP Webpage](#)

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