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Natural Gas Safety for First Responders

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Natural Gas Safety for First Responders

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Abstract

Natural gas leaks and explosions are growing problems across the country. Recommended Practice (RP) 1162, a federal regulation, requires pipeline operators to implement public awareness programs. One key stakeholder audience includes first responders and fire departments.

This training was developed for a Utility Company, who is a regional pipeline operator, to teach first responders response protocols of different types of natural gas incidents. The module not only helps the Utility Company meet its RP 1162 outreach requirements but also fills educational gaps of firefighters.

To design this training, a team of subject matter experts was assembled to develop the content with regard to protocols in the various regional territories to create a unified training program. Once the content was developed, an online elearning module and reference materials were developed and implemented.

A formative evaluation was conducted by way of a short survey and review and feedback process. Recommended changes were implemented for the live release of the online training.

Online learning is gaining favor within the firefighter training industry. Its self-paced nature has strong appeal due to the firefighters' unpredictable schedules. Many firefighters are required to complete additional training hours during the year, so it benefits them to receive a certification of mastery and completion. The final training provided by the Utility Company provides printable certificates upon the successful completion of the module and quiz, with a passing grade of at least 80%.

The training program offers firefighters access to important, potentially life-saving information about natural gas incident response.

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SECTION I: ANALYSIS

Background

Introduction

Natural gas leaks and explosions are a growing problem across the country, largely due to aging infrastructures. Firefighters frequently respond to gas odor calls but many do not take them seriously. Often they consider them to be nuisance calls. Many firehouses differ in the way they handle gas calls – some demonstrate an attitude of complacency, some demonstrate poor execution of the fire department's standard operating procedures on incidents involving flammable gas.

Federal pipeline safety regulations require pipeline operators to develop and implement public awareness programs provided by the American Petroleum Institute (API) Recommended Practice (RP) 1162, "Public Awareness Programs for Pipeline Operators". One of the key stakeholder audiences of RP 1162 is emergency officials, including, first responders and fire departments.

This module will be developed and distributed by a Utility Company who is a regional pipeline operator. It will teach first responders about different types of natural gas (natural gas, carbon monoxide, liquefied natural gas), its distribution systems, gas properties, and proper response protocols so they can effectively recognize and respond to certain types of natural gas incidents. The module fills two purposes: it helps the Utility Company meet its RP 1162 compliance requirements, and it fills educational gaps of firefighters.

Problem Statement

Career and volunteer firefighters, located in the Utility Company's territorial service areas that spread across multiple states, receive varying levels of training and education about natural gas safety.

Because local fire training requirements vary widely, no uniform channels exist for the delivery of this safety information. For example, one state requires that 4.5 of the mandated 100 hours of annual in-service training focus on natural gas and other hazardous materials, but other states do not have any comparable requirements. In states with no such requirements, firefighter in-service training topics are set at the department level and are shaped by local priorities such as recent incidents, infrastructure, or specific local hazards.[i]

According to the *2012 US Fire Department Profile*, issued by the National Fire Protection Association[ii], in the U.S., 31% of firefighters are career firefighters, while 69% are volunteers. While some gas training is provided for career firefighters who train at the Academy level for their Firefighter 1 or 2 certifications, there are no minimum

training requirements, and no continuing education requirements for volunteer firefighters in the Utility Company's regional territories.

Volunteer fire department members receive some form of general training, either in a formal or informal setting, depending on the state and regulatory authorities. Although many volunteer fire departments have training programs equal to that of paid departments, the level and type of basic and specialty training varies across the country.

The assumption is that many firefighters have not yet been trained in natural gas incident response. Volunteer firefighters in the Utility Company's regional territories are rewarded for taking a certain number of training courses each year. Thus, Fire Academies in the Utility Company's regional territories endorse the Utility Company's program, which could provide a valuable incentive.

Lastly, the Utility Company currently provides regional in-person training seminars that vary across some of their regional territories. They vary from trainer to trainer. The decision of what to teach is left up to the trainer so that there is no unified messaging coming from the Utility Company. Further, some critical compliance information is not represented in the current in-person courses. And there is no alternative way to access the training material if a firefighter chooses not to attend an in-person training course.

Training Goal

Teach first responders, particularly firefighters, about different types natural gas (natural gas, carbon monoxide, liquefied natural gas), its distribution systems, gas properties, and proper response protocols so they can effectively recognize and respond to certain types of natural gas incidents.

The ultimate goals of this project are to:

1. Create training materials for firefighters that will provide consistent and industry-compliant natural gas safety protocols that fill educational gaps for firefighters;
2. Create training materials that will provide access to natural gas safety information to firefighters in the Utility Company's regional territories across multiple states;
3. Help the Utility Company meet its federal RP 1162 compliance requirements.

At the end of this program, participants will be able to:

1. Distinguish the different types of natural gas emergencies;
2. State the properties and behavioral characteristics of the different types of natural gas;
3. Follow the proper incident protocols when responding to different types of natural gas emergencies;
4. Identify what NOT to do when responding to different types of natural gas emergencies.

Analyses

As summarized below, a needs analysis, a task analysis, a learner analysis, and an environmental analysis were conducted prior to designing the training program. The corresponding surveys, collection instruments, and breakdowns can be found in Appendix A.

Needs Analysis

Data Collection

A sample list of participants was made up of fire departments located within the Utility Company's service area zip codes. An attempt was made to balance across first responder type and size, including: Large metro, serving metropolitan populations of 150,000 or more; Mid-size career, serving medium-sized cities or suburbs and are also staffed mostly by career personnel; and Small and/or volunteer, primarily serving communities under 25,000.

An advisory panel was developed with people from across the Utility Company's geographic territories. The 12-member panel included fire chiefs and training officers. One-on-one telephone interviews were conducted with the advisory panel members using a questionnaire with a combination of multiple choice and open-ended questions to generate ideas and opinions about training practices and materials.

Key Findings: Training Practices

1. Some delivery of utility safety training is nearly universal among participants. More than 80% of participants provide training for emergencies involving natural gas.
2. Training durations vary widely across all department sizes and types, pointing to the need for materials that can be used flexibly to suit different training timeframes.
3. Large metropolitan departments train least frequently on utility safety issues; small and volunteer departments train more frequently. Only 30% said they train on natural gas at least once per year. By contrast, 66% of small departments train at least once per year on natural gas.
4. Among fire departments, 52% of participants said they train at least once a year on natural gas.
5. For small and mid-sized departments, station houses are the most common training location; for large metropolitan departments, the academy is more commonly used. This implies that outreach efforts to larger departments will be most successful if they target academy-based trainers as well as those at individual stations.
6. Trainers consider first responders to be predominantly kinesthetic and hands-on learners; several suggested that a combination of print materials, electronic materials, and hands-on activities would serve them best.
7. First responder training programs that allow users to stop and start at their own convenience make it easier to schedule training time and helps fit training into

work shifts prone to frequent interruption. Trainers appreciate checkpoints within the modules to ensure the user actually reads the materials before taking the test.

8. Certifying training materials for continuing education units (CEUs) could enhance their use by trainers. CEUs are required for firefighters in some states.

Key Findings: Training Materials Preferences

1. Departments of different sizes and types prefer different types of materials. For example, participants from larger departments preferred more concise print materials, while those from smaller departments and fire departments preferred more in-depth materials. Presenting training officers with a broad range of options will likely result in more requests for materials and more training.
2. Electronic materials preferences vary widely across department sizes and types, and are most heavily influenced by trainee attention spans and timeframes available for training.
3. First responders have a need for refreshers of basic natural gas safety information. Many suggested they would like a laminated card or tabbed brochure that could be kept in a vehicle and used as a reference for responding to various utility-related emergencies.

Learner Analysis

Ages: 92% of all firefighters are between the ages of 25 and 54.[iii]

Gender: Most firefighters are male, with fewer than 4% females.[iv]

Education: The following is assumed about the participants:

- Participants have basic computer skills and know how to use the Internet.
- Participants can read and speak English. They can follow directions.
- They have a minimum education of a high school degree with fire service certification. Some have an additional associate's degree, some have bachelor's degrees and a few have master's degrees.

Location of participants: The lessons will be offered to firefighters who reside in any of the geographic territories across multiple states where the Utility Company has gas distribution assets. It is estimated there are about 78,000 potential participants.

Learning styles: According to one study of the learning styles of firefighters, the majority of firefighters indicated a preference for kinesthetic learning (59%), with a close margin between visual learners (22%) and auditory learners (19%).[v]

Top ten group characteristics: Honest, Physically Fit, Able to Communicate, Flexible/Adaptable, Dedicated, Team Player, Have Mechanical Aptitude, Good Public Image, Tolerant, Self Sacrifice (Courageous, Giving)[vi]

Attitudes: Some fire departments handle gas calls so differently from others, which seems to be based on people's personal and direct experiences. Considering the variety of attitudes across locations, participants may or may not have managerial support for the

training. However, the trainings are voluntary and the likely participants will be those who are interested and motivated for their own knowledge and safety. The skills learned will be relevant to all firefighters but some will recognize the learning opportunity more than others.[vii]

There are some potentially hazardous attitudes to which firefighters can fall prey, including:

- Invulnerable – That can't happen to us
- Anti-authority – Disregard of the team effort
- Impulsive – Do something even if it's wrong
- Macho – Trying to impress or prove something
- Complacent – Just another routine fire
- Resigned – We can't make a difference
- Group Think –Afraid to speak up or disagree[viii]

Prior Knowledge of Topic: Firefighters are trained to respond to gas odor calls so they have some basic training about gas safety. However, they may not have specific prior knowledge of this topic in depth.

Task Analysis

Example of a Standard Natural Gas Response

This capstone project task analysis will focus solely on the general firefighter response to natural gas incidents. Beyond the scope of this capstone project, but necessary for the actual development of this training to be comprehensive, additional task analyses would be conducted.

The results of the task analysis indicated that two groups, dispatchers and firefighters, need different types of knowledge, skills, and abilities, at the moment of incident report, and on the incident scene, respectively. The skills for dispatcher include knowing how to assess and the dispatch calls, knowing how to notify the utility company, and familiarity with general procedures.

Skills for the firefighter on the scene include a wide variety of things, such as knowing: standard operating procedures, what to do and what *not* to do, operating heavy and light equipment, how to use personal protective gear, evacuation procedures, chains of command, communication skills, characteristics of gas, gas fires, and explosions.

Environmental Analysis

The results of the environmental analysis revealed the need to look at two environments: one at the moment of incident report, and one at the incident scene.

At the Moment of Report

Dispatchers have desk jobs and sit at large computer consoles with tools that allow them to receive the 911 calls, contact others, and dispatch the trucks. They can work long shifts and irregular hours. They must know pager and phone codes and numbers, be able to locate geographic areas using software, and must know how to use back-up systems if something breaks during an emergency call.

At the Incident Scene

Firefighters work closely with others. They regularly work in outside weather conditions, including temperature extremes, during day and night shifts. They can work at heights on scaffolding and ladders; work with water; travel from site to site. They can be exposed to smoke, heat, and flames. They can be exposed to hazards such as noxious fumes, and chemicals. They work near moving mechanical parts, with all kinds of small and large tools and equipment, and special protective gear, and they work under potentially risky conditions. Firefighters routinely operate at incidents where other emergency services are present. They are trained to follow the Incident Command System. Things that breakdown include, having no unified command in-place, misunderstandings of communications, lack of a clear incident plan, acting out of habit, or focusing on small tasks but ignoring the big picture.

Notes

The role of firefighters at a natural gas incident is to ensure public safety, adopting a defensive mode while waiting for the utility company to arrive. Once on an emergency scene, firefighters must continually reevaluate fire conditions and hazards. They are responsible for gathering information from witnesses and other sources, while maintaining composure to think quickly and acquire the appropriate information to deal with each unique situation.

In almost every case, the emergency response begins with a call to 911. First and foremost, the dispatcher should immediately notify the Utility Company. Firefighters must intimately coordinate their activities and work as a team. This includes those working directly with the emergency, directing traffic, and standing by to relieve other firefighters. They must also coordinate their activities with those of other public agencies, such as law enforcement and public work agencies.[ix] They must know their clear lines of responsibility, which should be reinforced during the training.

Many fire departments staff a single engine company consisting of 4-5 personnel. The departments operate with three shifts. Each shift works 48 hours on duty followed by 96 hours off duty. Typically, each shift includes a Captain, one or two Engineers and two Firefighters. This varies, however, by state and even by municipality.

In firefighting, the policy of two-in, two-out refers to United States Occupational Safety and Health Administration policy 29 CFR 1910.134(g)(4)(i)[1] that mandates that firefighters never go into a dangerous situation in a fire or rescue incident alone, and that there be two firefighters outside the hazard area to initiate a rescue of the firefighters inside, should they become in trouble, during the initial stages of the incident where only one crew is operating in the hazard area. Once a second crew is assigned or operating in the hazard area, the incident is no longer considered in the initial stages and a dedicated Firefighter Assist and Search Team or Rapid Intervention Crew is required.[x]

Rescue vehicles are often set up so that similar equipment is stored together; for example, there might be bags and boxes labeled "hardware" and "software." Firefighters should set up task-oriented kits, called “first-in bags”, or “jump kits”, to reduce the time it takes to

get organized prior to leaving the vehicle and getting systems rigged. These kits can be stored on an upper shelf in the rig, so they are ready to go.[xi]

The fire engine is the basic unit of response for most fire departments and is staffed to be able to respond to the widest range of possible emergencies including fires, medical emergencies, hazardous materials incidents and other hazardous situations. Because the personnel operate as a cohesive crew with set responsibilities, they respond as a unit to all emergencies.[xii]

The exact working conditions faced by a firefighter vary. Regardless of the size of the department or the nature of the fire, all firefighters share some common working conditions.

1. They face many dangers in the performance of their duties. The risks begin when a firefighter must respond to an emergency situation.
2. They must respond to calls regardless of the weather.
3. The work hours for firefighters can be irregular and the workweek lengthy.
4. They typically spend their duty hours at the fire station. When not responding to a call or in training, the fire station is their home away from home.
5. They can get called to respond to an incident at any time of day or night.
6. They must work together as a team.
7. They must be strong mentally and physically. [xiii]

Context Analysis

Performance Context

It s acknowledged that the firefighters perform their duties outside or inside, at the gas incident scene. Therefore some field training is recommended. However, this capstone project will focus only on the online training module and the quick reference guide. The delivery of online training for this capstone will execute the solution for PCs only, not for mobile devices. Accordingly, the performance context examined below relates to access to computers.

PCs and Internet access is part of the fire station infrastructure.[xiv] In 2011, 80 percent of Virginia fire departments reported that they had a computer at their station; 19 percent had access to one at a different location, and only 1 percent claimed they had no computer. More than half of these departments (52%) enjoyed high-speed Internet, whereas a small minority (5%) had no Internet service at their stations.[xv] Nationwide in 2010, 16 percent of U.S. fire departments did not have Internet access. In departments that protected a community of 250,000 or more, 45 percent provided individual Internet access, and 37 percent provided access at each station.[xvi]

For use in the fire engines, many have toughbooks, which are rugged, reliable and wireless laptop computers. The use of tablets is increasing but some find typing on a touchscreen will be next to impossible while bouncing around the front seat. Some use it for navigation (GPS) while on the road. Some use the Firehouse NFIRS software on the tablets.[xvii]

Smartphones have become an important tool in the firefighter toolbox and have changed the way they work. Some people used to consult wallet-sized reference cards but can access certain information through apps. They still may carry the card, but prefer to use the apps.[xviii]

Learning Context

Ideally there will be three learning contexts for the trainings.

1. Self-paced online module
    a. Elearning delivered trough a learning management system;
    b. Accompanying printed quick reference guides that can be easily accessed while the firefighters are at an incident scene;
2. Online with general information and access to log in to the eLearning module
    a. Website
    b. Mobile app, with the caveat that firefighters are not allowed to use anything that can ignite a spark during a gas incident response, such as a cell phone, as it poses an explosive risk.
        i. As one Chief Fire Instructor said, "A mobile phone app would be a great way to communicate important safety stuff: critical numbers, check this and that, information you have to give when you call the Utility Company for an emergency, things to do prior to their arrival."[xix]
3. Hands-on field training.

SECTION II: DESIGN

Performance Objectives

Goal

Upon completion of the online module, learners will know the proper responses when responding to different types of natural gas emergencies, including indoor leaks, outdoor leaks, fires, explosions, and carbon monoxide incidents.

Objectives

According to the materials presented, learners will be able to, within 80% accuracy:

- Identify the circumstances in which to contact the Utility Company.
- List the steps for calling in a gas incident to the Utility Company.
- List the steps of the Universal Response Tactics.
- Describe the proper actions to take in response to an indoor leak.
- Identify the seven areas in the building to test for the presence of natural gas when responding to an indoor leak.
- Identify what to do after the source of the leak has been identified.
- Describe the proper actions in response to an outdoor leak.
- List the proper actions to take and not to take in response to a natural gas fire.
- List the proper actions to take and not to take in response to a natural gas explosion.
- Describe the conditions under which a gas explosion can occur.
- List the steps to take when responding to a carbon monoxide incident.
- Identify the five areas in the building to test for the presence of natural gas when responding to a carbon monoxide incident.
- Give at least two examples of do's and don'ts for firefighters who respond to a call involving natural gas.

Instructional Strategy

Self-paced Online Module

Nature of Environment and Equipment. The module can be taken using a PC, either at the firehouse, or at the participant's own home (or elsewhere), or can be used by regional trainers who lead regularly scheduled in-service trainings to groups. In this case, the regional trainers can use the materials to facilitate their own trainings and discussions. Constraints may include such things as: irregular access to computers, varying Internet speed, unfamiliarity with and/or intimidation of eLearning technology and procedures like creating accounts and logging in. The funding of the module will come from the Utility Company who will produce and distribute the trainings at no cost to participants. The computers, however, will be at the expense of the firehouse or the individual participants.

Instructional Strategies. The materials will be presented using a combination of multimedia, narration, on-screen reading, video, and intermittent knowledge checks. There will be resources and glossaries to aid in retention. Beyond the scope of this

capstone, but ideally, case studies will be used to represent real-life situations that would reflect or resonate with the participants' on-the-ground experience.

Delivery Approaches. The online modules will be self-paced, allowing users to stop and start at will, in the event that they are interrupted to respond to an emergency. Due the critical nature of the information, and the fact that their lives, and the lives of the public depends on their ability to respond correctly to a natural gas emergency, the navigation of the module content will use program controls. This means that user will be forced to view all module content, in the order presented, prior to taking the final quiz. The passing grade of the final quiz will be 80%.

The delivery of the module will be through a Learning Management System (LMS). The LMS will be used to track and report on participation to the Utility Company so they can judge the effectiveness and participation levels. The reports will be provided monthly to the Utility Company for use in their compliance reports to its insurance company. The LMS will tie into a database to track user who have completed the module and will be the portal through which the user log in and module completion is registered, and the certificate of completion is distributed and collected by the individual users.

Time. There will be no time limits imposed on the user, either for completion of the module or of the number of times he can stop and resume the module, nor of the number of times he can take the test prior to passing. The goal of the module is to educate, not to discourage the users.

Language Considerations. English language will be of a technical nature, with new terms defined in context. Idioms will be avoided. The emphasis on simple, clear sentence structure will meet the needs not only of non-native speakers of English, but also of native speakers whose literacy skills are not strong.

Printed Quick Reference Guide

Nature of Environment and Equipment. The quick reference guide can take the form of something that can be kept in the fire engine, such as a magnet or a visor card, or something that can be kept on one's person, such as a wallet card. Or the guides could come in all of those forms. These guides are supplemental to the online module material, providing an at-a-glance reminder of procedures or contact information in the midst of an emergency. There are two benefits of providing resources in an analog format (as opposed to an app or electronic aid) are: 1) that it can be quick to access and is not dependent upon wireless or Internet service (in case that is unavailable); 2) that in a natural gas emergency, firefighters are not allowed to use anything that can ignite a spark, such as a cell phone, as it poses an explosive risk.

Instructional Strategies. The materials will use a shortened version of the in-depth online module content, such as quick procedural steps to act as a reminder of what to do and what not to do.

Delivery Approaches. The materials must be made of sturdy, water resistant materials, such as laminated board or magnetic material to stick to the inside of a truck or metal case. Materials can be downloaded from the online module.

Language Considerations: The guides must be easy to read and written in clear and simple language. They will be developed in English.

SECTION III: DEVELOP

Two training vehicles were created: an online multimedia, self-paced elearning module, and a printed visor card for use in trucks. Appendix B displays the samples.

Description of Self-Paced Online Module

The elearning module was produced in Articulate Storyline.

The online training started with the draft of a factual Word document containing the raw content. The document was developed by combining resources from the Utility Company, plus materials from their regional in-person training courses. The first draft was missing content that complied with the RP1162 requirements and that was added in later by subject matter experts.

The raw content was then turned into a storyboard created in Word. Most of the instructional design occurred at this stage, as I decided how to chunk the content and pace the information, what kinds of interactions to use, and how to present the media. The chunking decisions were made easier because the raw content was already outlined into natural sections, such as indoor fire response, outdoor fire response, etc. Those sections were further chunked by how much imagery and content would fit onto a screen. Where possible, I wanted to use a font size of at least 14 points for easy readability.

For sections that cover multiple slides, two design elements were used: one is the inclusion of a menu on the side of the player formatted in traditional outline style to indicate hierarchy; and one is the use of the same headline across multiple slides. Both indicate section relationships.

Questions immediately arose from the storyboarding process. For example, in the raw document, many sections referred to certain procedures, which would create redundancies throughout the module and make it lengthy and repetitive. To resolve that, I used a Storyline feature called a marker, which is a small button that can be opened and closed upon clicking. This was a good solution because it does not take up much real estate but was available on any slides that referred to it. I placed it always in the same spot to condition the user to its presence. By creating repetition of information, this could reinforce the learning and stress the importance of that procedure.

Another feature of the software that I used to aid in chunking the presentation of materials was the use of buttons. In some sections there was too much information to be contained, and absorbed by the user, so I made smaller sections and placed the sections behind buttons. This not only prevents from information overload but also forces the user to engage with the media and hopefully helps to maintain user interest.

I also used other visual features such as the use of “spotlights” to focus user attention to a given area, or the use of moving elements, such as arrows, to instruct the user how to navigate the module.

One big design decision was around the voice. I decided to develop a narrative to replace the third person editorial style of the raw content provided. The module is meant to be engaging and the narrative speaks directly to the user, making it more personal.

Writing the narrative also helped in creating the pacing. The final module design uses a mix of narration and on-screen text that the user must read. Narration was used to introduce topics and shorter passages. On-screen text is used mostly for larger paragraphs or long lists of items. In some cases I used both narration and on-screen text to reinforce the information.

Image selection was another time-consuming factor in the design and development. It was important to show images that were industry-compliant and would show authentic people in context, actual tools, and information graphics that would impart learning. Although the customer provided some imagery, I designed many of the final images using Photoshop and Illustrator. Images were noted by name in the storyboard, but sometimes, small thumbnails were also pasted in as a visual reference.

The look for the final slide template in Storyline had to adhere to the company's brand style guidelines, including the color palette and fonts. I designed slides to keep header space to a minimum so I could maximize the content area.

When the narrative script was finalized, a voice professional recorded the final script and provided audio files, one per slide, named as requested by slide number.

Audio files were imported into the individual slides in Articulate Storyline and the timing for each slide was developed. Narration scripts were added into the corresponding Notes pages of each slide so that the user can read along if they want. This provides access to the content through multiple means of representation in case the learner is a visual learner, rather than auditory learner.

Ultimately, after reviewer feedback, navigation restriction was added. This was a big design change that came late in the process. Storyline offers a quick solution to restrict usage of built-in navigation controls. But we also had to write special conditional coding to force the user to complete the audio *and* the interactions on each slide. If a user tries to advance prior to completion, a warning message pops up (which can be closed) indicating that the user must complete the slide. To complete it he must not only listen to the complete narration but he must also click any buttons on that slide. This ensures that participants will be exposed to all content.

As a result of the changes restricting navigation, I redesigned the navigation instructions. After researching best practices, I knew I wanted to keep it simple and short, so I focused on pointing out the restrictions, and the main features of the interface, with which the users would not be familiar. The navigation review occurs on slide 2. Because there is a title slide that precedes that, I added an arrow prompt pointing at the 'next' button upon the completion of slide 1 only. On slide 6, I added some "just in time" navigational instruction about the use of the marker for recurring information. This way the

navigational instructions are minimal and occur where the user would most need them, and the rest of the instruction was designed to be intuitive.

There are no time limits to complete the module and a user can stop and restart at any time. This stresses the importance of the users learning the information, no matter how long it takes them. This course is not taken for CEUs, so the time factor was not critical.

The module contains one ungraded knowledge check with three quiz items that occur near the middle of the module. The knowledge check serves as a reinforcement of information, plus the chance to experience the interface of the final quiz.

At the end of the module, there is a mandatory, graded quiz, with 10 closed questions: a combination of true/false, select all, and multiple choice. The user is allowed two tries to get the answer correct. Upon submitting an answer, the user will see a pop-up box with a message indicating a "try again", or the correct response to reinforce the learning. The user can take the quiz as many times as needed to pass.

The order of the quiz questions is not randomized, but where possible, response options are shuffled within each quiz item. Each item is worth 10 points, and the user must obtain at least 80% to pass in order to receive the certificate of completion.

The quiz records the user responses. Upon completion, the user will see the results slide that will lead him back through each item with his recorded responses. For incorrect responses, there is a button that links back to the corresponding section of the module so that he can review the content, again reinforcing the material.

Another design feature is the Resources tab that links to PDFs and web links to key content that can be printed out and kept for reference after the module is complete.

Content Outline

Gas Incident Management Module

1. Welcome
2. Navigation review
3. Working with Utility Company
4. Objectives
5. When to call
6. Universal response tactics
7. Arriving on the scene
    a. Parking (Slide Layer)
    b. Evacuation
    c. Safeguards
8. What NOT to do
9. Indoor leak response
    a. Use your Combustible gas indicator (CGI)
    b. Turn off the gas at the meter
10. Ventilation and explosive range
    a. Ventilating precautions
    b. Top-down ventilation

11. Outdoor leak response
    a. Combustible gas indicator (CGI)
    b. Evacuate occupants
    c. Arriving on the scene
12. Fire response
    a. Use a fog spray
    b. Using water to access valves
    c. Valve precautions
13. Knowledge check
14. Gas explosions
15. Severity
16. Precautions
17. Carbon monoxide response
18. Evacuate the building
19. Check carbon monoxide detectors
20. Dos and don'ts for firefighters
21. Module Quiz
22. Thank you

Description of Visor Card

One such resource that can be accessed from the module is the double-sided visor card, which is meant to be an at-a-glance reference of key information and steps to take on the scene. This is supplemental to the module and is for storage in the vehicle and can be pulled out at an incident scene. Space is limited so the information is pared down to its bare minimum. Content is derived from the final module.

According to one source, both volunteer and career emergency responders like sun visor cards in their vehicles. They should be "laminated and large enough to read in a scenario but also small enough to be stored in the vehicle. They need to include the proper emergency contact for pipeline operators. The visor cards should be picture-oriented and explain what to do and what not to do during a pipeline emergency, similar to the safety cards on airplanes."[xx] Considering that input, the design of this card conveys essential information. On one side the phone numbers are treated as a graphic element in an orange box, making it easy to see. On the other side there is a graphic depicting the explosive range of gas.

The card was created using Adobe Indesign and turned into a PDF, which can be printed, laminated, and distributed to participants of the training. The user can download it and print it on demand.

Quick Reference Guide – Visor Card

Side 1: Response Procedures
1. Universal Response Tactics
2. What NOT To Do

Side 2: Characteristics of Natural Gas
1. Explosive Range
2. Precautions

Instructional Materials

A narrated run-through of the module can be seen online at:
http://olioenterprises.com/capstone/walkthrough/story.html

SECTION IV: EVALUATION

Evaluation

Methodology and Instruments

The same panel review committee, 12 fire chiefs and training officers who participated in the needs analysis, were contacted by email to participate in a formative evaluation and asked to review an early draft of the online module and provide feedback. They were given two weeks to respond. All reviewers responded, with the bulk of useful comments coming from five of the 12 people. In addition reviewers were asked to complete a survey of four questions with one closed and three open-ended questions. Eight reviewers responded to the survey questions. All comments from both evaluation instruments were consolidated into an Excel spreadsheet and reviewed overall, on a slide-by-slide basis for comparison and analysis across reviewers. Appendix C contains the evaluation instruments.

The draft of the module was an early release with some known, minor functionality issues. The issues were disclosed to the reviewers in advance of their review process. Most commented on these despite the disclosure.

Reviewers were asked to make suggestions for improvements, or to correct any inaccuracies. They were also asked to identify anything that was contradictory to their department's regulations or standard operating procedures.

Reviewers were given the link to the online module and a corresponding Word document of it, with slides images, and typed content. They were asked to enter comments directly in the Word document by inserting comments, using track changes, or by typing comments in a different color.

Comments were consolidated into an Excel spreadsheet and categorized by slide and by type of change: image, content, interaction, and whether the change would impact the narration and/or the quiz questions.

Results

All eight of survey respondents found the navigation to be easy, with two calling out preferences for how they would like buttons to function (lighting up or changing color). Five rated the effectiveness of the training to be very effective and two rated it somewhat effective, none rated it as "not all effective". Other reviewers made suggestions to provide printable resources, adding narration to slides that had none, and adding certain types of content.

From the comments on the Word document of the module content, suggestions were made to revise content, phone numbers, protocols, and module functionality. One repeated suggestion was to "lock" the navigation of the module, which would force

learners to focus on each slide and "would prevent the student from rapidly clicking through each of the slides without listening to the important additional information that is available in the narration". Some people identified areas for new content that needed additional research, some of which will be incorporated into future updates.

Improvement Plan

For the next draft, and public version of the module, contradictions in standard operating procedures among the different service territories were resolved. The respondents identified some content that contradicted that which the customer wanted to relay. To resolve that, a subcommittee of customer representatives and subject matter experts, along with one of the expert reviewers met to resolve the issues and the final changes were implemented for the live release.

Some of the functional suggestions were not included, but the module was developed with a 'restriction' that forces users to watch and listen to all content on all slides prior to advancing, ensuring that they will be exposed to all content.

Access was provided to printable PDFs of information that would be useful to have as quick reference guides. Further improvements to those reference materials include providing laminated copies for use on the incident scene, making pocket-guides and checklists that can be used in the field.

Additional improvements include adding a notation at the start of the module (in the LMS environment) about the approximate length of time it will take a user to complete the module, adding additional modules with new content areas, and showing some of the content in alternative ways so that it will be accessible for different kinds of learners.

Appendix A

Needs Analysis Interview Questions

Training Practices

Question	Response
1. Do your people get trained in how to respond to emergencies that involve natural gas?	15% of large departments, 7% of mid-size departments, and 14% of small departments report they do not train for either electric or natural gas emergencies
2. Is natural gas safety treated as a discrete training topic or as a secondary or sub-topic within other training such as patrol response or hazmat (hazardous materials).	49% said they treat this topic independently and 51% embed it in other general safety training.
3. Thinking about a typical training, about how much time do participants spend focused on gas safety?	The data do not reflect any typical training duration. It does appear, however, that mid-size and large departments spend more time training for natural gas. 65% of participants spend at least 1 hour focused on natural gas safety.
4. What is the frequency of this natural gas safety training?	Training frequency is another aspect that varies widely among participants. 53% say they train on natural gas once per year or more frequently. A significant number of departments train in both electric and natural gas safety only one time for new hires.
5. Do trainees learn about safety around gas lines in a group situation or individualized instruction?	Group trainings are by far the most common format for instruction (88%), followed by tabletop exercises or emergency drills. Most groups are no larger than 20; however, groups of up to 60 may also train at the academy. Individualized or self-guided instruction is negligible, with computer-based learning at 5%.
6. Where do your safety trainings take place?	The bulk of training happens either at stations or a central academy, with the predominance of one or the other a function of department size.
7. Who delivers these training?	Internal training instructors and safety officers most commonly deliver trainings. Representatives from the local utility are also a frequently named training resource for all department sizes.
8. What kinds of AV equipment are	Responses show, computers top the list,

typically used for gas safety trainings?	followed by DVD players, TVs/VCRs, and overhead projectors. PowerPoint is widely used. Videoconferencing is not widely used; however, a few departments said they would be adding this capability in the near future.
9. Describe your ideal natural gas training.	Many participants emphasized they'd like trainings that incorporate hands-on practice with props and/or tabletop models. Several suggested that a combination of print materials, electronic materials (DVDs and PowerPoints), and hands-on activities would serve them best. Several participants also highly valued recent or past presentations by utility representatives.
10. What is your perception of self-paced online training for firefighters?	Online learning is gaining favor within the firefighter training industry, and the self-paced nature of it has strong appeal due to the many interruptions in their work. Some said mobile apps would probably get the farthest reach, especially to communicate emergency numbers and safety tips.
11. How important is it to provide a certificate of completion to the firefighters as an incentive for the training?	Such a certificate demonstrates mastery of a subject area and completion of training hours that may be required at the departmental level. Respondents expressed enthusiasm for training that awards this type of certificate to firefighters who pass a test upon completion. Printable certificates are desirable to turn into the department.
12. What would be a good way to promote the training and get regional departments to adopt it?	Natural gas falls under Hazardous Materials training. Gas safety would be taught upon request, to supplement any requirements, and it's up to the department whether they want their officers to do that—usually on a knee-jerk reaction because they had an incident and it didn't go well. Or it went well and they thought they should have their guys better trained. There is no mandate for our utilities class. It includes 3 hours of classroom gas and 3 hours of hands-on gas instruction. Tie it in with the Firefighter Academies for refresher/annual trainings.

	Keep it updated annually. Promote it through the fire schools. Have the Utility Company hold safety classes.

Task Analysis

Skill	Assumption	KSA
Receive 911 emergency call about gas leak, incident, or fire.	Dispatch center knows protocol around natural gas incident response.	Answer the phone in a timely manner. Know what details they need to know. Know how to record them in writing for further reporting. Know to assess the urgency of situation by questioning the caller.
Dispatcher sends a full box, consisting of an incident commander, one truck company, and three engines--bringing 13-15 members, depending on staffing that day.	Dispatch knows who is on duty; knows how and what size crew to send to respond to incident; knows whom to call for additional help.	Knows how to assess the severity of the call; Knows how to dispatch the crew quickly; Knows how many trucks and men to dispatch and what equipment to tell them to take; Dispatchers should be familiar with the section of the fire department General Orders dealing procedures.
Dispatcher notifies the utility company if natural gas leak is suspected or confirmed.	Knows the location of incident; knows who is the local regional utility company to call; knows that the utility company to call is the one where the incident is occurring, not always the same one where the firehouse is located; has access to utility company phone numbers.	Knows phone numbers of local utility where incident is occurring; Know what to tell the utility company: Identify themselves, including the name of the fire station and a phone number at which they can be reached. Explain the nature of the incident, describing whether it is a gas leak, a gas fire, explosion, etc. Let Utility Co. know if firefighting personnel are on the scene or en route, and if there are

		any injuries or need for evacuation. Give the exact location of the incident, including the town, street, house number, cross street (with the direction), utility pole number and ownership, and type of building.
Truck approaches the scene cautiously and stages apparatus upwind, out of the path of the leak and a safe distance away (typically 50 to 200 feet, depending on the situation).	Is informed about incident; understands severity and type of incident; is knowledgeable about SOPs.	Knows how to drive and operate heavy equipment; Knows the exact incident location; Knows how to detect wind direction and knows where upwind of location is; Knows "safe distances" and knows how to gauge the distances;
Truck parks safely at scene of incident, away from collapse zone of involved structures, and away from manhole covers and storm sewer grates.	Understands that if the leak made its way into the sewer system and an explosion occurs, this manhole could damage the underside of the apparatus or injure the operator.	Knows how to park and operate heavy equipment; Knows where manhole covers and sewer grates are located and knows not to park over or near them; Knows where the collapse scene is so he can park safely away;
During a natural gas emergency, the incident commander, or IC, should always include the senior representative from the Utility Company.	The IC knows how to, and does, notify the Utility Company for any of the following situations: •A natural gas leak is suspected or confirmed •Natural gas is contributing to a fire •Any gas valve has been operated by a firefighter, in which case you must report the valve's precise location •Carbon monoxide is detected or suspected in a building served by natural gas •Unidentified odors are reported	IC knows he should collaborate with rep from Utility Company to optimize the outcome of the emergency situation; IC knows the chain of command when the utility rep is involved; IC knows which situations warrant working with the utility rep; IC knows how to assess and categorize the types of situations;
The first-arriving units	Understands importance of	Knows how to determine

secure the perimeter with caution tape and reroute traffic by blocking all intersections and lanes of traffic to the entire square block surrounding the reported leak.	protecting the apparatus and personnel, as well as civilians traveling on those roads from being in front of or near a potential explosion, or near a hydrant in case an explosion does occur. Able to assess geographic the area. Knows protocol, and has tools for blocking off traffic.	the intersections to cordon off; Knows which equipment and protocols to use to create reroutes; Knows how to assess the severity of incident; Knows the criteria to detemine a large enough safe area to mark off;
Evacuate at least 100 meters (330 feet) in all directions. For larger leaks, consider initial downwind evacuation for at least 800 meters (1/2 mile). The IC will consult with a representative of the Utility Company and make the final determination of the extent of the evacuation.	Is informed about incident; understands severity and type of incident; is knowledgeable about SOPs. Has good communication skills. Shows courtesy, discretion, and sound judgment.	Knows how to assess the severity of incident; Knows how to gauge distances; Knows evacuation procedures (as described in task at left); IC knows to coordinate with Utility Company rep and knows who makes which decisions;
Never enter a manhole, sewer or underground vault.	Is knowledgeable about SOPs; understands about gas migration patterns and the dangers they pose;	Knows the protocol to never enter a manhole, sewer or underground vault. Knows to act with caution around openings to the underground;
Eliminate any potential sources of ignition, such as vehicle engines, flame-producing devices, and anything that could produce sparks. Use intrinsically safe radios and flashlights.	Has safe and working equipment; Knows what are potential ignitions sources;	Knows how to determine which equipment to take and which to leave in the vehicle; Knows what intrinsically safe equipment is; Knows what equipment can cause sparks; knows that spark-inducing elements are critically dangerous in a gas incident response;
Carry natural gas meters and forcible entry tools.	Has functioning and calibrated meters as those used by the gas company.	Knows how to use and read gas meter; Knows to ensure the meters are calibrated prior to arriving on the scene;
Wear full Personal	Has functioning PPE and	Knows that the incident

Protective Equipment (PPE) and Self-Contained Breathing Apparatus (SCBA) if approaching the incident.	SCBA.	protocol requires wearing/using PPE and SCBA
Approach incident on the same side of the street as the reported address.	Knows standard protocol of approaching from same side of street; Knows which side of street incident is on; knows to contact the IC or utility co. rep to find out how to find out the location;	Informed about location of incident; Understands patterns of explosions and that you tend to be more protected if you are on the same side of the street, since the explosion normally pushes straight out, across the street.
Firefighters begin taking samples as soon as they get off the apparatus, working their way toward the reported leak, trying to locate the source of the leak.	Has a calibrated meter and knows how to use it.	Knows how to work meter; understands meter readings; understands upper and lower explosive limits, the explosive range being 5 percent to 15 percent gas in the air. Understands the meaning of the readings as they relate to finding the leak source;
While monitoring for gas, they give very specific directives to bystanders and occupants.	Ability to recognize ignition sources, including non-intuitive or vague sources such as static electricity and causes of static electricity; Ability to multitask; Ability to deal with panicked people and to stay calm;	Knows the directives to give public in specific terms: • Direct them to extinguish any possible ignition sources such as cigarettes, running cars, an appliance that has an open flame, or anything capable of producing enough heat to ignite natural gas. Also direct them not to touch anything such as light switches, plastic supply pipe or door bells. Sometimes, we even ask them to put their hands in their pockets to keep them from forgetting. For ourselves, we try to inhibit static electricity

		by not dragging our feet and using all intrinsically safe equipment. Knows how to identify ignition sources; Knows to remove ignition sources; knows how to use and read gas meter;
Take readings in and around the originating structure and exposures on either side of the structure, if they are attached.	Knows how to work meter; understands meter readings; Understands risks and patterns of gas migration; Knows where to take readings at the originating structure;	Knows how to read gas meter; knows how to check for gas at original exposure site and in the vicinity, across street and around structure; knows to check both sides of the street to make sure the leaking gas doesn't follow water or sewer lines into the other homes.
If natural gas is detected with meters, or by smell, continue to check and evacuate until we buildings are clear.	Able to know when and where the leak is detected; Knows evacuation procedures; knows urgency of evacuating nearby buildings because an explosion, it has the potential to take adjacent structures with it.	Knows how to detect source of leak; knows how to measure with meter; knows evacuation protocols including how far to clear the area and how to escort or help victims; know to instruct occupants not to turn any electrical equipment on or off, including lights, switches, motors, circuit breakers and any battery-powered devices; knows how to identify gas by its odor.
Shut off the gas at the appliances, delivery meters, or curb shut-offs; the Utility Company allows it by supplying every fire company with a curb key.	Can locate meters, appliances, curb valves; knows how to use curb key; knows direction to turn for shut off; knows what NOT to shut off (underground valves); knows to NOT turn valves back on	Knows the location of gas shut-offs at the appliances, delivery meters, curb valves; knows how to use curb key to close curb shut-offs with one quarter turn to the left to close; knows not to operate any gas valves, other than the service shut-off valve at the meter or

		appliance piping valves.
Wait for the arrival of the gas utility company to fix the problem. Ventilate the structure if the Utility Company has deemed it safe to do so.	Is in contact with Utility Company; Defers to Utility Co. for info and direction; Knows how to determine when it is safe to ventilate; Knows SOPs for ventilation; Uses intrinsically safe (with no ignition source) ventilators and positive pressure ventilation on the upwind side. Takes care not to exhaust gas into adjacent structures.	Knows to coordinate with Utility Company to determine when it is safe to ventilate (gas to air ratio is outside the limits of 5 to 15% in air, with a buffer on either side of the upper and lower limits); Knows to ventilate the building from the top down using natural air currents, by opening windows and doors.
What NOT To Do		
Do NOT extinguish burning gas.	Natural gas fires are different from most other types of fires. Instead of trying to extinguish a gas fire as quickly as possible, the general rule is to let it burn. Allow the fire to continue until the gas supply can be turned off.	Knows that burning gas can help locate the source of a leak. While the fire is burning, you know where the hazard is. Allow the gas to burn until the source can be turned off. When the gas supply is depleted, the fire will extinguish itself.
Do NOT operate underground valves. Never attempt to close any underground gas pipeline valves.	They know how to operate valves and know SOPs RE: who is allowed to do so.	Knows that only someone from the Utility Co. should operate underground valves. Knows that first responders may close gas service valves on the pipes coming *out of the ground before gas meter*. Knows to inform the Utility Company of gas valve they have closed, and its precise location.
Do NOT open any type of gas valve that has been closed.	They know how to operate valves and know SOPs RE: who is allowed to do so.	Knows the system must be thoroughly checked by the Utility Company before it can be reopened.

Environmental Analysis

At the Moment of Report

Physical Environment

This is generally an office environment, with fluorescent lighting. The dispatcher sits at a large desk with a computer console surrounding him. It may be a large center with others, in which case there could be noise (others talking) around him. Or there may just be one person in a small office.

As a result of sitting for long periods and using such equipment, dispatchers can develop eyestrain and back problems. Many dispatchers must also work irregular hours to provide 24-hour service, which includes night, weekend, and holiday hours.[xxi]

Information

Dispatchers are responsible for monitoring all of the communications within a specific geographic area. They use GPS-like software. When an unassigned incident appears they must press a key to display the units that are assigned to respond. The software recommendation is based on sending the nearest appropriate fire apparatus to an emergency.[xxii]

Computer Aided Dispatch (CAD) can either be used to send messages to the dispatchee and/or used to store and retrieve data (i.e. radio logs, field interviews, client information, schedules, etc.).[xxiii]

CAD systems provide services, such as call input, call dispatching, call status maintenance, event notes, field unit status and tracking, and call resolution and disposition. CAD systems also include interfaces that permit the software to provide services to dispatchers, call-takers, and field personnel with respect to control and use of analog radio and telephone equipment, as well as logger-recorder functions.

A list of current pager codes for fire department administrative personnel is kept beneath the glass at the fire dispatch console.[xxiv]

Tools

The primary tool of the Dispatcher is the dispatch console. A dispatch console is a system that interfaces to a private or public radio system, allowing the dispatcher to communicate directly with all field workers, police officers, EMS personnel, and others in order to coordinate their activities. Dispatchers use various hardware and software to create dispatch. Dispatchers work with telephones, radios, ACARS, and computers on a routine basis. They also monitor traffic patterns or other outside activity via video surveillance.[xxv]

Knowledge sources

Computer Aided Dispatch (CAD) system; Other notes or posted documents on and around console.

What breaks?

Normally, all dispatching is done on the dispatch telephone system. However, if that system becomes inoperable, they must dispatch using the channel 3 radio paging system.[xxvi]

At the Incident Scene

Physical Environment

Firefighters work closely with others. They regularly work in outside weather conditions, including temperature extremes, during day and night shifts. Work at heights on scaffolding and ladders; work with water; travel from site to site. They can be exposed to smoke, heat, and flames.[xxvii]

The noise level can be moderate, except during certain firefighting or EMT activities when noise levels may be loud. There are alarms, radios, potentially the noise of fire, water spraying, people yelling.

They can be exposed to hazards such as, smoke, noxious odors, fumes, chemicals, liquid chemicals, solvents and oils, fumes or airborne particles, toxic or caustic chemicals.

They work near moving mechanical parts, in high, precarious places and is occasionally exposed to wet and/or humid conditions, risk of electrical shock, and vibration. It is reasonably anticipated that the individual will be exposed to blood-borne pathogens and other infectious materials in the course of their duties.[xxviii]

Information

Firefighters routinely operate at incidents where other emergency services are present. They are trained to follow the Incident Command System (ICS) , a component of the National Incident Management System established by the U.S. Federal Emergency Management Agency.[xxix]

ICS has common characteristics that permit different organizations to work together safely and effectively in order to bring about a favorable outcome to the emergency

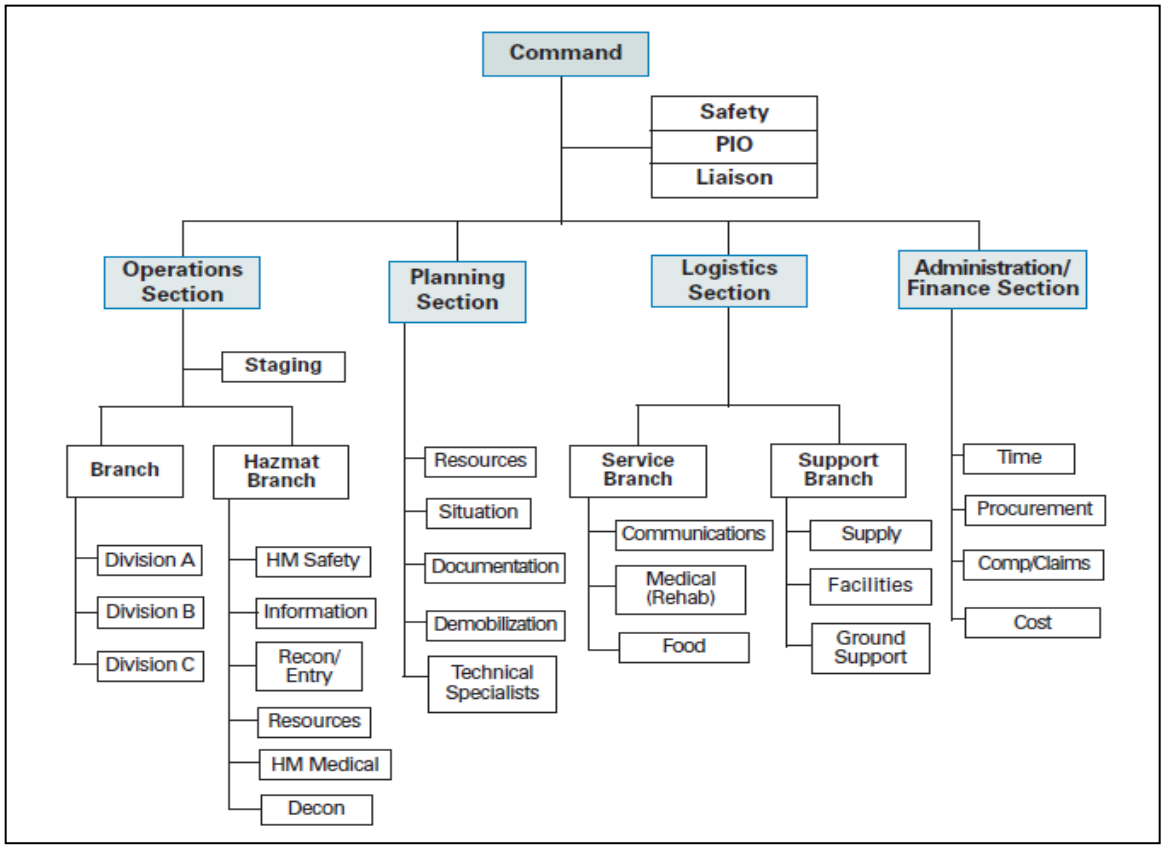
1. Division of labor
2. Lines of authority
3. Unity of command
4. Optimum span of control
5. Establishment of line and staff functions within the organization

The first responder of a scene has charge of the scene until the incident has been declared resolved, a more qualified responder arrives on scene and receives command, or the incident commander (IC) appoints another individual IC. The IC must work with the Utility Company represntative to make determinations about who does what.

The first arriving fire department unit activates the command process by giving an initial radio report. Then he develops an incident action plan (IAP) to ensure that: a) everyone works together toward a common emergency response goal; b) individual response agendas are coordinated so that personnel and equipment are used effectively and in a

spirit of cooperation and mutual respect; c) everyone works safely at the scene of the emergency.[xxx]

The chain of command is as follows:



Communications methods: Written guidelines reflect department policy on incident management; Megaphone; Radio communications; Briefs and debriefs at staging areas.

Distractions

Unexpected emergencies, explosions, fire eruptions; victims needing help; unclear lines of communications or action plans; radio traffic; conflicts; previous errors; collateral duties; incident within an incident; fatigue.

Motivations

Saving lives of others and of self; Staying safe.

Tools

Fire truck; ladders; radios and communications equipment; gas meters; combustible gas indicator; hand tools; self contained breathing apparatus; measuring devices; camera; power tools; hand tools; chain saws; shovels; brooms; exhaust fans; automobile; patient restraints; first aid equipment; oxygen; electronics test equipment; general medical equipment; patient lifting devices; breathing apparatus; steel-tip boots; hearing and eye protection; firefighting clothing; personal protective equipment; and hazardous chemical clothing; pumps, hoses, and extinguishers, fog nozzles.[xxxi]

Organizational Structure

Incident Command System is the standard organizational structure that should be followed.

What breaks?

- No unified command organization in-place
- Appropriate internal and external notifications were not made.
- People do not understand emergency orders or fail to follow through or are correctly implementing them.
- Not a representative from the Utility Company present.
- Lack of a clear incident action plan.
- Communication deteriorates or grows tense.
- Habitual or repetitive behaviors.
- Target fixation – Locking into a course of action, whether it makes sense or not, just try harder.
- Action tunneling – Focusing on small tasks, but ignoring the big picture.
- Escalation of commitment – Accepting increased risk as completion of task gets near.[xxxii]

Appendix B

Resources for Analysis and Content Development

1. http://www.fireengineering.com/training/fire-simulations.html
2. powerpoints, videos, lessons, maps, diagrams
3. Corporate materials, including, PowerPoint from in-person trainings, written content from SMEs, news clips of accidents and incidents, illustrations of gas distribution systems
4. http://opsweb.phmsa.dot.gov/pipelineforum/pipeline_emergency_response_forum/
5. http://www.phmsa.dot.gov/
6. https://www.npms.phmsa.dot.gov/application.asp?tact=npms&page=subapp.asp?app=aboutnpms&act=public
7. http://www.phmsa.dot.gov/training
8. outside corporate resources:
    a. https://www.dom.com/about/safety/natural-gas-safety.jsp
9. do's and don'ts
    a. http://primis.phmsa.dot.gov/comm/EmergencyResponse.htm?nocache=670
10. case studies:
    a. http://www.fireengineering.com/articles/2013/03/-lessons-learned--pipeline-emergency-response-at-2008-appomattox.html
    b. https://primis.phmsa.dot.gov/comm/publications/NASFM-LDC-GasLineBreakScenario-20070803.pdf
11. http://www.phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Pipeline%20Emergency%20Response%20Proceedings.pdf
12. Michael Callan book: http://pipelineemergencies.com/program.html
13. http://www.firemarshals.org/programs/pipelinesafetycommunitygroups.html
14. http://www.neafm.org/documents/online_editable_page.php
15. http://www.firstresponder.gov/Pages/Category.aspx?Category=Fire
16. http://www.usfa.fema.gov/
17. http://www.aga.org/Pages/default.aspx

Storyboard Sample

Slide 6

Ref	Text/Script	Interaction / List Items	Dev Notes
M4s6	NARRATION: There are several critical things that you must NOT DO when you respond to a natural gas incident. They are: 1. Do NOT extinguish burning gas. 2. Do NOT operate shut-off valves on gas mains. 3. Do NOT open any type of gas valve that has been closed.	TEXT TO DISPLAY: Step 3: Arriving on the Scene 1. Do NOT extinguish burning gas. 2. Do NOT operate shut-off valves on gas mains. 3. Do NOT open any type of gas valve that has been closed. BUTTON TEXT: 1 BUTTON TEXT WHEN CLICKED: **Do NOT extinguish burning gas.** Natural gas fires are different from most other types of fires. Instead of trying to extinguish a gas fire as quickly as possible, the general rule is to let it burn. Allow the fire to continue until the gas supply can be turned off. Specific details about responding to a gas fire can be found in the Fire Response section. [LINK TO SECTION] BUTTON TEXT: 2 BUTTON TEXT WHEN CLICKED: **Do NOT extinguish burning gas.** Natural gas fires are different from most other types of fires. Instead of trying to extinguish a gas fire as quickly as possible, the general rule is to let it burn. Allow the fire to continue until the gas supply can be turned off. Specific details about responding to a gas fire can be found in the Fire Response section. [LINK TO SECTION] BUTTON TEXT: 3 BUTTON TEXT WHEN CLICKED: **Do NOT operate shut-off valves on gas mains** Never attempt to close a gas pipeline shut-off valve. These valves should only be operated by trained National Grid personnel.	TYPE: Step by step slide. IMAGES: Outdoor fire scene depicting gas valves (like a residential fire scene). Place 1, 2, 3 over burning gas, and shut-off valves and gas valve. PROPERTIES: Animate text with narration User advances slide.

Module Sample

Slide 6 designed from the storyboard

Notes/Narration for Slide:
There are three critical things that you must not do when you respond to a natural gas incident. They are:

1. Do not extinguish burning gas.
2. Do not operate underground valves.
3. Do not open any type of gas valve that has been closed.

Click the round buttons to read these instructions in detail.

Visor Card

First Responder Gas Incident Response Procedures

Keep this card in the visor or glove box of your truck.

Universal Response Tactics

If natural gas is detected or suspected, confirm your dispatcher has notified the Utility Company and follow these steps:

1. Approach cautiously and stay upwind (typically 50 to 200 feet).
2. Park safely away from collapse zones and manholes.
3. Secure the perimeter and reroute traffic.
4. Evacuate the public – least 100 meters (330 feet) in all directions.
5. Never enter a manhole, sewer or underground vault.
6. Eliminate ignition sources.
7. Use full SCBA and PPE.
8. Monitor the atmosphere.

What NOT To Do

There are three critical things that you must **NOT** do when you respond to a natural gas incident. They are:

1. **Do not extinguish burning gas.** Allow it to burn until the gas supply can be turned off.
2. **Do NOT spray water into gas lines.** Use a fog spray to assist in rescuing victims.
3. **Do not operate underground valves.**
4. **Do not open any type of gas valve that has been closed.**

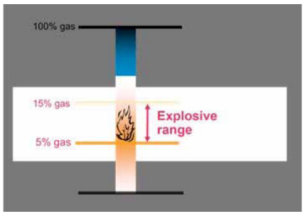
In a gas emergency, call The Utility Company:
24 hours a day—7 days a week
Region 1: XXX-XXX-XXXX
Region 2: XXX-XXX-XXXX
Region 3: XXX-XXX-XXXX

Characteristics of Natural Gas

Keep this card in the visor or glove box of your truck.

Explosive Range

- Natural gas explosions occur when leaking gas accumulates in **enclosed** areas.
- The **gas combines with air** above ground, below ground, or in any type of conduit, and forms a highly volatile mixture.
- When a **gas concentration of 5 to 15% encounters an ignition source, an explosion can occur.**



Precautions

The Utility Company can provide important guidance to the incident commander. Always exercise extreme caution.

1. An explosion can create an atmosphere immediately dangerous to life and health
2. T**here could be additional gas trapped** in the location where the initial explosion occurred.
3. Use your combustible gas indicator to check surrounding buildings, especially basements, for the presence of gas.
4. In prolonged situations, the **power should be turned off** to the structures.
5. When the Utility Company deems it safe, ventilate buildings from the top down.

Appendix C

Evaluation

Survey Questions

1. Were you able to move easily through the module? If not, please describe any difficulties you encountered.

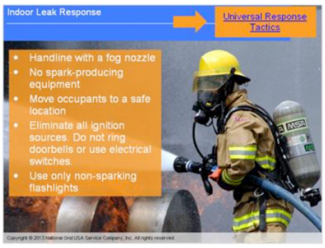
2. How would you rate the effectiveness of this training module in preparing firefighters to respond to emergencies involving natural gas?
   - o Very effective
   - o Somewhat effective
   - o Not at all effective

3. What additional natural gas incident response tips/information, if any, would you like to see included?

4. What is the single most important thing we can do to make this module a more effective training tool for firefighters in your department?

Sample Word Document of Module with with Comment

1.11 Indoor Leak Response



Narration:

We will now discuss how to respond safely to an indoor gas leak.

If a gas leak has been reported inside a structure, contact the National Grid Dispatch Center.

Follow the procedures outlined in the Universal Response Tactics, and take these additional precautions:

Have a charged handline with a fog nozzle ready to use in the event of a fire. The general rule is to never put out a gas fire, but you may use a fog spray to cool combustible exposures and assist with rescue operations.

(At some point in the presentation review dangers of the use of fog nozzles at fires.)

Do not bring any spark-producing equipment into the building. Leave radios, pagers, and cell phones in your vehicle or turn them off before entering.

Clear the building of all occupants and bystanders, moving them to a safe location.

Do not ring doorbells or turn on or off any electrical switches. Eliminate possible ignition sources like phones or other types of electrical devices, including radios, beepers and flashlights. A spark from these devices could ignite the gas.

Use only intrinsically safe flashlights and other intrinsically safe equipment, which are designed to be non-sparking.

Endnotes

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