TENNESSEE

Coordinated Response Exercise

PIPELINE SAFETY TRAINING FOR FIRST RESPONDERS

PROGRAM GUIDE

2025

Table of Contents

Pipeline Purpose and Reliability
- Critical national infrastructure
- Over 2.7 million miles of pipeline provide 65% of our nation's energy
- 20 million barrels of liquid product used daily
- 21 trillion cubic feet of natural gas used annually

Safety Initiatives
- Pipeline location
  - ° Existing right-of-way (ROW)
- ROW encroachment prevention
  - ° No permanent structures, trees or deeply rooted plants
- Hazard awareness and prevention methods
- Pipeline maintenance activities
  - ° Cleaning and inspection of pipeline system

Product Hazards and Characteristics

Petroleum *(flow rate can be hundreds of thousands of gallons per hour)*
- Flammable range may be found anywhere within the hot zone
- H2S can be a by-product of crude oil

Type 1 Products	Flash Point	Ignition Temperature
Gasoline	- 45 °F	600 °F
Jet Fuel	100 °F	410 °F
Kerosene	120 °F	425 °F
Diesel Fuel	155 °F	varies
Crude Oil	25 °F	varies

Natural Gas *(flow rate can be hundreds of thousands of cubic feet per hour)*
- Flammable range may be found anywhere within the hot zone
- Rises and dissipates relatively quickly
- H2S can be a by-product of natural gas – PPM = PARTS PER MILLION

◦ 0.02 PPM	Odor threshold
◦ 10.0 PPM	Eye irritation
◦ 100 PPM	Headache, dizziness, coughing, vomiting
◦ 200-300 PPM	Respiratory inflammation within 1 hour of exposure
◦ 500-700 PPM	Loss of consciousness/possible death in 30-60 min.
◦ 700-900 PPM	Rapid loss of consciousness; death possible
◦ Over 1000 PPM	Unconsciousness in seconds; death in minutes

- Incomplete combustion of natural gas may release carbon monoxide
- Storage facilities may be present around populated areas/can be depleted production facilities or underground caverns
- Gas travel may be outside the containment vessel along the natural cavern between the pipe and soil

Propane, Butane and Other Similar Products
- Flammable range may be found anywhere within the hot zone
- Products cool rapidly to sub-zero temperatures once outside the containment vessel
- Vapor clouds may be white or clear

Type 3 Products	Flash Point	Ignition Temperature
Propane	- 150 °F	920-1120 °F
Butane	- 60 °F	725-850 °F

Line Pressure Hazards
- Transmission pipelines – steel *(high pressure: average 800-1200psi)*
- Local gas pipeline transmission – steel *(high pressure: average 200-1000psi)*
- Local gas mains and services – steel and/or plastic *(low to medium pressure)*
  - ◦ Mains: up to 300psi
  - ◦ Service lines: up to regulator
    - Average 30-45psi and below
    - Can be up to 60-100psi in some areas
- At regulator into dwelling: ounces of pressure

Leak Recognition and Response
- Sight, sound, smell – indicators vary depending on product
- Diesel engines – fluctuating RPMs
- Black, dark brown or clear liquids/dirt blowing into air/peculiar odors/dead insects around gas line/dead vegetation
- Rainbow sheen on the water/mud or water bubbling up/frozen area on ground/frozen area around gas meter
- Any sign, gut feeling or hunch should be respected and taken seriously
- Take appropriate safety actions ASAP

High Consequence Area *(HCA)* Regulation
- Defined by pipeline regulations 192 and 195
- Requires specialized communication and planning between responders and pipeline/gas personnel
- May necessitate detailed information from local response agencies to identify HCAs in area

Emergency Response Basics
- Always follow pipeline/gas company recommendations – pipeline representatives may need escort to incident site
- Advance preparation
  - Get to know your pipeline operators/tour their facilities if possible
  - Participate in their field exercises/request on-site training where available
  - Develop response plans and practice
- Planning partners
  - Pipeline & local gas companies
  - Police – local/state/sheriff
  - Fire companies/HAZMAT/ambulance/hospitals/Red Cross
  - LEPC/EMA/public officials
  - Environmental management/Department of Natural Resources
  - Army Corps of Engineers/other military officials
  - Other utilities
- Risk considerations
  - Type/volume/pressure/location/geography of product
  - Environmental factors – wind, fog, temperature, humidity
  - Other utility emergencies
- Incident response
  - Always approach from upwind/park vehicle a safe distance away/if vehicle stalls – DO NOT attempt to restart
  - Gather information/establish incident command/identify command structure
  - Initiate communications with pipeline/gas company representative ASAP
  - Control/deny entry: vehicle, boat, train, aircraft, foot traffic, media – refer all media questions to pipeline/gas reps
- Extinguish fires only
  - To aid in rescue or evacuation
  - To protect exposures
  - When controllable amounts of vapor or liquid present
- Incident notification – pipeline control center or local gas company number on warning marker
  - In ***Pipeline Emergency Response Planning Information Manual***
  - Emergency contact list in ***Program Guide***
  - Call immediately/provide detailed incident information
- Pipeline security – assist by noting activity on pipeline/gas facilities
  - Report abnormal activities around facilities
    - Suspicious excavation/abandoned vehicles/non-company personnel/non-company vehicles
    - Freshly disturbed soil/perimeter abnormalities

One-Call
- One-Call centers are not responsible for marking lines
- Each state has different One-Call laws. Familiarize yourself with the state you are working in
- Not all states require facility owners to be members of a One-Call
- You may have to contact some facility owners on your own if they are not One-Call members
- In some states, homeowners must call before they dig just like professional excavators

Pipeline Emergency Response Training

First Responders and Emergency Personnel

CORE

Instructor: Sam Jerideau

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Coordinated Response Exercise®

- **Learn** your roles and responsibilities as emergency responders should a pipeline emergency happen in your jurisdiction. As well as your access to resources.
- **Acquaint** you with the operator's ability to respond to a pipeline emergency.
- **Identify** the types of pipeline emergencies.
- **Plan** how all parties can engage in mutual assistance to minimize hazards to life, property and the environment.

Code of Federal Regulations (CFR): 49 CFR Parts 192 and 195

By attending this session today, you are preparing, along with the pipeline companies, to create a coordinated effort in responding to pipeline incidents and accidents. These programs take place over 1,000 times in 46 states annually.

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Liberty County Emergency Communications Secretary: Liberty County Emergency Communications, how may I direct your call?

Pipeline Operator: I'm Jim Jones with ABC Pipeline Company. I'm calling your direct number because I am in special operations in our SCADA center located in Houston Texas. We are required to give you a "Notice of Potential Release" on one of our pipelines in your jurisdiction.

Liberty County Emergency Communications Secretary: Is this an emergency? If so, I need to transfer you to an emergency call taker.

Pipeline Operator: We are unsure of the exact situation; we are working through the details with our local operations and need to ensure we are in communication with local responders as details unfold. Yes, please transfer me to the 9-1-1 dispatcher, thank you.

Emergency Dispatcher: Liberty County 9-1-1 – What is your emergency?

Pipeline Operator: I'm Jim Jones with ABC Pipeline Company. I am in special operations in our SCADA center located in Houston, Texas. We are required to contact you regarding a "Notice of Potential Release" on one of our pipelines in your jurisdiction.

Emergency Dispatcher: OK, do you know the exact location of the potential release?

Pipeline Operator: We do not have a specific location at this time – it could be in Liberty County or Carroll County, next door to you.

Emergency Dispatch: What company are you with again?

Pipeline Operator: ABC Pipeline, our SCADA center is in Houston, Texas but the potential release could be on line 214A which runs through 35 miles of Liberty County and 20 miles of Central County – in the jurisdiction next to you. We want to ensure we make you aware and open the line of communication if response is needed.

Emergency Dispatcher: So, what emergency service do you need and in what location?

Pipeline Operator: We are unsure at the time because we are required by PHMSA to give you this "notice of potential release" before we have actual confirmation. We will keep your PSAP informed when information becomes available. We want you to be aware of this situation in case you get other calls.

Emergency Dispatch: Where is pipeline 214A located?

Pipeline Operator: We have 10 miles of pipeline in Liberty County. We have yet to confirm there is an actual release. The pipeline is 20-inches in diameter and has an MAOP of 800 PSI.

Emergency Dispatch: What actions do you need us to take right now?

Pipeline Operator: Engage your pipeline emergency response procedures for a potential pipeline emergency…and stand by for additional information. I've got to provide notice of potential release to three additional PSAP's, so I'll be terminating this call now.

CORE **Central Dispatch Receives a call…** Paradigm

Table and / or Group Discussion

- Your dispatch has just received a NOTICE OF POTENTIAL RUPTURE. The caller represents a pipeline company following their in-house emergency response plans.
- Now, discuss with those around you how your dispatch will handle this information. What existing policies and procedures are applicable to this call? Describe, at least generally, those relevant policies and procedures.
- Work with the pipeline operators present to discuss, evaluate and prepare for a response to a potential rupture on their facilities.

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Virtual Scenario Manager (VSM™) Map

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New PHMSA Rule – Impact on PSAPs

For both natural gas and hazardous liquids pipelines

- Rupture mitigation valves must be installed on all newly constructed and replaced pipelines 6" in diameter or greater for onshore gas transmission and hazardous liquids
  - This does not include natural gas distribution pipelines
- Pipeline operators must contact 9-1-1 or Emergency Management with a "notice of potential rupture"

How does this rule potentially affect PSAPs

- How will your agency process this call when notified of a 'potential' release?
  - Will you record it and *not* pass it on to your response agencies?
  - Will you record and pass that information on to your response agencies?
  - Will this require your PSAP (and emergency services) to develop written policies?
  - Where, potentially, could this call be coming from?
  - Pipeline control center locations
    - Contacting a PSAP through the non-emergency number (no Automatic Number Identification (ANI), No Automatic Location Identification (ALI)
    - Is this number monitored 24/7?
- Pipeline operators were required to update their Emergency Response Plans (ERP) with this requirement in October 2022

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What is the intent of this new final rule?

- To require design and equipment elements and improved operational practices for quick and efficient identification of ruptures, that in turn will improve rupture mitigation and shorten rupture isolating times for certain gas transmission, gathering, and hazardous liquid pipelines.
- Rupture isolation time, as it is discussed in this final rule, is the time it takes an operator to identify a rupture after notification of a potential rupture, implement response procedures, and fully close the appropriate valves to terminate the uncontrolled flow of commodity from the ruptured pipeline segment

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Potential "Best Practice" for Pipelines

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National Emergency Number Association (NENA)

Pipeline Emergency Operations Standard

NENA's pipeline emergency operations workgroup recommendations
- Awareness of pipelines affecting the 911 service area
- Pipeline leak recognition and initial response actions
- Additional notices to pipeline operators

Initial intake checklist
- Quick reference guide in program materials

Pipeline emergency operations standard/model recommendations
- Access the full report through **nena.org**

"Actions taken during this time frame significantly impact the effectiveness of the response and are critical to public safety"

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Pipeline Outreach to Stakeholders

- Mailings (More than 20 Million pieces annually)
- Over 1,000 Liaison Meetings with Emergency Officials, Public Officials, and Excavators
- Face-to-Face Meetings with Emergency Officials at their agencies
- Emergency Response Planning Portal (ERP)

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Pipeline Operators Emergency Response Plans

Natural gas and hazardous liquids
- Notify appropriate fire, police, and other public officials of **gas** or **liquid** pipeline emergencies, coordinate planned responses, and actual responses during an emergency
- Identify the type of incident
- Prompt and effective response measures
- Availability of personnel and equipment
- Make safe any actual or potential hazard to life, property, and the environment
- Incident investigation and review

Natural gas (49 CFR 192.615)
- Establish and maintain communication with fire, police, and other public officials
- Direct actions to protect people, then property
- Emergency shutdown to minimize hazard to life, property, and the environment
- Safely restore service

Hazardous liquid (49 CFR 195.402)
- Take necessary actions, such as emergency shutdown and pressure reduction
- Control of released hazardous liquid or carbon dioxide at scene to minimize hazards
- Minimize public exposure to injury by taking appropriate actions such as evacuations or traffic controls
- Use instrumentation to assess vapor cloud coverage and determine hazardous areas

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Emergency Response and 811

Derailments, car accidents, excavating/farming mishaps, natural disasters, and wildfires

PHMSA Advisory Bulletin (2012-08)
- Based on National Transportation Board recommendation
- Inform emergency responders about the benefits of 811
- Identify underground utilities in the area
- Notify underground utilities in the area

Tennessee 811

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Integrity Management

Pipeline companies are required to have Integrity Management programs to insure safe and efficient operations:

- Internal and external cleaning and inspection, of the pipeline and affected areas
  - Rights-of-Way and valves
- Supervisory Control and Data Acquisition (SCADA)
- Identification of High Consequence Areas (HCA)
- Aerial Rights-of-Way Patrols
- Public Awareness Outreach to stakeholders
- Participation as a member of 811
- Operator Qualification (OQ) Training
- Local Distribution Company (LDC)
  - Meter Testing
  - Leak Surveys
    - May also be utilized on transmission pipelines

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Other challenges impacting pipelines…

Natural Disasters

- Tornadoes
- Wildfires/Forest Fires
- Flooding/Mudslides/Slips
- Earthquakes

Human Error

- Vehicle accidents involving above ground valve sites
- Third party strikes by contractors and excavators
- Agricultural activities, field tiling

National Security Threats

- Cyberterrorism involving pipeline systems
- IED's on pipeline assets

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Pipeline Operator / Responder Challenges

- Timely notification of the incident
- Denied entry at scene of incident
- Quick access to remote valves/ICP
- Getting equipment into the area
- Communications with incident command
- Clear lines of communication (both ways)
- Face to face meetings with local officials
- Pre-planning with emergency services

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Pipeline Company - Internal Responsibilities

- Regular pressure testing of the pipeline
- Smart pigging in a timely manner of the pipeline
- Personnel logistics – Drive time and other factors
- Personnel training – Actual practice of closing a Pipeline
- Tool placement / positioning
- Human reaction to working under stress
- Working with local Public officials and First Responders

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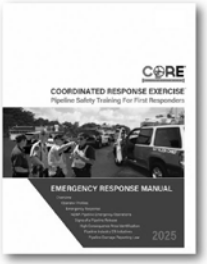
Local Operator Information*

- Operator and/or company name
- Pipeline systems and products
- Location of pipelines
- Pipeline size/operating pressure(s)
- Operator Response(s) to a pipeline emergency

*Information in the materials may not represent all pipeline companies in your area.



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Program Resources

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Program Resources

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National Pipeline Mapping System (NPMS)

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Product Characteristics

Hazardous Liquids
ER Guide 128 (Pages 186-187)
- Crude oil, jet fuel, gasoline and other refined products
- **Liquid in and liquid out of the pipeline**

Highly Volatile Liquids
ER Guide 115 (Pages 160-161)
- Propane, Butane, Ethane and natural gas liquids
- **Liquid in and vapor out of the pipeline**

Natural Gas
ER Guide 115 (Pages 160-161)
- Gas in and gas out of the pipeline
- **Odorant Mercaptan added where required**

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Product Characteristics Resources

Mobile Applications: Android and iPhone

ERG for Android

CHEMICAL SAFETY DATA SHEETS

CAMEO Chemicals

CDC NIOSH Pocket Guide

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Propane (C_3H_8)

Description and Release Characteristics
ER Guide 115 (Pages 166-167)
- DOT Shipping Name – Liquefied Petroleum Gas
- Is a Highly Volatile Liquid product
- Simple Asphyxiant – Breathing apparatus required
- Vapors stay low to the ground looking for ignition sources
- Liquefied gas under pressure is highly flammable
- Skin contact with liquid can cause frostbite
- Evacuate personnel uphill/upwind from the area
- Use water spray to cool containers
- Avoid water on safety devices or icing may occur
- Do not extinguish flames
- Pre-planning with the local operator is essential

270 x 1 Expansion Ratio

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Temporary Containment Strategies

- Booming
- Culvert blocking
- Drain blocking
- Pailett Containment

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Above Ground Storage Tanks

Considerations when responding to tank farms/ terminals

Work with your local operator to:

- Develop an effective response plan
- Identify products and hazards
- Determine evacuation radius

Response recommendations:

- Cool tank(s) or nearby containers by flooding with water
- Use unmanned hose holders/monitor nozzles
- Do not direct water at safety devices or icing may occur
- Let product burn, even after air supply line/system is closed
- Beware of the potential for Boiling Liquid Expanding Vapor Explosion (BLEVE)

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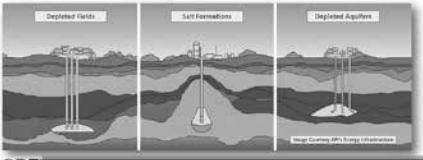
Underground Storage Fields

Emergency response "non-intervention"

- Emergency contact information found on pipeline markers and all wellhead locations
- Always be aware of wind direction; walk into the wind, away from hazardous fumes
- Do not drive into a leak or vapor cloud
- Monitor combustible atmosphere
- Determine hazardous area and escape routes



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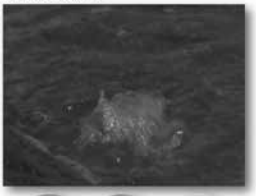
Leak Recognition

- Pools of liquid on the ground near a pipeline
- Dense white cloud or fog over a pipeline
- Discolored vegetation surrounding a pipeline
- Unusual dry spot in an otherwise moist field
- Dirt blowing up from the ground
- Bubbling in marshland, rivers or creeks
- Oily sheen appearing on water surfaces
- Frozen ground near a pipeline
- Unusual noise coming from a pipeline
- Unusual smell or gaseous odor



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Local Distribution Systems

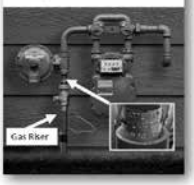
Caution

- Be aware, not all natural gas leaks are from excavation; unintended leaks from stoves, water, heaters, furnaces, etc. can occur
- When called out on natural gas leak events, use combustible gas indicators
- Mercaptan can be stripped as it travels through soil
- Frost heaves, breaking pipes
- Gas meter breaks due to snow buildup from melting snow falling from roofs

Excess flow valve meter tags

Identification tags [192.381(c)]

- The presence of an excess flow valve on the service lines may or may not be marked with an identification tag. The identification tag (if present) will typically be located at the top of the service riser below the meter stop valve



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Excess Flow Valve (EFV)

Local Distribution Lines

- **Automatic reduction of gas flow** should a service line break
- **May not** completely stop the flow of natural gas
- **May not** hear a distinct hissing sound
- Migration and ignition sources may still exist
- Always work a coordinated response with your local operator
- **Not all service lines have an EFV installed**

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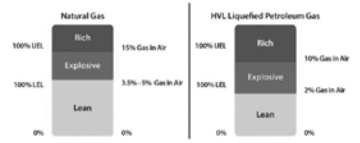
Explosive Limits

Explosive Limits vs. Percent of Gas in Air



Lower/Upper Explosive Limit depends on characteristics of gas (SDS)

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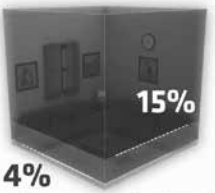
Explosive Limits

LOWER EXPLOSIVE LIMIT

THE MINIMUM CONCENTRATION OF NATURAL GAS IN AIR BELOW WHICH THE MIXTURE IS TOO LEAN TO IGNITE.



FOR NATURAL GAS RANGES BETWEEN ROUGHLY FOUR PERCENT Paradigm

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Farm Taps

- Mainly in rural areas, some natural gas pipeline companies may have facilities commonly referred to as "farm tap"
- These natural gas settings are made up of valves, pipes, regulators, relief valves and a meter. It may be located near the home or within the general vicinity
- To report the smell of gas near a farm tap, call 911 and the local gas company from a safe distance
- The lines after a farm tap or residential meter may or may not be PRIVATE LINES, be aware of these

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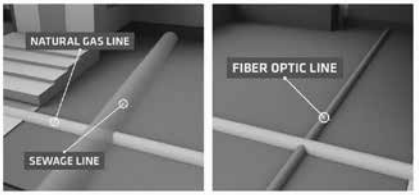
Horizontal Directional Drilling (Cross Bore)



THROUGH A SEWAGE LINE, LOCAL DISTRIBUTION, TRANSMISSION

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InfraGard – Protecting Critical Infrastructure

InfraGard is a partnership between the FBI and members of the private sector for the protection of U.S. Critical Infrastructure.

https://infragard.org

16 Critical Infrastructure Sectors:

- Chemical
- Commercial Facilities
- Communications
- Critical Manufacturing
- Dams
- Defense Industrial Base
- Emergency Services
- Energy
- Financial Services
- Food and Agriculture
- Government Facilities
- Healthcare and Public Health
- Information Technology
- Nuclear Reactors, Materials, and Waste
- Transportation Services
- Water & Wastewater Systems

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Emergency Response Portal (ERP)

PHMSA Advisory Bulletin issued October 2010

https://my.spatialobjects.com/admin/register/ERPP

Provides agencies secure access to participating pipeline operator profiles include:*

- Contact information
- Counties of operation
- Product(s) transported

*Additional information updated to share pipeline mapping, emergency response plans.

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Pipeline Preparedness Training Center

Share with others in your agency unable to attend today's program

- Access to your local pipeline sponsor information
- Download the same documents presented in this program
- Certificate of completion provided upon completion of course

trainingcenter.pdigm.com
Use Code: 2025CORE

911 Communications Director: Appreciate the opportunity to do this online and have it available for my staff. Very informative!

Battalion Chief: Thank you for the information. I also like the fact of being able to take the course online when I cannot make the live sessions.

Commissioner: Very informative and increased my awareness of the resources available to our county leadership in case of an emergency.

Deputy Emergency Management Coordinator: Excellent presentation, Thank you for the resources and useful web pages.

Director of Public Safety: Excellent presentation. Thank you for the ability to take class online due to scheduling conflict.

Fire Chief: Thank you for providing this informative course. I would like to see more courses like this. It is a very good review and helps us tremendously.

Police Chief: The training is very informative, and I will pass this onto our Fire Department and our Law Enforcement Supervisors. Great job!!!

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Product INFORMATION

The Emergency Response Guidebook is available at:
https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/2024-04/ERG2024-Eng-Web-a.pdf

ANDROID APP ON Google play

Download on the App Store

This app is only available on the App Store for iOS devices.

EMERGENCY RESPONSE PLANS FOR GAS AND HAZARDOUS LIQUID PIPELINE OPERATORS

Federal regulations for both gas and hazardous liquid pipelines require operators to have written procedures for responding to emergencies involving their pipeline facility. Because pipelines are often located in public space, the regulations further require that operators include procedures for planning with emergency and other public officials to ensure a coordinated response. Please contact your local pipeline operators for information regarding their company specific emergency response plan.

Natural Gas

Each operator shall establish written procedures to minimize the hazard resulting from a gas pipeline emergency. At a minimum, the procedures must provide for the following:

- Receiving, identifying, and classifying notices of events which require immediate response by the operator.
- Establishing and maintaining adequate means of communication with appropriate fire, police, and other public officials.
- Prompt and effective response to a notice of each type of emergency, including the following:
  1. Gas detected inside or near a building.
  2. Fire located near or directly involving a pipeline facility.
  3. Explosion occurring near or directly involving a pipeline facility.
  4. Natural disaster.
- The availability of personnel, equipment, tools, and materials, as needed at the scene of an emergency.
- Actions directed toward protecting people first and then property.
- Emergency shutdown and pressure reduction in any section of the operator's pipeline system necessary to minimize hazards to life or property.
- Making safe any actual or potential hazard to life or property.
- Notifying appropriate fire, police, and other public officials of gas pipeline emergencies and coordinating with them both planned responses and actual responses during an emergency.
- Safely restoring any service outage.
- Each operator shall establish and maintain liaison with appropriate fire, police, and other public officials to:
  1. Learn the responsibility and resources of each government organization that may respond to a gas pipeline emergency;
  2. Acquaint the officials with the operator's ability in responding to a gas pipeline emergency;
  3. Identify the types of gas pipeline emergencies of which the operator notifies the officials; and
  4. Plan how the operator and officials can engage in mutual assistance to minimize hazards to life or property.

**Reference 49 CFR 192.615*

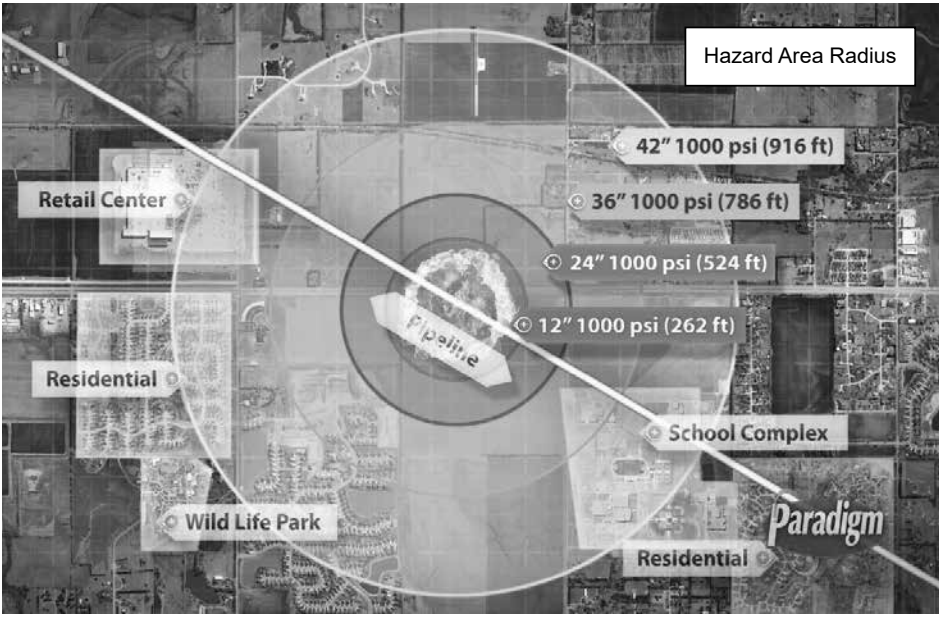
HAZARDOUS LIQUIDS

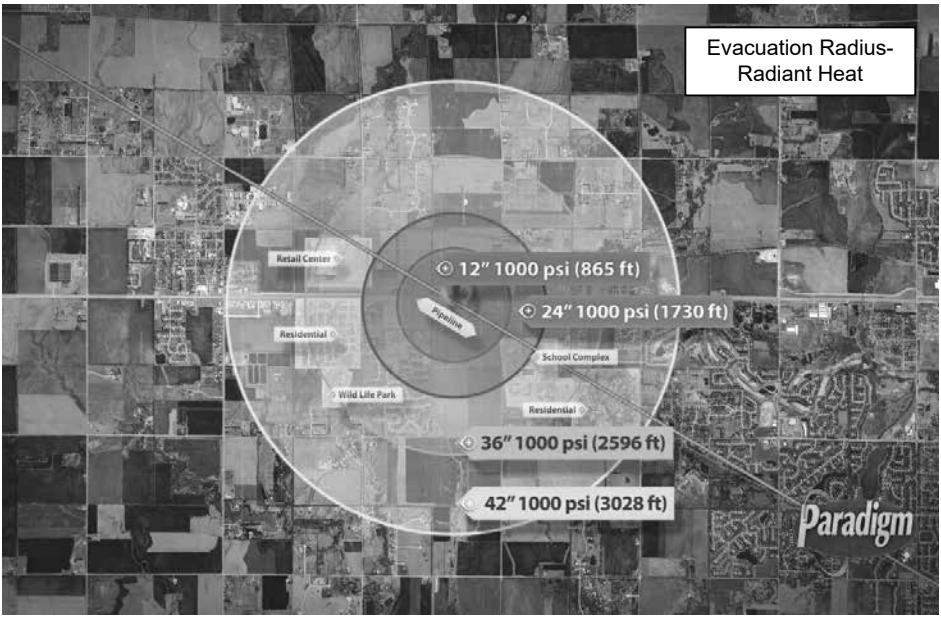
(a) General: Each operator shall prepare and follow for each pipeline system a manual of written procedures for conducting normal operations and maintenance activities and handling abnormal operations and emergencies. This manual shall be reviewed at intervals not exceeding 15 months, but at least once each calendar year, and appropriate changes made as necessary to insure that the manual is effective. This manual shall be prepared before initial operations of a pipeline system commence, and appropriate parts shall be kept at locations where operations and maintenance activities are conducted.

Emergencies. The manual required by paragraph (a) of this section must include procedures for the following to provide safety when an emergency condition occurs:

- Receiving, identifying, and classifying notices of events which need immediate response by the operator or notice to fire, police, or other appropriate public officials and communicating this information to appropriate operator personnel for corrective action.
- Prompt and effective response to a notice of each type emergency, including fire or explosion occurring near or directly involving a pipeline facility, accidental release of hazardous liquid or carbon dioxide from a pipeline facility, operational failure causing a hazardous condition, and natural disaster affecting pipeline facilities.
- Having personnel, equipment, instruments, tools, and material available as needed at the scene of an emergency.
- Taking necessary action, such as emergency shutdown or pressure reduction, to minimize the volume of hazardous liquid or carbon dioxide that is released from any section of a pipeline system in the event of a failure.
- Control of released hazardous liquid or carbon dioxide at an accident scene to minimize the hazards, including possible intentional ignition in the cases of flammable highly volatile liquid.
- Minimization of public exposure to injury and probability of accidental ignition by assisting with evacuation of residents and assisting with halting traffic on roads and railroads in the affected area, or taking other appropriate action.
- Notifying fire, police, and other appropriate public officials of hazardous liquid or carbon dioxide pipeline emergencies and coordinating with them preplanned and actual responses during an emergency, including additional precautions necessary for an emergency involving a pipeline system transporting a highly volatile liquid.
- In the case of failure of a pipeline system transporting a highly volatile liquid, use of appropriate instruments to assess the extent and coverage of the vapor cloud and determine the hazardous areas.
- Providing for a post accident review of employee activities to determine whether the procedures were effective in each emergency and taking corrective action where deficiencies are found.

**Reference 49 CFR 195.402*


Hazard Area Radius
42" 1000 psi (916 ft)
36" 1000 psi (786 ft)
24" 1000 psi (524 ft)
12" 1000 psi (262 ft)
Retail Center
Residential
Pipeline
School Complex
Wild Life Park
Residential
Paradigm


Evacuation Radius-
Radiant Heat
Retail Center
12" 1000 psi (865 ft)
24" 1000 psi (1730 ft)
Pipeline
Residential
School Complex
Wild Life Park
Residential
36" 1000 psi (2596 ft)
42" 1000 psi (3028 ft)
Paradigm

In accordance with NENA Pipeline Emergency Operations Standard/Model Recommendation NENA 56-007 (https://www.nena.org/?page=PipelineEmergStnd)

GOALS FOR INITIAL INTAKE:

1. Obtain and Verify Incident Location, Callback and Contact Information
2. Maintain Control of the Call
3. Communicate the Ability to HELP the Caller
4. Methodically and Strategically Obtain Information through Systematic Inquiry to be Captured in the Agency's Intake Format
5. Recognize the potential urgency of situations involving the release of dangerous gases or liquids related to pipelines or similar events of this nature and immediately begin the proper notifications consistent with agency policy
6. Perform all Information Entries and Disseminations, Both Initial and Update

FIRST RESPONSE CALL INTAKE CHECK LIST

The focus of this Standard is on the first minute of the call intake process. Actions taken during this time frame significantly impact the effectiveness of the response and are critical to public safety.

The following protocol is intended as a solid framework for call intake, but should not in any manner rescind or override agency procedures for the timing of broadcasts and messaging.

These procedures are established as recommended practices to consider with existing agency policy and procedure to ensure the most swift and accurate handling of every incident involving the release of dangerous gases or hazardous liquids.

All information should be simultaneously entered, as it is obtained by the telecommunicator, into an electronic format (when available) that will feed/populate any directed messages which will be sent to emergency responders in conjunction with on-air broadcasts.

Location:

Request exact location of the incident (structure addresses, street names, intersections, directional identifiers, mile posts, etc.) and obtain callback and contact information.

Determine Exactly What Has Happened:

Common signs of a pipeline leak are contained in Table 1 below. If any of these conditions are reported, THIS IS A PIPELINE EMERGENCY.

TABLE 1

Common Indications of a Pipeline Leak

Condition	Natural Gas (lighter than air)	LPG & HVL (heavier than air)	Liquids
An odor like rotten eggs or a burnt match	X	X	
A loud roaring sound like a jet engine	X	X	
A white vapor cloud that may look like smoke		X	
A hissing or whistling noise	X	X	
The pooling of liquid on the ground			X
An odor like petroleum liquids or gasoline		X	X
Fire coming out of or on top of the ground	X	X	
Dirt blowing from a hole in the ground	X	X	
Bubbling in pools of water on the ground	X	X	
A sheen on the surface of water		X	X
An area of frozen ground in the summer	X	X	
An unusual area of melted snow in the winter	X	X	
An area of dead vegetation	X	X	X

Signs Of A Pipeline Release

SIGHT*
- Liquid on the ground
- Rainbow sheen on water
- Dead vegetation in an otherwise green area
- Dirt blowing into the air
- White vapor cloud
- Frozen area on ground

**Signs vary based upon product*

SMELL
- Odors such as gas or oil
- Natural gas is colorless and odorless
  - Unless Mercaptan has been added *(rotten egg odor)*

OTHER - NEAR PIPELINE OPERATIONS
- Burning eyes, nose or throat
- Nausea

SOUND
- A hissing or roaring sound

What To Do If A Leak Occurs

- Evacuate immediately upwind
- Eliminate ignition sources
- Advise others to stay away
- **CALL 911** and the pipeline company – number on warning marker
  - Call collect if necessary
- Make calls from safe distance – not "hot zone"
- Give details to pipeline operator:
  - Your name
  - Your phone number
  - Leak location
  - Product activity
  - Extent of damage
- DO NOT drive into leak or vapor cloud
- DO NOT make contact with liquid or vapor
- DO NOT operate pipeline valves *(unless directed by pipeline operator)*:
  - Valve may be automatically shut by control center
  - Valve may have integrated shut-down device
  - Valve may be operated by qualified pipeline personnel only, unless specified otherwise
- Ignition sources may vary – a partial list includes:
  - Static electricity
  - Metal-to-metal contact
  - Pilot lights
  - Matches/smoking
  - Sparks from telephone
  - Electric switches
  - Electric motors
  - Overhead wires
  - Internal combustion engines
  - Garage door openers
  - Firearms
  - Photo equipment
  - Remote car alarms/door locks
  - High torque starters – diesel engines
  - Communication devices

Pipeline Emergency

Call Gas Control Or Pipeline Control Center
Use ***Pipeline Emergency Response Planning Information Manual*** for contact information
Phone number on warning markers
Use state One-Call System, if applicable

Control Center Needs To Know
Your name & title in your organization
Call back phone number – primary, alternate
Establish a meeting place
Be very specific on the location ***(use GPS)***
Provide City, County and State

Injuries, Deaths, Or Property Damage
Have any known injuries occurred?
Have any known deaths occurred?
Has any severe property damage occurred?

Traffic & Crowd Control
Secure leak site for reasonable distance
Work with company to determine safety zone
No traffic allowed through any hot zone
Move sightseers and media away
Eliminate ignition sources

Fire
Is the leak area on fire?
Has anything else caught on fire besides the leak?

Evacuations
Primary responsibility of emergency agency
Consult with pipeline/gas company

Fire Management
Natural Gas – DO NOT put out until supply stopped
Liquid Petroleum – water is NOT recommended; foam IS recommended
Use dry chemical, vaporizing liquids, carbon dioxide

Ignition Sources
Static electricity *(nylon windbreaker)*
Metal-to-metal contact
Pilot lights, matches & smoking, sparks from phone
Electric switches & motors
Overhead wires
Internal combustion engines
Garage door openers, car alarms & door locks
Firearms
Photo equipment
High torque starters – diesel engines
Communication devices – not intrinsically safe

High Consequence Areas Identification*

Pipeline safety regulations use the concept of "High Consequence Areas" (HCAs), to identify specific locales and areas where a release could have the most significant adverse consequences. Once identified, operators are required to devote additional focus, efforts, and analysis in HCAs to ensure the integrity of pipelines.

Releases from pipelines can adversely affect human health and safety, cause environmental degradation, and damage personal or commercial property. Consequences of inadvertent releases from pipelines can vary greatly, depending on where the release occurs, and the commodity involved in the release.

What criteria define HCAs for pipelines?

Because potential consequences of natural gas and hazardous liquid pipeline releases differ, criteria for HCAs also differ. HCAs for natural gas transmission pipelines focus solely on populated areas. (Environmental and ecological consequences are usually minimal for releases involving natural gas.) Identification of HCAs for hazardous liquid pipelines focuses on populated areas, drinking water sources, and unusually sensitive ecological resources.

HCAs for hazardous liquid pipelines:

- Populated areas include both high population areas (called "urbanized areas" by the U.S. Census Bureau) and other populated areas (areas referred to by the Census Bureau as a "designated place").
- Drinking water sources include those supplied by surface water or wells and where a secondary source of water supply is not available. The land area in which spilled hazardous liquid could affect the water supply is also treated as an HCA.
- Unusually sensitive ecological areas include locations where critically imperiled species can be found, areas where multiple examples of federally listed threatened and endangered species are found, and areas where migratory water birds concentrate.

HCAs for natural gas transmission pipelines:

- An equation has been developed based on research and experience that estimates the distance from a potential explosion at which death, injury or significant property damage could occur. This distance is known as the "potential impact radius" (or PIR), and is used to depict potential impact circles.
- Operators must calculate the potential impact radius for all points along their pipelines and evaluate corresponding impact circles to identify what population is contained within each circle.
- Potential impact circles that contain 20 or more structures intended for human occupancy; buildings housing populations of limited mobility; buildings that would be hard to evacuate. (Examples are nursing homes, schools); or buildings and outside areas occupied by more than 20 persons on a specified minimum number of days each year, are defined as HCA's.

** https://primis.phmsa.dot.gov/comm/FactSheets/FSHCA.htm*

Identified Sites*

Owners and companies of gas transmission pipelines are regulated by the US Department of Transportation (DOT). According to integrity management regulations, gas pipeline companies are required to accept the assistance of local public safety officials in identifying certain types of sites or facilities adjacent to the pipeline which meets the following criteria:

(a) A small, well-defined outside area that is occupied by twenty or more persons on at least 50 days in any twelve-month period (the days need not be consecutive). Examples of such an area are playgrounds, parks, swimming pools, sports fields, and campgrounds.

(b) A building that is occupied by 20 or more persons on at least 5 days a week for 10 weeks in any 12 month period (the days and weeks need not be consecutive). Examples included in the definition are: religious facilities, office buildings, community centers, general stores, 4-H facilities, and roller rinks.

(c) A facility that is occupied by persons who are confined, are of impaired mobility, or would be difficult to evacuate. Examples of such a facility are hospitals, schools, elder care, assisted living/ nursing facilities, prisons and child daycares.

Identified Site Registry

Pipeline operators need your help keeping people and property safe.

Identified Sites - locations where many people occupy an area near a pipeline asset or facility. These are places where people may gather from time to time for a variety of reasons.

Some of these sites are very difficult for companies to obtain without help from those with local knowledge of the area.

Please use the following website to gain secure access, so you can assist in identifying sites where people congregate in your community:

my.spatialobjects.com/admin/register/ISR

Pipeline operators are required by law to work with public officials who have safety or emergency response, or planning responsibilities that can provide quality information regarding identified sites.

** 49 CFR §192.903.*

Common Ground Alliance Best Practices

In 1999, the Department of Transportation sponsored the Common Ground Study. The purpose of the Common Ground Study was to identify and validate existing best practices performed in connection with preventing damage to underground facilities. The collected best practices are intended to be shared among stakeholders involved with and dependent upon the safe and reliable operation, maintenance, construction, and protection of underground facilities. The best practices contain validated experiences gained that can be further examined and evaluated for possible consideration and incorporation into state and private stakeholder underground facility damage prevention programs.

The current Best Practices Field Manual is divided into nine chapters that provide a collection of current damage prevention best practices. The nine chapters include:

1. Planning & Design Best Practices
2. One Call Center Best Practices
3. Location & Marking Best Practices
4. Excavation Best Practices
5. Mapping Best Practices
6. Compliance Best Practices
7. Public Education Best Practices
8. Reporting & Evaluation Best Practices
9. Miscellaneous Practices

To view the latest version of the Best Practices please visit www.commongroundalliance.com

CGA Common Ground Alliance℠

Pipelines In Our Community

According to National Transportation Safety Board statistics pipelines are the safest and most efficient means of transporting natural gas and petroleum products, which are used to supply roughly two-thirds of the energy we use. These pipelines transport trillions of cubic feet of natural gas and hundreds of billions of ton/miles of liquid petroleum products in the United States each year.

This system is comprised of three types of pipelines: transmission, distribution and gathering. The approximately 519,000 miles of transmission pipeline* transport products, including natural gas and petroleum products, across the country and to storage facilities. Compressor stations and pumping stations are located along transmission and gathering pipeline routes and help push these products through the line.

Approximately 2.2 million miles of distribution pipeline* is used to deliver natural gas to most homes and businesses through underground main and utility service lines. Onshore gathering lines are pipelines that transport gas from a current production operation facility to a transmission line or main. Production operations are piping and equipment used in production and preparation for transportation or delivery of hydrocarbon gas and/or liquids.

*mileage according to the Pipeline Hazardous Materials Safety Administration (PHMSA).

811 Know what's **below.** **Call** before you dig.

Training Center

Supplemental training available for agencies and personnel that are unable to attend:

- Train as your schedule allows
- Download resources including pipeline operator specific information
  - Sponsoring pipeline operator contact information
  - Product(s) transported
- Submit Agency Capabilities Survey
- Receive Certificate of Completion

Visit https://trainingcenter.pdigm.com/ to register for training

TC TRAINING CENTER

Damage Prevention Programs

Pursuant to 49 CFR Parts 192.614 (c)(2)(i) and 195.442 (c)(2)(i) pipeline operators must communicate their Damage Prevention Program's "existence and purpose" to the public in the vicinity of the pipeline and persons who normally engage in excavation activities in the area in which the pipeline is located.

State and federally regulated pipeline companies maintain Damage Prevention Programs. The purpose of which is to prevent damage to pipelines and facilities from excavation activities, such as digging, trenching, blasting, boring, tunneling, backfilling, or by any other digging activity.

Pipeline Markers

The U.S. Department of Transportation (DOT) requires the use of signs to indicate the location of underground pipelines. Markers like these are located on road, railroad, and navigable waterway crossings. Markers are also posted along the pipeline right-of-way.

The markers display:
- The material transported
- The name of the pipeline operator
- The operator's emergency number

MARKER INFORMATION
- Indicates area of pipeline operations
- May have multiple markers in single right-of-way
- May have multiple pipelines in single right-of-way
- DOES NOT show exact location
- DOES NOT indicate depth *(never assume pipeline depth)*
- DOES NOT indicate pipeline pressure

Call Before You Dig

Statistics indicate that damage from excavation related activities is a leading cause of pipeline accidents. If you are a homeowner, farmer, excavator, or developer, we need your help in preventing pipeline emergencies.

1. Call your state's One-Call center before excavation begins - regulatory mandate as state law requires.
2. Wait the required amount of time.
3. A trained technician will mark the location of the pipeline and other utilities (private lines are not marked).
4. Respect the marks.
5. Dig with care.

American Public Works Association (APWA) Uniform Color Code

	WHITE - Proposed Excavation
	PINK - Temporary Survey Markings
	RED - Electric Power Lines, Cables, Conduit and Lighting Cables
	YELLOW - Gas, Oil, Steam, Petroleum or Gaseous Materials
	ORANGE - Communication, Alarm or Signal Lines, Cables or Conduit
	BLUE - Potable Water
	PURPLE - Reclaimed Water, Irrigation and Slurry Lines
	GREEN - Sewers and Drain Lines

National One-Call Dialing Number:

811 Know what's **below.** **Call** before you dig.

For More Details Visit: www.call811.com

Pipeline Damage Reporting Law As Of 2007

H.R. 2958 Emergency Alert Requirements

Any person, including a government employee or contractor, who while engaged in the demolition, excavation, tunneling, or construction in the vicinity of a pipeline facility;

A. Becomes aware of damage to the pipeline facility that may endanger life or cause serious bodily harm or damage to property; or

B. Damages the pipeline facility in a manner that may endanger life or cause serious bodily harm or damage to property, shall promptly report the damage to the operator of the facility and to other appropriate authorities.

Websites:

Association of Public-Safety Communications Officials - International (APCO)
www.apcointl.org/

Common Ground Alliance
www.commongroundalliance.com

Federal Emergency Management Agency
www.fema.gov

Federal Office of Pipeline Safety
www.phmsa.dot.gov

Government Emergency Telecommunications
www.dhs.gov/government-emergency-telecommunications-service-gets

Infrastructure Protection – NIPC
www.dhs.gov/national-infrastructure-protection-plan

National Emergency Number Association
https://www.nena.org/?

National Fire Protection Association (NFPA)
www.nfpa.org

National Pipeline Mapping System
www.npms.phmsa.dot.gov

National Response Center
https://www.epa.gov/emergency-response/national-response-center or 800-424-8802

Paradigm Liaison Services, LLC
www.pdigm.com

United States Environmental Protection Agency (EPA)
www.epa.gov/cameo

Wireless Information System for Emergency Responders (WISER)
https://wiser.nlm.nih.gov/

FOR MORE INFORMATION ON THE NASFM *PIPELINE EMERGENCIES* PROGRAM
www.pipelineemergencies.com

FOR EMERGENCY RESPONSE INFORMATION, REFER TO DOT GUIDEBOOK.
FOR COPIES: (202) 366-4900
www.phmsa.dot.gov/hazmat/erg/emergency-response-guidebook-erg

TC TRAINING CENTER

Register for access to Training Center
Code: CORE

ERP EMERGENCY RESPONSE PORTAL

Register for access to the Emergency Response Portal

About Paradigm

Paradigm is public awareness. We provide public awareness and damage prevention compliance services to assist with the regulatory requirements of 49 CFR 192 and 195, as well as API RP 1162. Since 2001, the oil and gas industry has worked with Paradigm to fulfill public education and community awareness requirements.

Our history of implementing public awareness programs and compliance services pre-dates API RP 1162. Most of the pipeline industry's large, mid-sized and small operators, as well as many local distribution companies utilize Paradigm's compliance services.

In serving our clients, Paradigm performs full-scope compliance programs from audience identification through effectiveness measurement. In addition, we offer consulting services for plan evaluation and continuous improvement. At the completion of each compliance program, we provide structured documentation which precisely records all elements of the program's implementation to assist with audits.

Paradigm leads the way in industry service. Pipeline operators and local distribution companies trust in Paradigm to implement their public awareness and damage prevention programs. Each year we:

- Distribute 25 million pipeline safety communications
- Compile and analyze roughly 250,000 stakeholder response surveys
- Facilitate over 1,200 liaison programs
- Implement approximately 1,000 public awareness compliance programs
- Provide audit support and assistance with over 50 public awareness audits

Contact Paradigm for more information regarding custom public awareness solutions.

Contact us:

Paradigm Liaison Services, LLC
PO Box 9123
Wichita, KS 67277
(877) 477-1162
Fax: (888) 417-0818
www.pdigm.com

VSM VIRTUAL SCENARIO MANAGER

TC TRAINING CENTER

ERP EMERGENCY RESPONSE PORTAL

HSEEP Homeland Security Exercise and Evaluation Program

EMERGENCY CONTACT LIST

Athens Utilities Board	**1-423-745-4501**
Atmos Energy	**1-866-322-8667**
BBT AlaTenn, LLC	**1-844-940-3077**
Bedford County Utility District	**1-931-684-1667**
Bolivar Utility Department	**1-731-658-5101**
BP Pipelines (North America), Inc.	**1-800-548-6482**
Brownsville Energy Authority	**1-731-772-8845**
Centerville, Town of	**1-931-729-4246**
Chattanooga Gas	**1-855-874-9690**
City of Clarksville Gas Department (8-4:30 M-F)	**1-931-645-7422**
City of Clarksville Gas Department (Holidays and weekends)	**1-931-645-0116**
City of Clifton	**911**
City of Collinwood	**911**
City of Friendship	**1-731-697-5648**
City of Henderson	**1-731-989-2201**
City of Hohenwald	**1-931-796-2231**
City of Lafayette Gas Department	**1-615-666-4580**
City of Lebanon Gas Department	**1-615-443-2835**
City of Loretto - Gas Division	**911**
City of Martin Public Works	**1-731-587-4910**
or	**1-731-587-5551**
City of Mt. Pleasant	**1-931-379-3201**
City of Munford	**1-901-837-0171**
City of Portland Natural Gas System	**1-615-325-6776**
City of Red Boiling Springs	**1-615-666-4725**
City of Savannah (Day)	**1-731-925-4216**
City of Savannah (After Hours)	**1-731-925-4930**
City of South Fulton	**911**
City of Waynesboro	**1-931-722-8035**
Claiborne Utilities District	**1-423-626-4282**
Cookeville Energy Department Gas Division	**1-931-520-4427**
Covington Gas	**1-901-476-7163**
Crockett Public Utility District	**1-731-696-2104**
Delek Logistics Partners, LP	**1-800-344-5325**
Diversified Gas & Oil Corporation (legacy Atlas Tennessee)	**1-877-711-1138**
Diversified Gas & Oil Corporation (legacy Coalfield Pipeline)	**1-800-642-0300**
Dyersburg Gas System	**1-731-285-4019**
East Tennessee Natural Gas	**1-800-231-7794**
Enable	**1-800-474-1954**
Energy Transfer Crude Oil	**1-800-753-5531**
Enterprise, TE Products Pipeline System	**1-888-883-6308**
Etowah Utilities	**1-423-263-9441**
Fayetteville Public Utilities	**1-800-379-2534**
First Utility District of Tipton County	**1-901-476-9525**
Gallatin Public Utilities Natural Gas System	**1-615-451-5922**
Gibson County Utility District	**1-731-855-1441**
Greater Dickson Gas Authority	**1-615-441-2830**
Hardeman Fayette Utility District	**1-901-877-6236**
Hawkins County Gas Utility District	**1-423-272-8841**
Horton Highway Utility District	**1-931-364-2283**
Humboldt Utilities	**1-731-784-9212**
or	**1-731-784-1322**

EMERGENCY CONTACT LIST

Jackson Energy Authority	**1-731-422-7500**
Jamestown Gas Department, City of	**1-931-879-8815**
Jefferson-Cocke County Utility District	**1-423-623-3069**
or	**1-865-475-7911**
Lewisburg Gas Department	**1-931-359-4016**
Lexington Gas System	**1-731-968-2917**
Loudon Utilities	**1-865-458-2091**
Lucy Woodstock Marine Terminal (Operated by Lemm Corp)	**1-901-358-0151**
Marion Natural Gas System	**1-423-942-2528**
Mid-Valley Pipeline	**1-800-753-5531**
Navitas Utility Corporation	**1-866-797-3342**
Oak Ridge Utility District	**1-865-483-1377**
Plains Pipeline, L.P.	**1-800-708-5071**
or	**1-800-322-7473**
Powell Clinch Utility District	**1-865-426-2822**
Pulaski Natural Gas System	**1-931-363-1752**
Ridgetop Natural Gas	**1-615-440-2616**
Selmer Utility Division	**1-731-645-7928**
Sevier County Utility District	**1-865-453-3272**
Smyrna Municipal Gas System (8 am - 4:30 pm)	**1-615-355-5711**
Smyrna Municipal Gas System (After Hours)	**1-615-355-5742**
Southern Company Pipelines	**1-844-357-4656**
Springfield Gas System	**1-615-384-0008**
Sweetwater Utilities Board	**1-423-337-5081**
Tennessee Gas Pipeline	**1-800-231-2800**
Texas Eastern Transmission L.P. (Enbridge)	**1-800-231-7794**
Texas Gas Transmission, LLC	**1-800-626-1948**
Town of Livingston	**1-931-823-6496**
Town of Somerville	**1-901-465-7300**
Trunkline Gas	**1-800-225-3913**
Unicoi County Gas Utility District	**1-423-743-6793**
Valero Terminaling and Distribution Company	**1-866-423-0898**
Valero Partners Operating Co., LLC	**1-866-423-0898**

Note: The above numbers are for emergency situations. Additional pipeline operators may exist in your area. Visit the National Pipeline Mapping System at www.npms.phmsa.dot.gov for companies not listed above.

ONE-CALL SYSTEM	PHONE NUMBER
Tennessee 811	**1-800-351-1111 or 811**

Established in 1983, Tennessee 811 serves as the statewide official one-call center. Tennessee 811 does not mark lines but functions as a communications link between our member utilities and anyone excavating.

Tennessee's Underground Utility Damage Prevention Act (TCA 65-31-101) requires everyone who digs to contact Tennessee 811 at least three (3) working days' notice before starting a project. Tennessee 811 processes the notification of proposed excavation and notifies our member utilities, or their contract locators, to mark their underground facilities prior to the excavation.

This free service helps prevent damage incidents which can result in millions of dollars in property damage, the interruption of utility service, personal injuries, and even loss of life.

Visit tenn811.com for more information

TENNESSEE

Tennessee 811 800-351-1111
Website: tenn811.com
Hours: 24 hours
Advance Notice: Not less than 3 working days, not more than 10 working days
Marks Valid: 15 calendar days
Law Link:
https://www.tenn811.com/law

** 2' either side of the utility plus the width of the utility.*

TICKETS			STATE LAWS & PROVISIONS									NOTIFICATION EXEMPTIONS					NOTIFICATIONS ACCEPTED					
FAX	Online	Mobile	Statewide Coverage	Civil Penalties	Emergency Clause	Mandatory Membership	Excavator Permits Issued	Mandatory Premarks	Positive Response	Hand Dig Clause	Damage Reporting	DOT	Homeowner	Railroad	Agriculture	Depth	Damage	Design	Emergency	Overhead	Large Projects	Tolerance Zone
N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	N	N	24"

Chart Reference: https://pipelineawareness.org/media/pqto5xni/2021-excavation-safety-guide-pipeline-edition.pdf

Paradigm

1.877.477.1162 • tn.pipeline-awareness.com