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Pipeline Emergency Response Guidelines

Pipeline Association *for* Public Awareness

www.pipelineawareness.org

Pipeline Association *for* Public Awareness

The Pipeline Association for Public Awareness (Association) is a nonprofit corporation created to enhance public safety. The Association was established by a group of pipeline companies who operate facilities across the United States. The Association believes communication and cooperation with local organizations are key components to protecting life, enhancing public safety, improving emergency preparedness, increasing protection of the environment, and preventing damage to pipeline property and facilities. If you would like more information about the Association or pipeline safety and emergency preparedness education, please contact 16361 Table Mountain Parkway, Golden, CO 80403, or visit the Association's web site at www.pipelineawareness.org.

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I. Introduction

Pipelines are the safest and most reliable way to transport energy products, including: natural gas, crude oil, liquid petroleum products, and chemical products. Pipelines are primarily underground, which keeps them away from public contact and accidental damage. It is also a fact that pipelines can move large volumes of product at a significantly lower operating cost when compared to other modes of transportation. Despite safety and efficiency statistics, increases in energy consumption and population growth near pipelines present the potential for a pipeline incident.

To meet the pipeline industry's goal of incident-free operation, pipeline operators invest substantial human and financial resources to protect the people, property and environments near pipelines. Damage prevention measures include routine inspection and maintenance, corrosion protection, continuous monitoring and control technologies, public awareness programs, and integrity management and emergency response plans. While pipelines are generally the safest method of transporting hazardous chemicals, they are not failsafe. Pipeline product releases, whether in the form of a slow leak or violent rupture, are a risk in any community.

In the unlikely event of an incident near or involving a pipeline, it is critical you know how to respond and are prepared to work together with the pipeline operator's representatives.

This guide is intended to provide fire fighters, law enforcement officers, emergency medical technicians and all other emergency responders who may be the first to arrive at the scene with the information they need to safely handle a pipeline incident. This guide is not intended to provide information on the physical or chemical properties of the products transported through pipelines. Nor should it be considered a substitute for emergency response training, knowledge or sound judgment. Rather, this guide contains information that will help you make decisions about how to best protect your emergency response team and the surrounding public during a pipeline incident.

Please review and become familiar with the emergency response guidelines before you are called to respond to a pipeline incident.

II. Pipeline Basics

Before we discuss how to respond to a pipeline incident, let's quickly review the basics about pipelines:

- What are pipelines and why do we use them?
- Where are pipelines located?
- How will you identify a pipeline right-of-way in your community?
- How does the operator monitor pipeline performance?

A. Pipelines in Your Community

People across the nation expect to have the energy they need to drive their cars, heat their homes and cook dinner, never really considering how they get the petroleum, natural gas, and other chemical products necessary to power their daily activities.

The pipeline industry has installed more than 2.1 million miles of pipeline to transport a variety of gases and liquids from gathering points to storage areas, and from refineries and processing plants to customers' homes and places of business. The U.S. Department of Transportation (DOT) defines a pipeline system as all parts of a pipeline facility through which a hazardous liquid or gas moves in transportation, including piping, valves, and other appurtenances connected to the pipeline, pumping units, fabricated assemblies associated with pumping units, metering and delivery stations, and breakout tanks. To ensure these pipeline systems remain safe, a body of local, state and federal laws, regulations and standards govern pipeline design, construction, operation, and public awareness and damage prevention programs.

Specifically, pipeline operators use a series of gathering, transmission and distribution pipelines to transport more than 43 different gas and liquid products.

- **Gathering** pipelines transport crude oil and natural gas from the wellheads and production facility to processing facilities where the oil, gas and water are separated and processed.
- **Transmission** pipelines move refined liquid products, crude oil, and natural gas from refineries to marketing and distribution terminals typically using larger diameter, high-pressure lines.
- **Distribution** systems for liquid and gas products vary. Liquid products are stored and transported by tanker trucks to their final destination, while gases, such as natural gas, butane, propane, ethane, etc., are transported from a storage location directly to residential and industrial customers through low-pressure distribution pipelines.

Maps of transmission pipelines and contact information for pipeline operators in your area can be found in the National Pipeline Mapping System (NPMS) at: www.npms.phmsa.dot.gov. The directory can be searched by zip code or state and county. More detailed pipeline maps are also available to Emergency Responders who have obtained a logon ID and password.

B. Pipeline Right-of-Way

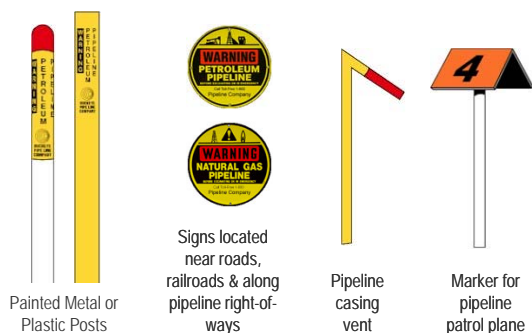
Although typically buried underground, pipelines may also be found aboveground in extremely cold and harsh environments, and at pump and compressor stations, some valve stations and terminals. Whether aboveground or belowground, pipelines are constructed along a clear corridor of land called the right-of-way (ROW). The ROW may contain one or more pipelines, may vary in width, and will cross through public and private property. The ROW should be free of permanent structures and trees and be identified with a marker sign.

C. Pipeline Marker Signs

Aboveground signs and markers identify the approximate location of underground pipelines. Markers are required to be present wherever a pipeline crosses under roads, railroads or waterways. They may also be found at other intervals and locations along the pipeline right-of-way, such as near buildings and pipeline facilities. Markers do NOT tell you the exact location, depth or direction of the pipeline; the pipeline may curve or angle around natural and manmade features. If there are multiple pipelines in the ROW, a marker sign should be posted for each pipeline.

Pipeline markers may look different, but every sign tells you the same information:

- Pipeline product
- Pipeline operator
- 24-hour emergency phone number



NOTE: *If you are responding to a 9-1-1 call about a strange odor or leak in the area, approach the scene with caution, look for clues that a pipeline is involved, and find a marker sign identifying the pipeline product, operator and phone number to call to report the incident and obtain additional information.*

D. Pipeline Control Center

When you call the 24-hour emergency phone number on a marker sign, you will speak with someone at the pipeline operator's control center. The control center is the heart of pipeline operations. Information about the pipeline's operating equipment and parameters is constantly communicated to the control center where personnel use computers to monitor pipeline pressure, temperature, flow, alarms, and other conditions in the pipeline. While pipeline operators work hard to achieve incident-free operation, accidents do occur. In the event of an emergency, the control center can immediately shutdown the pipeline and begin to isolate the source of the leak. The pipeline operator's control center may also have the capability to remotely open and close valves and transfer products both to and from the main pipeline at marketing and distribution facilities.

NOTE: *As an emergency responder, you can help control the incident by being prepared to communicate as much information as possible to the pipeline operator about the current, incident situation.*

III. Pipeline Incidents

A pipeline incident exists when third-party damage, corrosion, material defects, worker error or natural events cause a fire, explosion, accidental release, or operational failure that disrupts normal operating conditions.

Pipeline incidents present some of the most dangerous situations an emergency responder may encounter. Pipelines contain flammable, hazardous and even deadly petroleum gases, liquids, and other chemical products that present emergency responders with a myriad of hazards and risks that vary depending on the topography, weather, and properties of the material involved. For the majority of pipeline incidents, you will have a limited number of options to actually stop the leak. In almost all cases, the pipeline operator will be required to resolve the incident safely. Consequently, your goal is to minimize the level of risk to other responders, the community and the environment.

Advance knowledge of where pipelines are located in your community, the products transported in them, and how to contact and work together with the pipeline operator in the event of an incident are key factors to an effective and safe response. Each pipeline operator maintains an emergency response plan that outlines the roles and responsibilities of company, contractor, and local response personnel.

***NOTE:** Contact your local pipeline operator(s) to learn more about the pipeline systems and specific response plans regarding your area of jurisdiction. Make sure you comment on special issues in your community. Pipeline operators use the feedback from communications with emergency responders to develop and update their integrity management and emergency response plans.*

To effectively respond to a pipeline leak, spill or fire, emergency responders need to understand the hazards and risks associated with the incident. You should seek additional information about the pipeline in question as soon as possible. Calling the 24-hour emergency phone number on a nearby pipeline marker sign, contacting the appropriate emergency response agency, and consulting the information in the DOT 2004 *Emergency Response Guidebook* may provide more detailed, situation-specific information.

Regardless of the nature of the pipeline incident, following standardized procedures will bring consistency to the response operation and will help minimize the risk of exposure to all responders. Pipeline operators hope you never have to respond to a pipeline incident, but if you do, remember:

- Every incident is different – each will have special problems and concerns.
- Carefully select actions to protect people, property and the environment.
- Continue to gather information and monitor the situation until the threat is removed.

IV. Incident Response Steps

Following standardized procedures will bring consistency to each response operation and will help minimize the risk of exposure to all responders. The information in this guide provides a framework to discuss safety issues as they relate to the hazards and risks presented by pipeline emergencies in your community.

After reviewing the standard pipeline incident response steps, you should discuss your agency's pipeline emergency preparedness, how you will handle an incident, and other planning issues within your community.

A. Assess the Situation

1. Approach with Caution from Upwind Location

To protect yourself and other responders from any hazards associated with the incident it is critical you approach cautiously from an upwind and/or crosswind location.

- Do not park over manholes or storm drains.
- Do not approach the scene with vehicles or mechanized equipment until the isolation zones have been established. Vehicle engines are a potential ignition source.
- Do not walk or drive into a vapor cloud or puddle of liquid.
- Use appropriate air-monitoring equipment to establish the extent of vapor travel.
- Because any number of fire and health hazards may be involved, it is important you resist the urge to rush in until you know more about the product and hazards involved in the incident. Consider the following:
 - Is there a fire, spill or leak?
 - What are the weather conditions?
 - What direction is the wind blowing?
 - What is the terrain like?
 - Who and what is at risk: people, property or environment?
 - Is there a vapor cloud?
 - What actions should be taken: evacuation or diking?
 - What human/equipment resources are required and readily available?
 - What can be done immediately?

2. Secure the Scene

Without entering the immediate hazard area, you want to isolate the area and deny entry to unauthorized persons including other responders. It may be necessary to evacuate everyone in the danger area to a safe location upwind of the incident area.

3. Employ NIMS and the Incident Command System

Developed by the Department of Homeland Security, the National Incident Management System (NIMS) integrates effective practices in emergency preparedness and response into a

comprehensive national framework for incident management. The NIMS enables responders at all jurisdictional levels and across all disciplines to work together – effectively and efficiently.

Because pipeline incidents require coordination of information and resources among all responders, the Incident Command System (ICS) is one of the most important ‘best practices’ in the NIMS. The ICS provides common terminology, organizational structure and duties, and operational procedures among operator personnel and various federal, state and local regulatory and response agencies that may be involved in response operations.

- Identify an Incident Commander. The Incident Commander is the person responsible for the management of on-scene emergency response operations. In cooperation with the pipeline operator’s point of contact, the Incident Commander determines when it is safe for the response teams to enter the area and access the pipeline. The Incident Commander must be trained to perform these responsibilities and not be automatically authorized by virtue of his/her normal position within the organization.
- Establish a command post, lines of communication and a staging area for additional responding equipment and personnel.

NOTE: *If other public safety units are on-scene, ensure operations are coordinated and unified command is established.*

4. Identify the Hazards

A product’s physical and chemical properties determine how the product will behave and how it can harm. Emergency responders need to analyze the problem and assess potential outcomes based on the hazardous materials involved, type of container and its integrity, and the environment where the incident has occurred. Understanding the hazards will enable you to understand what risk you will be taking and how to select the best course of action with the least risk.

- Locate a pipeline marker sign to identify the pipeline product, operator and 24-hour emergency phone number.
- Call the emergency phone number to report the incident to the pipeline operator’s control center. Control center personnel may provide additional information about the pipeline product and its hazards.
- Use the DOT *2004 Emergency Response Guidebook* to initially analyze the key properties (flash point, explosive range, specific gravity, and vapor density).
- Use air-monitoring equipment appropriate to the materials in the pipeline. Do NOT assume gases or vapors are harmless because of a lack of smell or quick desensitization to the strong odors of materials such as hydrogen sulfide or anhydrous ammonia.
- Use the highest level of precaution and protection until you know the area is safe of flammable, toxic, and mechanized and electrical hazards.

Use caution as you may encounter:

- Flammable atmospheres
- Hydrogen sulfide (H₂S) in crude oil/natural gas pipelines
- Anhydrous ammonia pipelines
- Oxygen deficient/enriched atmospheres

NOTE: *If natural gas is escaping inside a building, refer to Appendix B for additional precautions.*

B. Respond to Protect People, Property and the Environment

Protective actions are those steps taken to preserve the health and safety of emergency responders and the public during a pipeline incident. While the pipeline operator concentrates on the pipeline, responders should concentrate on isolating and removing ignition sources and moving the public out of harms way. Several response procedures can and should be pursued simultaneously. You will also need to continually reassess and modify your response accordingly.

1. Establish Isolation Zones and Set Up Barricades

Isolation zones and barricades prevent unauthorized people and unprotected emergency responders from entering the hazard area and becoming injured. The size of the containment area will be dictated by the location and size of the release. You also want to consider atmospheric conditions, as isolation distances change from daytime to nighttime due to different mixing and dispersion conditions in the air. Remember, gas odor or the lack of gas odor is not a sufficient measurement to establish safe isolation zones.

- Based on the type of incident, use any or all of the following to calculate and establish isolation zones:
 - DOT *2004 Emergency Response Guidebook*
 - Information from the pipeline operator's representative
 - Heat intensity levels
 - Measurements from air-monitoring equipment
- Use visible landmarks, barricade tape and traffic cones to identify hot/warm/cold zones.
- Define entry and exit routes. Plan an escape route in case conditions deteriorate.
- Be certain to allow enough room to move and remove your own equipment. The more time, distance and shielding between you and the material the lower the risk.

2. Rescue and Evacuate People

Any efforts made to rescue persons and protect property or the environment must be weighed against the possibility that you could become part of the problem.

- Do not walk or drive into a vapor cloud or puddle of liquid.
- Evacuate or shelter-in-place as necessary, providing instruction and frequent updates to the public while evacuated or sheltered-in-place.
- Administer first aid and medical treatment, as needed.
- Enter the area only when wearing appropriate protective gear, such as Structural Fire Fighters' Protective Clothing (SFPC) (helmet, coat, pants, boots, gloves and hood) and a Positive Pressure Self-Contained Breathing Apparatus (SCBA). Because no single protective clothing material will protect you from all dangerous pipeline materials, always use the highest level of caution.

3. Eliminate Ignition Sources

Ignition sources include electrical motors, firearms, vehicles, telephones, emergency radios, cigarettes, construction equipment, static electricity, open flames or sparks.

- Eliminate ignition sources, if possible without additional exposure or great risk.
- Park all emergency vehicles at a safe distance beyond the isolation zone (upwind).
- Do NOT light a match, start an engine, use a telephone or radio, switch lights on or off, or use anything that may create a spark.

4. Control Fires, Vapor and Leaks

Because there are many variables to consider, the decision to use water on fires or spills involving water-reactive materials should be based on information from an authoritative source, such as the pipeline operator, who can be contacted by calling the 24-hour emergency phone number listed on a nearby pipeline marker sign.

WARNING: Some products, such as anhydrous ammonia, can react violently or even explosively with water. Water getting inside a ruptured or leaking container may cause an explosion or the product's reaction with water may be more toxic, corrosive, or otherwise more undesirable than the product of a fire without water applied. Consequently, it is best to leave a fire or leak alone except to prevent its spreading.

a. Fire Control

Extinguishing a primary fire can result in explosive re-ignition. Unless it is necessary to save human life, flammable gas fires should NOT be extinguished on flammable gas pipelines unless the fuel source has been isolated and the pipeline operator advises you to take this action! If the fuel source is not shut off and the fire is extinguished, leaking gas can migrate away from the pipeline and find an ignition source.

- Let the primary fire burn. Eliminate potential ignition sources.
- Cool surrounding structures, equipment and vessels. Because water is an inefficient and even dangerous way to fight fuel fires, use a fog pattern, NOT a straight stream of water. Please note some products are not compatible with water; refer to the DOT 2004 *Emergency Response Guidebook*.
- Do not inhale fumes, smoke or vapors.
- Once the primary fire is out, beware of hot spot re-ignition.
- Do not operate pipeline equipment.

b. Vapor Control

Limiting the amount of vapor released from a pool of flammable or corrosive liquids requires the use of proper protective clothing, specialized equipment, appropriate chemical agents, and skilled personnel. For these reasons, it is best to contain the hazards and wait for the pipeline operator's representative to handle the pipeline and its product.

- Do not inhale fumes, smoke or vapors.

- Eliminate ignition sources! Flammable gases may escape under pressure from a pipeline, form a vapor cloud, and be ignited by an ignition source in the area. Explosions of unconfined vapor clouds can cause major structural damage and quickly escalate the emergency beyond responder capabilities.
- Do NOT ignite a vapor cloud! Pipeline operators will perform this dangerous task.
- Avoid forced ventilation of structures and excavations. Forced ventilation can actually increase the possibility of a flammable atmosphere.
- Limited fog misting can be of some benefit if knocking down a vapor cloud, especially if such a cloud appears to be spreading beyond the containment site. Fog misting must be used carefully to prevent incompatible product/water mixing or the spread of product to other areas, as containment dikes may become overfilled.
- Product-compatible foam can be used to suppress vapors or for rescue situations, however, be extremely cautious if fuel discharge is not yet stopped.

CAUTION: Before using water spray or foam to control vapor emissions or suppress ignition, obtain technical advice based on chemical name identification. Refer to the pipeline operator and DOT *2004 Emergency Response Guidebook*.

c. Leak Control

In addition to hazards such as flammability, toxicity and oxygen deficiency, liquid pipeline leaks and ruptures can create major problems with spill confinement and containment. What seems like a minor spill may evolve into a major spill as liquid inside the pipeline continues to bleed out of the line.

- Ask yourself where the spill will be in a few hours, how close the incident is to exposures or sensitive areas, and what can be done to confine the spill or divert it away from exposures.
- Establish barriers to prevent leak from spreading to water sources, storm drains or other sensitive areas. There are several basic containment devices that can be used to prevent the migration of petroleum products on land or on small streams.
 - Storm sewer or manhole dam
 - Small stream containment boom
 - Pipe skimming underflow dam
 - Wire fence or straw filter dam
- If a leak is accidentally ignited, firefighting should focus on limiting the spread of fire damage, but in NO circumstances should efforts be made to extinguish the fire until the source of supply has been cut off or controlled.
- Do not walk into or touch spilled material.
- Do not operate pipeline equipment.

C. Call for Assistance of Trained Personnel

1. Contact Your Organization

As soon as possible, contact your organization. This will set in motion a series of events ranging from dispatching additional trained personnel to the scene to activating the local emergency response plan. Ensure that other local emergency response departments have been notified.

2. Call the Pipeline Operator

- Immediately call the 24-hour emergency phone number of the pipeline operator, which is listed on a marker sign located at a nearby road crossing, railroad or other point along the pipeline right-of-way. During the call, pipeline control center personnel will dispatch a representative to the scene. The control center will immediately act to shutdown the pipeline and isolate the emergency. The pipeline control center may also have the capability to remotely open and close manifold valves and to transfer products both to and from the main pipeline at marketing and distribution facilities.
- Be prepared to provide pipeline control center personnel with the following information:
 - Call-back number, contact name (usually the Incident Commander)
 - Detailed location, including state, county, town, street or road
 - Type of emergency: fire, leak, vapor
 - When incident was reported locally
 - Any known injuries
 - Other officials on site: police, fire, medical, LEPCs, etc.
 - Surrounding exposures/sensitive areas
 - Any special conditions: nearby school, hospital, prison, railroad, etc.
 - Local conditions: weather, terrain

3. Obtain National Assistance

If the pipeline operator's 24-hour emergency phone number is not available, contact the appropriate emergency response agency listed in the DOT *2004 Emergency Response Guidebook*.

D. Work Together with the Pipeline Operator

Pipeline operator personnel will establish product containment and drain barriers while working in concert with local emergency responders to limit or contain the spill, and avoid possible ignition of a leak or vapor cloud.

1. Pipeline Operator's Representative:

- Serves as the primary contact for communication between the operator's team and emergency responders. They will be familiar with the Incident Command System and are normally HAZWOPER certified as well.
- Establishes contact with the Incident Commander before and upon arrival to avoid accidental entry into isolation zones or ignition of the release.
- Communicates which actions to take especially as they relate to containment and control of the pipeline product. The pipeline operator's representative(s) is trained to know:
 - How to shut off the supply of gas or liquid. Only the operator's representative is trained to operate pipeline equipment.
 - What potential hazards may be present at the location.
 - What additional complications may result from response activities as they relate to the pipeline and its product.
 - How to fight small fires with hand held extinguishers, administer basic first aid, perform CPR, and assist with evacuations or traffic control.

2. Emergency Responders:

- Maintain site control and act as Incident Commander.
- Eliminate ignition sources. Provide standby fire-watch personnel.
- Suppress vapor generation.
- Provide standby rescue personnel to pipeline operator personnel entering the incident area to stop the release.
- Help maintain containment dams and install more as needed.
- Monitor the atmosphere in the repair and containment areas.

3. Together, Incident Commander and Pipeline Operator's Representative:

- Review whether it is safe for the operator's emergency response team and/or their equipment to enter the incident area.
- Determine whether the zone of influence needs additional barricading and diking.
- Decide when the area is safe for the affected public to re-enter.

V. Damage Prevention – A Shared Responsibility

The pipeline industry uses a wide range of tools and technologies to maintain safe operations. They visually inspect aboveground pipes and related equipment for damage. Operator personnel walk, drive and fly over pipeline right-of-ways inspecting them for corrosion, obvious damage, unauthorized activities that might endanger the pipeline, or unusual changes in vegetation that might indicate a leak. As you already know, pipeline control center personnel continuously monitor pipeline operation. Pipeline operators also use in-line inspection tools known as “smart pigs”, hydrostatic testing, electromagnetic testing, and other techniques to remove impurities and ensure the integrity of the pipeline. If inspection and testing identify any integrity-threatening anomalies, the operator repairs them as soon as possible.

In our nation’s time of heightened security, it is more important than ever to protect pipelines against damage or attack. Homeland security and infrastructure protection is a shared responsibility.

A. Pipeline Mapping

Locate transmission pipelines in your community. Search the DOT’s National Pipeline Mapping System (NPMS) web site by zip code or county and state: www.npms.phmsa.dot.gov.

B. One-Call Center

Remind those in your community to always call the state or local one-call center to request marking of underground facilities within a proposed excavation site. This is a free service. They can simply dial 811 and will be connected to the center serving that area or they can call the national one-call locator number at 1-888-258-0808 to learn the number of the state’s one-call center.

C. Damage Reporting

Report any damage or unusual or suspicious activities along a pipeline right-of-way to the pipeline operator. The operator will immediately investigate and repair any damage.

Improved communication and cooperation with local organizations are key components to protecting life, enhancing public safety, improving emergency preparedness, increasing protection of the environment, and preventing damage to pipeline property and facilities. If you would like more information about The Pipeline Association for Public Awareness or pipeline safety and emergency preparedness education, please contact The Association at 16361 Table Mountain Parkway, Golden, CO 80403, or visit www.pipelineawareness.org.

Appendix A

Recommended Minimum Evacuation Distances For Natural Gas Pipeline Leaks and Ruptures

(Not applicable for Butane, Propane, or other Hazardous Liquids)

		Pipeline Size (inches)											
		4	6	8	10	12	16	20	22	24	30	36	42
Pressure (psig)	100	91	137	182	228	274	365	456	502	547	684	821	958
	200	129	193	258	322	387	516	645	709	774	967	1161	1354
	300	158	237	316	395	474	632	790	869	948	1185	1422	1659
	400	182	274	365	456	547	730	912	1003	1094	1368	1642	1915
	500	204	306	408	510	612	816	1020	1122	1224	1529	1835	2141
	600	223	335	447	558	670	894	1117	1229	1340	1675	2011	2346
	700	241	362	483	603	724	965	1206	1327	1448	1810	2172	2534
	800	258	387	516	645	774	1032	1290	1419	1548	1935	2322	2709
	900	274	410	547	684	821	1094	1368	1505	1642	2052	2462	2873
	1000	288	433	577	721	865	1154	1442	1586	1730	2163	2596	3028
	1100	302	454	605	756	907	1210	1512	1664	1815	2269	2722	3176
	1200	316	474	632	790	948	1264	1580	1738	1896	2369	2843	3317
	1300	329	493	658	822	986	1315	1644	1809	1973	2466	2959	3453
	1400	341	512	682	853	1024	1365	1706	1877	2047	2559	3071	3583
1500	353	530	706	883	1060	1413	1766	1943	2119	2649	3179	3709	
1600	365	547	730	912	1094	1459	1824	2006	2189	2736	3283	3830	
1700	376	564	752	940	1128	1504	1880	2068	2256	2820	3384	3948	
1800	387	580	774	967	1161	1548	1935	2128	2322	2902	3482	4063	
1900	398	596	795	994	1193	1590	1988	2186	2385	2981	3578	4174	
2000	408	612	816	1020	1224	1631	2039	2243	2447	3059	3671	4283	
2100	418	627	836	1045	1254	1672	2090	2299	2508	3134	3761	4388	
2200	428	642	856	1069	1283	1711	2139	2353	2567	3208	3850	4492	

Table 1 - Evacuation Distance in Feet

The applicable leak or rupture condition is that of a sustained trench fire fueled by non-toxic natural gas escaping from two full bore pipe ends. Blast overpressure is not addressed. The distances shown in Table 1 are intended to provide protection from burn injury and correspond to a thermal heat flux exposure level of 450 Btu/hr ft². This is the accepted limit of heat exposure for unprotected outdoor areas where people congregate; as established by the US Department of Housing & Urban Development Code 24CFR51, Subpart C, Siting of HUD Assisted Projects Near Hazardous Operations Handling Conventional Fuels or Chemicals of an Explosive or Flammable Nature. The formula used to calculate distance was taken from the Gas Research Institute Report GRI-00/0189, *A Model for Sizing High Consequence Areas Associated with Natural Gas Pipelines*, 2001, prepared by C-FER Technologies. That model does not take into account wind or other factors which may greatly influence specific conditions. Users are advised that the distances shown in Table 1 are considered to be "general information" only and are not intended to replace a site specific risk analysis. The Pipeline Association for Public Awareness makes no warranty with respect to the usefulness of this information and assumes no liability for any and all damages resulting from its use. Anyone using this information does so at their own risk.

Appendix B

Natural Gas Escaping Inside a Building

POTENTIAL HAZARDS

FIRE OR EXPLOSION

- **EXTREMELY FLAMMABLE.**

- Will be easily ignited by heat, sparks or flames.
- Will form explosive mixtures with air.
- Vapors from liquefied gas are initially heavier than air and spread along ground.

CAUTION: Natural Gas / Methane (UN1971) is lighter than air and will rise. Natural Gas / Methane (UN1971) fires are difficult to detect since they burn with an invisible flame. Use an alternate method of detection (thermal camera, broom, etc.)

- Vapors may travel to source of ignition and flash back.
- Cylinders exposed to fire may vent and release flammable gas through pressure relief devices.
- Containers may explode when heated.
- Ruptured cylinders may rocket.

HEALTH

- Vapors may cause dizziness or asphyxiation without warning.
- Some may be irritating if inhaled at high concentrations.
- Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.
- Fire may produce irritating and/or toxic gases.

PUBLIC SAFETY

- Approach cautiously.
- Establish an effective and safe perimeter.
- Position apparatus out of danger zone (avoid front of building and over manhole covers and sewers).
- Keep unauthorized personnel away.
- Secure the scene and deny entry.

EVACUATION

- Evacuate the public to a safe distance
- As soon as possible, contact the gas operator and coordinate large scale evacuations.
 - 2004 DOT ERG states 150-300 feet initially.
 - Pipeline operators, however, upon assessment at arrival may recommend a greater evacuation distance.

EMERGENCY RESPONSE

- Wear positive pressure self-contained breathing apparatus (SCBA) as well as full structural firefighter protective clothing.
 - Structural firefighters' protective clothing will only provide limited thermal protection
- Listen for hissing sound, but use CAUTION as no noise may be heard.
- Monitor the atmosphere, using multiple monitors where possible
 - Action Criteria: 0 to 10% of the LEL - Use Extreme Caution
 - Action Criteria: 10% of the LEL or greater - DO NOT ENTER THE BUILDING
- If possible, determine the source of the release without risk to the responders. Multiple locations are possible due to damage or pullout at joints.
- Monitor for natural gas traveling away from source toward exposures.
- Control ignition sources (smoking, open flames, internal combustion engines and motors).
- Do not operate electric devices such as switches, etc. Sparks can cause ignition.
- Be cautious of contacting the piping system; a static spark may occur and result in ignition.
- Whenever possible, adopt a defensive or non-intervention mode and wait for the utility company to arrive.
- Protect exposures from the radiant heat of the fire.
- Never extinguish the fire until the leak can be shut off and controlled, unless there is immediate danger to life.
- With any leak, always anticipate and expect that ignition will occur.

TACTICAL CONSIDERATIONS

- **Natural gas released inside buildings presents one of the greatest flammable hazards to emergency responders.**
- **Building full of natural gas should only be approached when needed with extreme caution and with a minimum number of personnel. CGI readings in excess of 10% LEL require evacuation of the building.**
- Stop or control the gas release at the appliance, or service meter valve.
- If possible to do safely, ventilate the area. If the flammable atmosphere is above the upper explosive limit (UEL), keep in mind that during ventilation the atmosphere will pass back through the flammable range of 4% to 16% gas to air. Also remember that fans are a potential ignition source.
 - Natural gas, depending on the makeup, requires a minimum mixture of 4% to 16% in air to ignite (40,000 ppm. to 160,000 ppm)
 - NOTE: Odor can be detected as low as 1 ppm. However, if underground migration occurs, odorant may be stripped from the gas.
- **NORMALLY, DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED.** Extinguish surrounding fires, but not gas fed fire.
- Use protective hose streams to approach if necessary.
- **DO NOT CLOSE** main valves or any other large transmission or distribution vales. This can lead to serious problems elsewhere in the system.
- Closed valves should remain closed until opened by gas utility personnel.
- Do not squeeze off gas piping – static electricity may cause ignition.

FIRST AID

- Move victim to fresh air.
- Call 911 or emergency medical service.
- Assess the victim to determine if he/she is breathing normally. The level of treatment provided should be based on your level of individual training.
- Professional Rescuers provide artificial respirations if the victim is in respiratory distress.
- Non-Professional Rescuers begin CPR if the victim is not breathing normally
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- In case of burns, immediately cool affected skin for as long as possible with cold water. Do not remove clothing if adhering to skin.
- Keep victim warm and quiet.
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

OTHER CONSIDERATIONS

- Decontaminate if necessary to remove the odorant.
- Debrief all responders and schedule a critique with all involved.

Pipeline Emergency Response Guidelines

Incident Response Checklist

Pipeline operators will concentrate on shutting down pipeline facilities. Responders should focus on protecting the public and isolating or removing ignition sources.

A. Assess the Situation

1. **Approach with caution from upwind/crosswind location**
 - Do not walk or drive into a vapor cloud or puddle of liquid
 - Do not park over manhole or storm drain
 - Use air-monitoring equipment
 - Note conditions of hazard, weather, surrounding community and available resources
2. **Secure the scene, denying entry to unauthorized persons**
3. **Employ NIMS and Incident Command System**
4. **Identify hazards**
 - Locate pipeline marker sign: product, operator, 24-hour emergency phone number
 - Contact pipeline operator
 - Refer to DOT *2004 Emergency Response Guidebook*

B. Protect People, Property and the Environment

1. **Establish isolation zones and set up barricades**
2. **Rescue and evacuate people**
 - Evacuate or shelter-in-place
 - Administer first-aid
3. **Eliminate ignition sources**
4. **Control fire, vapor and/or leak**
 - Let primary fire burn
 - Cool surrounding structures
 - Beware hot spot re-ignition

C. Call for Assistance of Trained Personnel

1. **Contact your organization**
2. **Call the pipeline operator**
3. **Obtain national assistance**

D. Work Together with the Pipeline Operator