

PIPELINE TRANSPORTATION

In North America, hazardous materials are commonly transported through millions of miles of pipelines and related structures. Products transported include natural gas, natural gas liquids, crude oil, gasoline, diesel fuel, anhydrous ammonia, carbon dioxide, jet fuel, and other commodities. Although most pipelines are buried, often there are above-ground structures and markers indicating the presence of pipelines. First responders should be aware of the pipelines in their jurisdictions, the products they transport, and the operators responsible for those pipelines. Proactive relationships can be beneficial in the safe and effective management of pipeline emergencies.

Types of Pipelines

Natural Gas Pipelines

Natural Gas Transmission Pipelines

Large-diameter, steel pipelines transport flammable natural gas (toxic and non-toxic) at very high pressures ranging from 200 to 1,500 psi*. Natural gas in transmission pipelines is odorless — generally *not odorized* with mercaptan (the “rotten egg” smell); however, natural gas containing hydrogen sulfide (H₂S) *will* have a distinct “rotten egg” odor.

Natural Gas Distribution Pipelines

Natural gas is delivered directly to customers via distribution pipelines. These pipelines are typically smaller-diameter, lower-pressure pipelines constructed of steel, plastic, or cast iron. Natural gas in distribution pipelines *is odorized* with mercaptan (the “rotten egg” smell).

Natural Gas-Gathering and Natural Gas Well Production Pipelines

Natural gas-gathering/well production pipelines collect “raw” natural gas from wellheads and transport the product to gas-processing and/or gas-treating plants. These gathering pipelines carry natural gas mixed with some quantity of gas liquids, water, and, in some areas, contaminants such as toxic hydrogen sulfide (H₂S). Natural gas in these pipelines is *not odorized* with mercaptan (the “rotten egg” smell); however, natural gas that contains hydrogen sulfide (H₂S) will have a distinct “rotten egg” odor.

Liquid Petroleum and Hazardous Liquids Pipelines

Liquid Petroleum Pipelines

Crude oil, refined petroleum products, and hazardous liquids often are transported by pipelines and include gasoline, jet fuels, diesel fuel, home heating oils, carbon dioxide, anhydrous ammonia, and other hazardous liquids.

Many liquid petroleum pipelines transport different types of liquid petroleum in the same pipeline. To do so, the pipeline operator sends different products in “batches.” For example, an operator could send gasoline for several hours, and then switch to jet fuels, before switching to diesel fuel.

* Data from <http://naturalgas.org/naturalgas/transport/>

Other Hazardous Liquids Pipelines

Some liquid pipelines transport highly volatile liquids that rapidly change from liquid to gaseous when released from a pressurized pipeline. Examples of these types of liquids include carbon dioxide, anhydrous ammonia, propane, and others.

Pipeline Markers

Since pipelines are usually buried underground, pipeline markers are used to indicate their presence in an area along the pipeline route. Of the three types of pipelines typically buried underground — distribution, gathering, and transmission — only transmission pipelines are marked with the following above-ground markers used to indicate their route.



Markers warn that a transmission pipeline is located in the area, identify the product transported in the line, and provide the name and telephone number of the pipeline operator to call. Markers and warning signs are located at frequent intervals along natural gas and liquid transmission pipeline rights-of-way, and are located at prominent points such as where pipelines intersect streets, highways, railways, or waterways.

Pipeline markers only indicate the presence of a pipeline—they do not indicate the exact location of the pipeline. Pipeline locations within a right-of-way may vary along its length and there may be multiple pipelines located in the same right-of-way.

NOTE:

- Markers for pipelines transporting materials containing dangerous levels of hydrogen sulfide (H₂S) may have markers that say: “Sour” or “Poison.”
- Natural gas distribution pipelines are not marked with above-ground signs.
- Gathering/production pipelines are often not marked with above-ground signs.

Pipeline Structures (Above Ground)

Natural Gas Transmission Pipelines:	Compressor stations, valves, metering stations.
Natural Gas Distribution Pipelines:	Regulator stations, customer meters and regulators, valve box covers.
Natural Gas Gathering/Well Production Pipelines:	Compressor stations, valves, metering stations, wellheads, piping, manifolds.
Petroleum and Hazardous Liquids Pipelines:	Storage tanks, valves, pump stations, loading racks.

Indications of Pipeline Leaks and Ruptures

Pipeline releases can range from relatively minor leaks to catastrophic ruptures. It is important to remember that gases and liquids behave differently once they are released from a pipeline. Generally, the following could be indications of a pipeline leak or rupture:

- Hissing, roaring, or explosive sound
- Flames appearing from the ground or water (perhaps very large flames)
- Vapor cloud/fog/mist
- Dirt/debris/water blowing out of the ground
- Liquids bubbling up from the ground or bubbling in water
- Distinctive, unusually strong odor of rotten eggs, skunk, or petroleum
- Discolored/dead vegetation or discolored snow above a pipeline right-of-way
- Oil slick or sheen on flowing/standing water

General Considerations for Responding to a Pipeline Emergency

- **Safety First!** Your safety and the safety of the community you protect is top priority. Remember to approach a pipeline incident from upwind, uphill, and upstream while using air monitoring equipment to detect for the presence of explosive and/or toxic levels of hazardous materials.
 - **Always** wear proper personal protective equipment. Be prepared for a flash fire. Use shielding to protect first responders in the event of an explosion. Use respiratory protection.
 - **Never** operate pipeline valves (except in coordination with the pipeline operator); this could make the incident worse and put you and others in danger.
 - **Never** attempt to extinguish a pipeline fire before supply is shut off; this could result in the accumulation of a large flammable/explosive vapor cloud or liquid pool that could make the incident worse and put you and others in danger.
 - **Do not** enter a vapor cloud in an attempt to identify the product(s) involved.
- **Secure the site** and determine a plan to evacuate or shelter-in-place. Work with other responders to deny entry to an area.
- **Identify the product and the operator.** If safe to do so, you may be able to identify the product based on its characteristics or other external clues. Look for pipeline markers indicating the product, operator of the pipeline, and their emergency contact information. Pipelines transport many different types of products, including gases, liquids, and highly volatile liquids that are in a liquid state inside the pipeline but in a gaseous state if released from the pipeline. The vapor density of gases determines if they rise or sink in air. Viscosity and specific gravity also are important characteristics of hazardous liquids to consider. Identification of the product also will help you determine the appropriate distance for isolation of the affected area.
- **Notify the pipeline operator** using the emergency contact information on the pipeline marker or other contact information you may have received from the pipeline operator. The pipeline operator will be a resource to you in the response.
- **Establish a command post.** Implement the Incident Command Structure, as needed, and be prepared to implement a Unified Command as additional stakeholders and resources arrive.

Other Important Considerations

- If no flames are present, do not introduce ignition sources such as open flames, running vehicles, or electrical equipment (cell phones, pagers, two-way radios, lights, garage door openers, fans, door bells, etc.).
- Abandon any equipment used in or near the area of the pipeline release.
- If there is no risk to your safety or the safety of others, move far enough away from any noise coming from the pipeline to allow for normal conversation.
- Pipelines often are close to other public utilities, railroads, and highways; these can be impacted by pipeline releases or may be potential ignition sources.
- Natural gas can migrate underground from the source of a release to other areas via the path of least resistance (including through sewers, water lines, and geologic formations).

Considerations for Establishing Protective Action Distances

- Type of product
 - If you know the material involved, identify the three-digit guide number by looking up the name in the alphabetical list (blue-bordered pages), then using the three-digit guide number, consult the recommendations in the assigned guide.
- Pressure and diameter of pipe (the pipeline operator can tell you this if you don't already know it)
- Timing of valve closure by the pipeline operator (quickly for automated valves; longer for manually operated valves)
- Dissipation time of the product in the pipeline once valves are closed
- Ability to conduct atmospheric monitoring and/or air sampling
- Weather (wind direction, etc.)
- Local variables such as topography, population density, demographics, and fire suppression methods available
- Nearby building construction material/density
- Natural and man-made barriers (such as highways, railroads, rivers, etc.)

U.S. Pipeline Resources

U.S. Pipeline Locations: The National Pipeline Mapping System (NPMS) <http://www.npms.phmsa.dot.gov> indicates the general locations of hazardous liquids and natural gas transmission pipelines found within the U.S. The pipelines depicted in the NPMS are within 500 feet of their actual locations. Emergency responders may apply for an NPMS web viewer account that will allow access to more detailed information than is available to the general public. The NPMS does not contain gathering/production or natural gas distribution pipelines.

U.S. Pipeline Emergency Response Training: Where appropriate, reference Pipeline Emergencies training materials, produced by PHMSA and the National Association of State Fire Marshals (NASFM). This training guide is available at <http://www.pipelineemergencies.com> and <http://nasfm-training.org/pipeline> and offers a thorough overview of U.S. pipeline operations and emergency response considerations. Your state or jurisdiction also may provide training on how to handle the response to a pipeline incident.

Other Resources:

Pipeline Association for Public Awareness <http://www.pipelineawareness.org/>

U.S. DOT, Pipeline and Hazardous Materials Safety Administration <http://phmsa.dot.gov/pipeline>

Pipeline 101 <http://pipeline101.com/>

Canadian Pipeline Resources

Canadian Pipeline Locations: The Canadian Energy Pipeline Association (CEPA) provides the general locations of natural gas and liquid pipelines found within Canada.

<http://www.cepa.com/library/maps>