



CO₂, Oil and Natural Gas Pipelines- What's the Difference?

The production of oil and natural gas is critical in meeting our country's significant energy demands. While oil and natural gas pipelines are most common, accounting for 99% of the nation's pipeline infrastructure, the transportation of Carbon Dioxide (CO₂) via pipeline is becoming more prevalent as our nation moves towards energy independence.

The main driver for the increase of domestic CO₂ pipelines is the implementation of enhanced oil recovery utilizing carbon dioxide (CO₂ EOR), a method which increases oil production in depleting oil fields. Though the transportation methods of oil, natural gas, and carbon dioxide may be similar, these products have very distinct and differentiating characteristics.

Facts	Natural Gas	Oil	CO ₂
Colorless	YES	NO	YES
Odorless	YES	NO	YES
Transported in liquid form	YES	YES	YES
Flammable	YES	YES	NO
Toxic	YES	YES	NO ⁽¹⁾
US Mileage	350,000+	187,896	4,500

- Unlike natural gas, CO₂ is heavier than air. Therefore, in the unlikely event of a leak or release, CO₂ will dissipate slower than natural gas and could accumulate in low-lying areas, displacing oxygen in the affected area. Since natural gas is lighter than air, in the event of a natural gas leak it will quickly dissipate into the atmosphere. In the event of an oil leak, liquid pools and/or an oily sheen on water will be present around the damaged sections of the pipeline. If exposed to the atmosphere, CO₂ transported in liquid form inside of a pipeline will transform into a gas due to temperature and pressure changes.

A further differing characteristic of CO₂ is that it is odorless, unlike oil, but like natural gas in its original state. The rotten-egg smell associated with a natural gas leak actually comes from an odorant added as a safety precaution to aid in leak detection; CO₂ does not have any odorant added to it.

(1) Non-toxic but can act as an asphyxiant in large amounts.



To locate hazardous liquids and natural gas pipelines and their operators in your area, please visit the [NPMS](#). If you are a government official, you may request more detailed access specific to your county

Pipelines: The safest and most efficient means for energy transportation

While truck, rail and ship are all methods for transporting CO₂, oil and natural gas, statistically the safest and most effective mode is via pipeline. In the United States alone there are over 2.5 million miles of pipelines, enough to circle the earth over 10 times! Within the classification of regulated pipelines there are two main types - hazardous liquids pipelines and gas pipelines. Though CO₂ is non-toxic in small amounts, both crude oil and CO₂ are recognized within the family of hazardous liquids pipelines. In 2013, the Pipeline and Hazardous Materials Safety Administration reported there were over 350,000 miles of natural gas pipelines, and 192,396 miles of hazardous liquids pipelines. CO₂ pipelines account for 4,500 miles within the hazardous liquids pipeline category.

While CO₂, oil and natural gas vary in their physical properties, they are a critical component of our country's energy infrastructure and play a role in our daily lives. For more information on enhanced oil recovery utilizing CO₂, please visit www.denbury.com. For more information on oil and natural gas pipelines please visit www.aopl.org and www.ingaa.org.



Detecting a CO₂ leak and Coordinating Response Tactics

While CO₂ pipeline accidents are very rare, it is vital for emergency responders to be versed in specific information on identification and response tactics. Should a leak or release occur, systems will be shut down by the operator and the damaged section of the pipeline isolated. Given that CO₂ is colorless and odorless, it can make identification of a leak more difficult. Some general indicators of a CO₂ pipeline leak may include:

- presence of a cloud, fog or ice near the pipeline
- dead or discolored vegetation near healthy plants
- liquid or bubbles near the pipeline
- blowing of dirt or dust, along with an unusual hissing sound
- unusual musty odor

When responding to a CO₂ leak or release, emergency responders should arrive on-scene with appropriate personal protective equipment (PPE), including turnout gear, mask and a self-contained breathing apparatus (SCBA). Wearing a SCBA is a particularly critical precaution in these situations due to the risk of CO₂ displacing oxygen in the affected area. Prior to, or upon arrival, first responders should reference any pipeline maps previously

provided by pipeline operators. These maps include critical information such as the start location, product and quantity of product transported, isolation valve placement, and termination points. Maps for pipelines located in counties and parishes in which Denbury operates are available to emergency responders upon request by emailing aware@denbury.com.

Upon arrival, the scene must be evacuated quickly, and any non-essential personnel must stay away from the hazard area. One of the first steps should be the establishment of hot, warm and cold zones, a decontamination zone, and medical evaluation areas. Should there be any injuries at the scene, responders should not attempt to assess a patient's vitals in a hazardous atmosphere, but instead should evacuate the patient as quickly as possible to the cold zone or medical evaluation area for an examination. Others who may be in the area should be removed as quickly as possible.

During the response it is critical that oxygen gas detectors such as an "MSA" or "QRAE" devices are used to monitor the amount of oxygen in the atmosphere. CO₂ has a density of almost 1.5 times greater than oxygen, meaning it will congregate in confined spaces close to the ground. Due to this, proper ventilation is the most important mediation tactic that can be performed at the site of a CO₂ incident. Using positive pressure ventilation (PPV) systems found on fire trucks, or booster fans, the area can be properly ventilated in most cases. When preparing to leave the "hot zone" and enter the decontamination zone, always ensure that an oxygen deficient atmosphere does not exist prior to removing your PPE and SCBA.

For more information on CO₂ pipelines, map requests or to contact Denbury personnel in your area, please email aware@denbury.com.



Pipeline Companies & Emergency Responders – A Critical Alliance

It is imperative that a solid, trusting and open relationship exist between emergency responders and representatives of pipeline companies, especially since they share a common and overriding objective – public safety. While maintaining a regular, on-going and focused dialogue with emergency responders and other key external stakeholders is a critical component of new standards for public outreach adopted by the pipeline industry; some respected companies have seen the benefits of education and collaboration for many years.

Denbury's 4-Step Process

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One area where first responders and pipeline companies can work together is in meetings to discuss emergency planning and specifically how to join forces in the unlikely event of a pipeline-related accident/incident. At such meetings, the two groups can establish personal relationships, and match names with faces to forge a common understanding of exposures and risks. Things like specific measures for how to jointly respond to different types of accidents/incidents, or how to deal with a variety of products can also be discussed. The two parties can also work to educate each other about respective needs -- including communications, equipment and training opportunities. Annually, Denbury operations personnel will endeavor to meet face-to-face with the emergency responders dedicated to areas located within 10 miles of our pipelines

Additionally, relationships between companies and response organizations can be established through various drills and exercises. These can take the form of “stay in the room” tabletop exercises, or can involve full-scale response drills with both parties dispatching personnel to an incident scene and testing response to a hypothetical incident involving a realistic scenario. Effective drills not only provide “hands on” experience, but serve to reinforce training in a more effective and relatable manner. Progressive companies and response organizations use drills as an effective tool in forging a common understanding of such elements as the Incident Command System (ICS) structure, measures for establishing command posts, means for testing communication methods and protocols, steps for coordinating humanitarian assistance efforts, and for jointly determining how they will work together to meet media and public requests for information.

As is the case with any type of successful relationship, to be most effective in responding to an emergency situation, it is vital that both companies and response organizations share a common commitment and comfort level with each other BEFORE an emergency occurs. Such commitment requires effort and focus from both sides, as well as innovative approaches in training and dialogue. Ideally, communication is never-ending, and is an open dialogue between both parties.