Environmental and Energy Study Institute

Fact Sheet

Shale Gas and Oil Terminology Explained:

Products and Byproducts

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The most common way to retrieve natural gas and oil from shale formations is through hydraulic fracturing, or fracking. Fracking involves injecting fluid into a body of rock to create fissures from which natural gas and oil can be extracted. While fracking has been credited with opening an extremely large amount of previously unrecoverable fossil fuels, the development of shale gas and oil formations, called "plays" in industry jargon, can involve many different types of products, byproducts, and wastes. This factsheet describes some of the most common in shale gas and oil development.

WET GAS AND DRY GAS

- **Dry gas** is natural gas, consisting primarily of methane that has little or no liquid hydrocarbons or condensate. Dry gas is produced from wells with very little condensate or liquid reserves.
    - **Hydrocarbons** are chemicals that consist of carbon and hydrogen. Higher hydrocarbons such as ethane, propane, and butane are isomorphic to methane, meaning they have the same elemental composition but feature more complex bonds.
- **Wet gas** is a mixture of gas that includes methane and higher hydrocarbons that become liquefied.[1]
- Wet gas typically contains less methane and more ethane and other hydrocarbons than dry gas.
    - Wet gas is more attractive to drillers because additional hydrocarbons are often marketable. Natural gas can include up to 20% ethane, butane, and propane. These gases can be useful in enhancing the efficiency of oil recovery in wells, as raw materials for petrochemical plants, and as energy sources.[2]
    - Wet gas is the primary source of ethane, which can be converted into ethylene—an important compound in many industrial production processes—through thermal processing and steaming.[3]

GASEOUS WASTES

- Raw natural gas sometimes contains **hydrogen sulfide** (H2S), a toxic gas that is sometimes vented from wells. Unlike other gases frequently emitted from wells, such as methane, hydrogen sulfide carries a recognizable odor (like rotten eggs).
- **Sulfur dioxide** (SO2) is another gas that is emitted in the process of hydraulic fracturing—although in very low amounts compared to coal-burning. SO2 is highly reactive and poses many known risks to human health.[4]
- **Methane** (CH4), often the main product of hydraulic fracturing with many economical uses, is often released as a byproduct of oil shale fracking because recovering the oil is more profitable.
- **Carbon Dioxide** (CO2) is released as a waste product that is separated from methane at the processing facility.[5]

LIQUID WASTES

- The disposal of flowback water or produced water—water that has already been used to fracture shale rock—is an important concern. **Produced water** typically contains at least 26 chemicals. Some are carcinogenic, such as benzene.

- The high injection pressure used during hydraulic fracturing prevents full recovery of fluids. Thus, many chemicals are never removed from the ground.[6]
- The chemical composition of produced water is affected by surrounding geological formations.
    - Deep wells tend to produce more salinated water—which can harm the health and productivity of the soil where it is deposited.[7]
    - Some regions, such as areas of the Marcellus shale formation in the Northeast United States, contain minerals with elements that form acids when weathered, such as *pyrite* and *sulfides*. Exposed pyritic shales could cause metal mobilty, acid generation, and salination.[8] Some fracturing can cause the leaching over of various materials, creating additional toxicity in this produced water.
- **Radioactive elements** such as radium and uranium occur naturally deep in the ground. These can be disturbed during drilling and included in produced water.[9]
    - Over 179 hydraulic fracturing wells produce wastewater with high levels of radiation. Over 116 facilities report levels of radioactive chemicals 100 times higher than permitted by federal regulation.[10]
    - Most sewage treatment plant operators lack the capacity to remove enough radioctive chemicals to discharge water that meets federal standards for drinking water. Radioactive produced water is often treated in plants that are not designed to deal with levels of radioactivity observed in the water from hydraulic fracturing wells.[11]
    - Consuming radioactive elements directly through drinking water, or by eating contaminated fish or farm produce, is a cause of cancer.[12]
- Depending on state regulations, discharged produced water could end up on land, roads, percolation pits, commercial facilities, or aquifers.[13] Restrictions and requirements for casing on pits for discharged produced water depend on state regulation.

This fact sheet is available electronically at www.eesi.org/papers.

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[2] "Natural Gas.org: Background" http://www.naturalgas.org/overview/background.asp
[3] From Natural Gas to Ethylene via Methane Homologation and Ethane Oxidative Dehydration" http://www1.eere.energy.gov/industry/chemicals/pdfs/ng_ethylene.pdf
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[11] "Regulations Lax as Wells' Tainted Water Hits Rivers" http://www.nytimes.com/2011/02/27/us/27gas.html
[12] "Radioactive Fracking Waste Threatens Drinking Water" http://www.growwny.org/whats-new/610
[13] "Strategic Produced Water Management and Disposal Economics in the Rocky Mountain Region." http://www.gwpc.org/meetings/special/PW%202002/Papers/Deidre_B_Boysen_PWC2002.pdf