# Hydraulic Fracturing - A Further Step to Foreign Oil Independence

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Any country that is dependent on an outside supply for their energy needs would love to reduce fuel imports and tip the balance of power in the global energy market. Across Europe, Latin America, Africa and the Asia-Pacific regions a number of countries have unconventional natural gas resources that could be released by hydraulic fracturing and offer new hydrocarbon supplies. To date, North America is the only one producing shale gas commercially.

The lack of development in some countries is in part due to environmental and safety concerns as seen with France's July 2011 decision to stop natural gas exploration. The public is concerned that hydraulic fracturing could contaminate drinking water with drilling chemicals, gas leaks or radioactive elements released from the shale. In dry regions such as western China, the amount of water needed for the fracturing process is also an issue.

Some of these concerns could be alleviated with on-site environmental testing and systems that treat the wastewater for proper disposal or reuse, especially in areas where water scarcity is an issue. Oil in water testing is often one of the first measurements needed for handling of wastewater from hydraulic fractioning (also known as frac water). On-site oil in water analysis can give results in minutes rather than the few days or a few weeks that it takes to get an off-site laboratory result. Getting information quickly can help gas well operators make necessary adjustments to optimise wastewater treatment.

Wastewater from hydraulic fracturing is either flowback water or produced water. Flow back water is what comes back out of the well once the water/chemical mix has been pumped in, to physically fracture the shale to release the gas. While it has a high volume (as much as 3,000 barrels per day) [1] it only flows back for one day to a couple of weeks. Flow back is a mixture of fracture fluid and water from the shale formation containing solids, metals, salts, chemical additives and trace amounts of oil. Once the well is producing, naturally occurring water comes to the surface as "produced water" gradually decreasing to a few barrels per day[2]. Produced water has high levels of Total Dissolved Solids (TDS), minerals such as barium, calcium, iron and magnesium that are leached out of the shale along with dissolved hydrocarbons[3].

Wastewater management options include evaporation ponds, removal to an off-site treatment facility, injection into disposal wells, and treatment for reuse in hydrofracking or for surface discharge. Each option has maximum levels of free or dissolved oil that will be accepted.

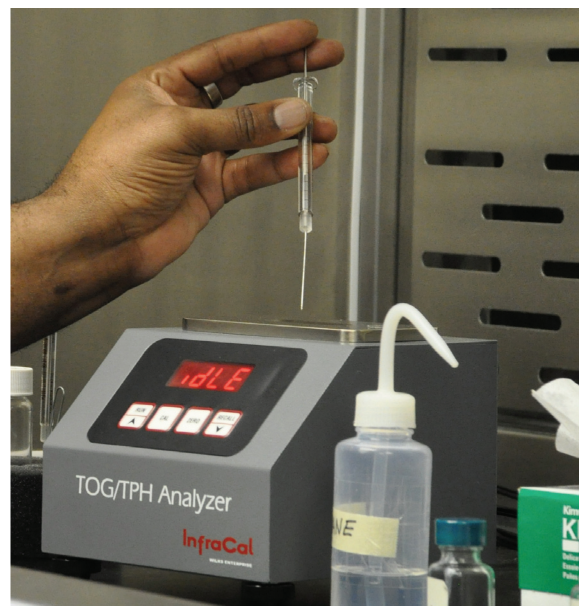
Evaporation ponds are often employed for frac water disposal in arid areas. The amount of oil in the water must be controlled to avoid an oil film or sheen as it will reduce the evaporation efficiency. In some locations frac water is sent to public treatment plants for processing which have limits for the amount of oil and grease their systems can handle.

If flowback or produced water is going to be recycled and reused for hydrofracking, treatment will usually be required. Free oil (oil carryover) averages around 300 ppm. The level preferred for fracturing is less than 30 ppm. Common treating methods include hydrocyclones, ozone, aeration, chlorine dioxide, skimmers and separators [2].

TDS removal may be needed for frac water reuse and is necessary for surface discharge disposal. The two most common methods to lower TDS levels are either membrane or thermal technologies.

Membrane technologies require the removal of oil in order to prevent fouling of the membrane surfaces. While membrane manufacturers have developed different schemes to prevent oil fouling, many chose to have on-line oil in water systems to alert operators of high oil levels. On-line systems may be sensitive to other chemicals present other than oil, as well as concentrations of sand or dissolved gas. They are also typically dependent on regular automated cleaning and scale can sometimes build up in spite of the cleaning. To ensure the membrane does not foul, it is wise to have an at-line analysis to periodically check that the on-line system is functioning properly.

For TDS levels higher than a membrane system can handle (typically above 40,000 mg/L[4]), thermal evaporation and crystallisation systems may be the only option. In a thermal system, coarse solids and free oil are usually separated prior to evaporation.




In each case where treatment systems can only tolerate a specific level of oil in the water, an on-site oil in water tester is a valuable asset to ensure that the oil/water separator is removing the oil to the required limit. Infrared oil in water analysers, such as the Wilks InfraCal TOG/TPH Analyzer in photo 1, have been used in the petrochemical industry for more than 40 years. Many off-shore oil rigs worldwide use infrared analysis as an on-site test to confirm that the produced water is within the accepted limit required to pump overboard. The same technology is ideal for testing the wastewater from hydraulic fracturing as the analysis does not require a skilled laboratory technician and can be done on-site in less than 15 minutes—reducing the cost and delay of laboratory analysis.

Infrared analysis can also be used for TPH in soil if a spill or pond leak occurs to determine the extent of contamination or verify that groundwater has not been affected helping ensure environmental compliance as well as ease public concerns.

The amount of water used in hydraulic fracturing and the potential for drinking water contamination has put a negative spotlight on the oil and gas industry. Reusing water where economically feasible and mitigating environmental risks will help to reinforce a good public image. Quick and simple on-site oil in water testing is one piece that can help boost environmental stewardship as well as ensure smooth wastewater treatment procedures for operators at the well site.

1 United States Environmental Protection Agency, Draft Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources EPA/600/D-11/001/February 2011/www.epa.gov/research.

2 King, George E., Estimating Frac Risk and Improving Frac Performance in Unconventional Gas and Oil Wells, Apache Corporation, January 23, 2012

3 Shramko, Andrea; Palmgren, Tor; Gallo, Daniel; Dixit, Rahul; M-I SWCO, Analytical Characterization of Flowback Waters in the Field, 16th Annual Petroleum & Biofuels Environmental Conference (IPEC), Houston, Nov 2009.

4 National Energy Technology Laboratory (NETL), Produced Water Management Technology Descriptions, Fact Sheet-Thermal Distillation, http://www.netl.doe.gov/technologies/pwmis/techdesc/thermal/index.html