

Managing Risks Associated with Water Re-Use in the Unconventional Oil and Gas Sector: Knowing Your NORMs

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Water conservation and reuse are becoming increasingly important for unconventional oil and gas operations employing multi-stage hydraulic fracturing, as water reliability decreases and water regulations become more stringent. Reuse of hydraulic fracturing flowback and produced water can reduce a producer's fresh water consumption, trucking and disposal costs, as well as provide water security during periods of limited water supply (i.e., droughts). However, there are several challenges and risks associated with reuse of frac flowback and produced water. These include:

- Variability in flow volumes
- Changes in water quality over time
- Logistics related to storage, transport, and eventual disposal
- Capital costs of supporting infrastructure
- Environmental considerations
- Health and safety of field personnel

An emerging risk associated with flowback and produced water re-use is the presence of carcinogenic naturally-occurring radioactive materials, or NORMs, that can accumulate and pose health and safety concerns. Although NORMs are present everywhere in our environment, the process of hydraulic fracturing of the gas and liquids-rich shale deposits has the ability to liberate NORMs present in the rock material. The most common species include ^{210}Pb ($t_{1/2} = 138$ days) and ^{226}Ra ($t_{1/2} = 1600$ yrs). In Western Canada, the occurrence of NORMs in flowback and produced waters has been confirmed in both the Duvernay and Montney plays of northwest Alberta and northeast BC. Following the hydraulic fracturing process, fluids containing NORM are returned to surface where they interact with piping and treating equipment, and eventually make their way into lined storage ponds. In oil and gas operations, NORMs accumulate in sludges, solids, and scale present in tanks, ponds, and process piping. As such, areas of the system with increased residence times can facilitate a build-up of these constituents to hazardous levels. Fortunately, most of the NORMs tend to become sequestered in the solid phases, but this produces a risk when these solids are handled and/or disposed.

Reuse of flowback waters typically requires treatment processes such as precipitation and filtration, which can result in a concentrated waste high in NORM content. As such the handling and transport of such wastes can present a hazard not only to workers, but also to the environment should a spill occur while in transit for safe and proper disposal. Although the level of shale gas activity in Western Canada is currently low, future development of these vast resources could lead to cumulative issues and challenges with NORMs management. As such, proactive risk assessment and management processes are of benefit.

This presentation will introduce some of the physical and chemical properties of the more common NORMs related to shale gas development, and discuss the risks and mitigation strategies required to develop a water management plan to ensure the safety of workers and protection of the environment.

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