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Foreword

Foreword to 'Fracking: Environmental Challenges and Solutions for Unconventional Oil and Gas Development' Research Front

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The amalgamation of advanced horizontal drilling and multistage hydraulic fracturing has enabled the economic feasibility of oil and gas recovery from unconventional resources. Fossil energy from these unconventional resources is the fastest growing component of new supplies of oil and gas. In addition to extensive use of these technologies in the United States, there are many new unconventional oil and gas resources that are being exploited in Asia, Europe, Australia and Africa. These developments have generated public concern over the potential for adverse social, environmental and human health impacts.

As the environmental challenges and solutions for oil and gas development are emerging and growing, accumulation of the initial scientific body of research addressing environmental issues is underway. This is an important time to highlight significant findings.

In this Research Front, Gregory and Mohan[1] provide an overview of issues associated with well casing and cementing, hydrological fracturing, and the chemistry and management of produced waters, for the general reader who may be unfamiliar with this topic. This is followed by three original research articles. Tang et al.[2] report on a combined chemical and bioanalytical assessment of water associated with coal seam gas (CSG) in Australia. They found that, in addition to high concentrations of sodium, chloride and bicarbonate, the waters contained low concentrations of polycyclicaromatic hydrocarbons (PAHs). However, the observed concentrations of PAHs and other constituents explained only 5% of the observed effects on induction of several stress response genes in bioassays. Regardless, the observed responses were similar to those observed for treated wastewater effluent, storm water or surface water. Payne et al.[3] describe the toxicity of CSG-associated water to human gastrointestinal cell lines. Although acute cytotoxicity was observed in this study, it was found that a 5-fold dilution of the water would reduce toxicity to below the threshold of the assay. The authors point out that there are many possible fracturing fluid mixtures that should be characterised; in some cases these mixtures can contain up to 80 chemical constituents posing a challenge for regulators. Their assay is offered as a potential screening tool, although they indicate that other cell types and endpoints should be evaluated. Finally, Monzon et al.[4] report on the use of microbial fuel cells (MFCs) to treat hypersaline-produced water and to generate electricity. Based on pyrosequencing data, they identified a single genus (*Halanaerobium*) that constituted ~86% of the microbial community colonising the anode of the MFC. The study demonstrates the feasibility of this technology to treat produced waters and suggest avenues for future research.

Together these articles clearly outline some of the challenges associated with understanding the chemistry and toxicity of produced waters, as well as some of the potential solutions to assessing and mitigating their risks.

References

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