

Assessment of Water Quality and Genotoxicity Downstream of NPDES Oil and Gas Produced Water Discharges

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Abstract. The water generated from oil and gas (O&G) reservoirs, called produced water (PW), is the largest volume waste stream associated with O&G extraction, with over 3 trillion liters produced annually in the U.S. Because of its origins, PW contains elevated levels of toxic petroleum hydrocarbons, salts, heavy metals, naturally occurring radioactive materials and any remaining drilling, stimulation or well maintenance chemicals. Many water-scarce western states can take advantage of the National Pollutant Discharge Elimination System (NPDES) which permits PW to be released to the environment for agricultural uses if it is "of good enough quality." This requirement is not clearly defined through permissible concentrations, however, and the locally and temporally varying composition of PW discharges is largely unknown. The goal of this project is to characterize potential environmental and health impacts of PW discharges on downstream water quality. PW-impacted water samples have been collected from 30 different locations throughout an oil field in Wyoming. Contaminants of concern were identified using various advanced analytical techniques to conduct non-targeted analysis. Additionally, bioassays were used to quantify genotoxicity. Preliminary results show increased mutation rates (8-10 fold) in PW-impacted samples as compared to unimpacted upstream water samples. Ethoxylate surfactants, chemicals commonly used in stimulation and well maintenance processes, have also been found in samples with increased mutagenicity. The results of this study will be used to assess the efficacy of treatment strategies between operators, and ultimately help regulators to effectively and safely manage produced water discharges for beneficial use.