

An Integrated Treatment System of Bio-processing and Membrane Separation for Beneficial Use of Produced Water

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The production of natural gas and petroleum from conventional wells results in the release of produced water in substantial quantities. Produced waters can contain significant levels of inorganic and organic constituents and its management is a major problem in oil and gas production because large volumes are produced in dispersed locations. This water is primarily composed of dissolved (and some entrained) hydrocarbons such as BTEX and total dissolved solids (TDS) such as salts. The produced water is primarily disposed via salt-water disposal (SWD) wells, which are deemed to be geologically isolated from potential sources of drinking water. Other management options such as surface discharge, surface evaporation, freeze thaw followed by surface treatment are also practiced but to a lesser extent.

The Gas Technology Institute (GTI) has been conducting and/or sponsoring research with a goal to treat the produced water for beneficial use by employing an integrated system consisting of biological degradation of hydrocarbons followed by membrane separation of dissolved salts. The most appropriate biological system, in general, was determined to be granular activated carbon based fluidized-bed reactor (GAC-FBR). Depending upon the TDS concentration, the separation techniques may include electrodialysis or nanopore separation, followed by reverse osmosis. The cost of such integrated systems can be highly attractive when used with current communication and process-feedback technologies for remote and/or dispersed operations. This paper will discuss technical results and the business model to achieve cost-effective treatment.