

THE FREEZE-THAW/EVAPORATION (FTE[®]) PROCESS FOR THE COMMERCIAL TREATMENT AND BENEFICIAL USE OF OIL AND GAS PRODUCED WATER

John E. Boysen, Deidre B. Boysen and Timothy J. Larson

Biographical Sketch of Authors

All three authors are employed by BC Technologies, Ltd., an environmental services consulting firm in Laramie, Wyoming. John Boysen, a Chemical Engineer and President of the company, has been involved with the research, field testing and commercialization of the Freeze/Thaw Evaporation (FTE[®]) Process for treating produced water since the concept was first developed in the 1990s. Tim Larson and Deidre Boysen have assisted with permitting and reporting requirements associated with the operation of the FTE[®] commercial facilities.

Abstract

Evaporation ponds are often used to dispose of oil and gas produced water in arid regions. But, in many arid locations, climatic conditions promote seasonal freezing which renders evaporation ineffective. However, freezing of water is a crystallization process that can also be used to purify produced water. In 1992, research sponsored by the US Department of Energy and the Gas Research Institute to develop a commercial freeze-thaw/evaporation (FTE[®]) process for treatment and disposal of produced waters was initiated

The basic concept of the FTE[®] process is simple. Constituents in the produced water lower the freezing point below that of pure water. When such a solution is cooled below 32⁰F, relatively pure ice forms, along with an unfrozen solution containing elevated concentrations of constituents. The purified ice and brine are easily separated by density. Coupling of the processes of freezing and evaporation makes the FTE[®] process a more economic and effective method for the treatment and disposal of produced water by allowing year-round facility operation. Since the process requires essentially the same equipment as conventional evaporation, it simply allows more water to be processed in an evaporation facility by operating at times when evaporation is ineffective. The treated water is suitable for uses such as livestock water, as well as uses in construction, dust abatement or irrigation. Importantly, reduced water treatment/disposal costs can result in increased production from economically marginal oil and gas resources. This paper provides details regarding the successful commercial development of the FTE[®] process.