

Patented Evaporation & Crystallization Process



Timeline

- 2009 – Facility was constructed under previous ownership
 - Q4 2009 – Venture Engineering & Construction, Inc. (“Venture”) hired by previous ownership to manage construction and commissioning
 - Late 2009 – Operations begin (3,500 bbl/day facility)
- 2010 - Facility encounters increasing and severe metallurgical issues
 - Facility shuts down due to improper materials of construction and process issues
- 2012 - Facility is acquired by Fairmont Brine Processing, LLC (“FBP”)
 - Venture is hired to redevelop the facility as a 4,000 bbl/day plant
- 2013 - Pretreatment operations commence
- July 1, 2014 - Evaporation & Crystallization process operations commence
- **October 1, 2014 – Sold 100% of the plant capacity under two take or pay contracts (4,000 bbls /day) through end of 2016.**



Patent & Permits

- **United States Patent**
 - **US 8,535,538 B1**
 - **20 Years**
 - **Brine Recycling Process**
- National Pollution Discharge Elimination System (NPDES)
 - NPDES Permit #01164086554
- United States Environmental Protection
 - US EPA ID #WVR00521948
- West Virginia Department of Environmental Protection
 - WVDEP Air Permit #R13-2794



Market Needs

- Deep Well Injection (\$4.00/bbl plus trucking) Often \$15+/bbl all in.
 - Technically Enhanced Seismic Activity
 - Induced earthquakes becoming a more common occurrence
 - Capacity not sufficient to handle future volumes
 - Sequesters Water Underground
 - Trillions of gallons of recoverable water being injected beneath the earth's surface
- **In The Year 2027**
 - 38,041 wells in both Pennsylvania and West Virginia
 - 382,944 bbls of fluid will need to be disposed of on a daily basis (PADEP 2012)
- Fairmont Brine provides a cost comparable, environmentally responsible alternative to deep well injection
 - Contracts range from \$6.00 to \$7.50/bbl plus trucking
 - Most clients within 60 miles which limits trucking cost
 - Expansion of Plant 1 on-going (10,000 bbls /day)
 - Negotiating 35,000 bbl /day plant with an E&P on a 5 year take or pay commitment



Process Overview

- Nameplate 4,500 bbls /day
- Pre-treatment to remove Barium, O&G, TSS
- Equalization
- Multiple Effect Evaporation (3 Effects)
- Centrifugation and Drying
- Storage of distilled water for cooling and reuse
- Storage of dry sodium chloride rock salt
- Storage of liquid calcium chloride
- Design Feed Total Dissolved Solids (TDS) 17%
 - TDS is a measure of total salt content



Multiple Effect Evaporation

- **Principle of Operation:**
 - Takes advantage of the relationship between boiling point and pressure (boiling point increases with increase in pressure, and decreases with decrease in pressure)
 - Horizontal shell & tube heat exchangers, suppressed boiling type evaporation, feed forward
 - Effect 1 is boiler steam driven (Elevated pressure)
 - Water boiled in Effect 1 used as energy to drive Effect 2 (lower pressure than Effect 1)
 - Water boiled in Effect 2 used as energy to drive Effect 3 (lower pressure than Effect 2)

BYPRODUCTS

- Distilled Water
 - Reused in the drilling & fracturing process
 - Discharged under NPDES
- Sodium Chloride
 - Dry rock salt for de-icing of roads, as well as the chlorine and caustic soda manufacturing sector within the chemical industry
- Calcium Chloride (“Heavy Brine”)
 - 10.2+ PPG
 - Freeze point -10 to - 25 F
 - Reused in the drilling and hydraulic-fracturing process
 - De-icing of roads and coal piles
 - Dust suppressant
 - Ballast for tractor tires

What is Unique?

- Dissolved salts also change the boiling point, as a function of concentration, and composition.
- Mixed salt composition increases the challenge
- As the concentration or composition of salt changes in the feed and throughout the process, operating parameters must be adjusted or boiling will stop
- Careful process control is required
- Byproducts are recycled for reuse

There are no other Evaporation & Crystallization plants operating on flowback and produced water!

Questions?

As an Alternative To Deep Well Injection, Fairmont Brine Processing Provides Environmentally Responsible Water Treatment Solutions To the Oil & Gas Industry

