

TETRA[®] Higgins Loop[™] Continuous Ion Exchange CBM Produced Water Purification

Coal Bed Methane (CBM) production requires the pumping of water along with the gas. This produced water, separated from the gas in the borehole, contains high levels of sodium (Na) and sometimes chlorides (Cl) and sulfates (SO₄). More stringent federal and state water regulations now prohibit the discharge of this water into the environment or its use for irrigation due to its high salt content. The Higgins Loop[™] Continuous Ion Exchange (I-X) Technology from Severn Trent Services offers a proven, economical and efficient process for the purification of produced waters without the generation of hazardous wastes or large byproduct streams.

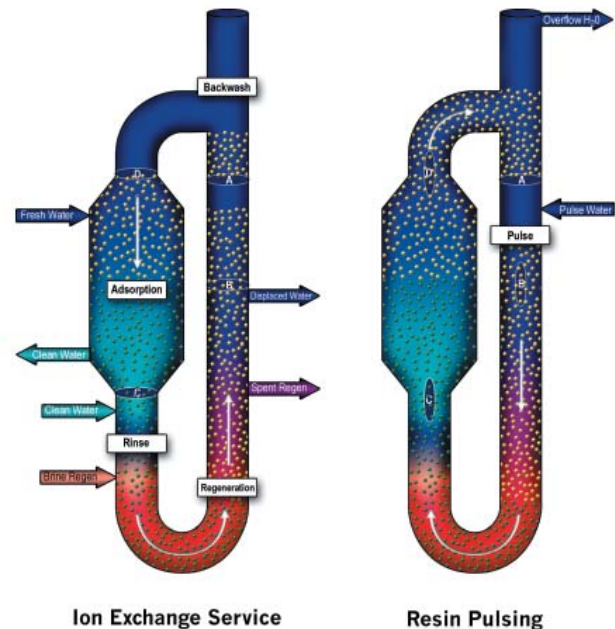
How CBM Purification Works

Produced water containing high Na levels is fed to the adsorption zone within the TETRA[®] Higgins Loop[™] where it contacts strong acid cation resin which loads Na ions in exchange for hydrogen (H) ions. Treated water exits the loop containing less than 10 mg/L Na.

Concurrent with adsorption and in the lower section of the Higgins Loop, Na-loaded resin is regenerated with either hydrochloric or sulfuric acid to produce a small, concentrated spent brine stream. Regenerated resin is rinsed with water prior to reentering the adsorption zone to remove acid from its pores.

As resin in the upper layer of the adsorption zone becomes loaded with Na, the flows to the Higgins Loop are momentarily interrupted to allow advancement of the resin bed (pulsing) through the loop in the opposite direction of liquid flow. Liquid flows are restarted after resin pulsing is complete.

Treated water is slightly acidic due to its increased H ion strength, and it is neutralized with limestone which also increases its calcium concentration so that the water's sodium adsorption ratio (SAR) is less than 1.0. Spent brine containing removed Na ions has a density high enough for use as a kill fluid.



Service

EMIT Water Discharge Technologies (www.emittechnologies.com) is aligned with Severn Trent Services to provide the Coal Bed Methane industry with full service for produced water purification in Wyoming and Montana. With over 20 years of experience in oil and gas production operations, EMIT has developed a comprehensive service program to meet the needs of the industry.





Higgins Loop™ Continuous I-X Process

Higgins Loop Systems use conventional ion exchange technology in a unique manner. Commercially available cation and anion resins are used to purify produced water of sodium, chloride, sulfate and other ions in both a continuous and countercurrent operating mode. These chemical engineering principles of mass transfer maximize the resins' abilities in purifying water with a consistent quality. They also optimize the use of acid and alkali regenerants, minimize their volumes and generate a dense brine solution that can be used as a clear brine fluid within the oil and gas industry. The key to the Higgins Loop features is its ability to move the resin through the loop via incremental "pulsing". The pulse vessel serves as a resin flow meter to ensure its flow is in proportion to the water treated and the amount of regenerant consumed.

System Features

- Proven Efficient Technology – 50 years experience
- Treated Water Meets NPDES Permit Requirements – Low Na water has low SAR
- Byproduct Value – High density spent brine kill fluid
- Variable Feed Conditions & Operating Periods – Insensitive to start/stop, flow & pH changes.
- Simple, Unattended Automated Process – The system operates continuously with little attention.
- Patented Process (US Patent No. 7,273,555)

System Benefits

- Low Treatment Costs – <20¢ per barrel of produced water in many applications
- No Wastewater Generation – All service water recycled
- Beneficial Use of Treated Water – Irrigation, grazing & potable water source
- Environmentally Attractive – Regulatory compliant quality



EMIT Services

- Process produced water to a compliant specified discharge quality
- Site preparation assistance
- NPDES permitting assistance
- Provision of all equipment & chemicals
- Operations & maintenance
- Disposal of generated spent brine
- QA/QC – compliance monitoring and reporting

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