

Treating SAGD Blowdown with the SaltMaker Evaporator Crystallizer

Steam assisted gravity drainage (SAGD) blowdown water from three operating sites was treated using Saltworks' SaltMaker Evaporator Crystallizer. The energy efficient treatment system reduces the cost of blowdown transport and disposal. The SaltMaker produces a low volume solid that could be disposed at a Class II landfill and recovers freshwater for reuse.



SaltMaker Evaporator Crystallizer Test Pilot

SAGD and the Issues with Blowdown Water Management

Steam assisted gravity drainage (SAGD) is an enhanced oil recovery process that uses injected steam to reduce bitumen viscosity and increase oil production. This process generates produced water alongside oil production and recycles the water as much as possible before 'blowdown' is required. Blowdown purges dissolved solids and organics from the SAGD water balance so they do not accumulate to a detrimental level in the recovery process. The majority of SAGD operators dispose their blowdown waters in deep wells and withdraw fresh or slightly saline water to make

up the loss. Increasingly, operators truck their blowdown water to deep wells, resulting in high operating costs and associated environmental impacts. Blowdown management can be the second largest cost of production, after natural gas usage to generate steam. As a result, operators are looking for on-site blowdown water treatment solutions to remove freshwater from the blowdown for re-use, and condense all waste to solids for safe and lower cost disposal in certified landfills.

Conventional crystallizer systems have been trialed with limited success due to plugging from the highly saturated mixed ionic-organic chemistry, high energy demands, and the requirement for a gas fired drier to complete the final solids production.

Dealing with SAGD Blowdown: The SaltMaker Evaporator Crystallizer

Saltworks' SaltMaker was proven to reliably treat SAGD blowdown to recover freshwater for reuse and produce solids suitable for disposal in Class II (non-hazardous) landfills. Both Once Through Steam Generator (OTSG) and evaporator blowdown were successfully trialed with four active SAGD operators.

The SaltMaker is a low temperature crystallizer (<90°C) that was designed from the ground up to treat and produce solids from the toughest waters. The zero liquid discharge system uses low grade waste heat in multiple effects to reduce energy consumption and operating costs. Since there is no steam in the process, steam ticketed operators and time-consuming certifications are not required during installation and maintenance.

The SaltMaker uses humidification-dehumidification (HDH) principles for low temperature operation, providing three fundamental design benefits at the expense of footprint: (1) process components built from engineered plastics that remove corrosion concerns and scaling/fouling concerns; (2) high circulation rates that provide a scouring effect on highly saturated flows; and (3) sensible heat transfer in place of boiling, which removes troublesome tube scaling.

Also, full automation and intelligent cleaning operations built into the SaltMaker measure scaling potential and initiate automated cleaning cycles prior to irreversible scaling. The modular design is based on ISO shipping container blocks for low cost rapid dispatch, installation, and expansion. Modules can be slid in and out for simple inspection without confined spaces. A standard S125 SaltMaker has a capacity of 125 m³/day water removed. High capacities can be achieved by adding more S125 plant blocks.

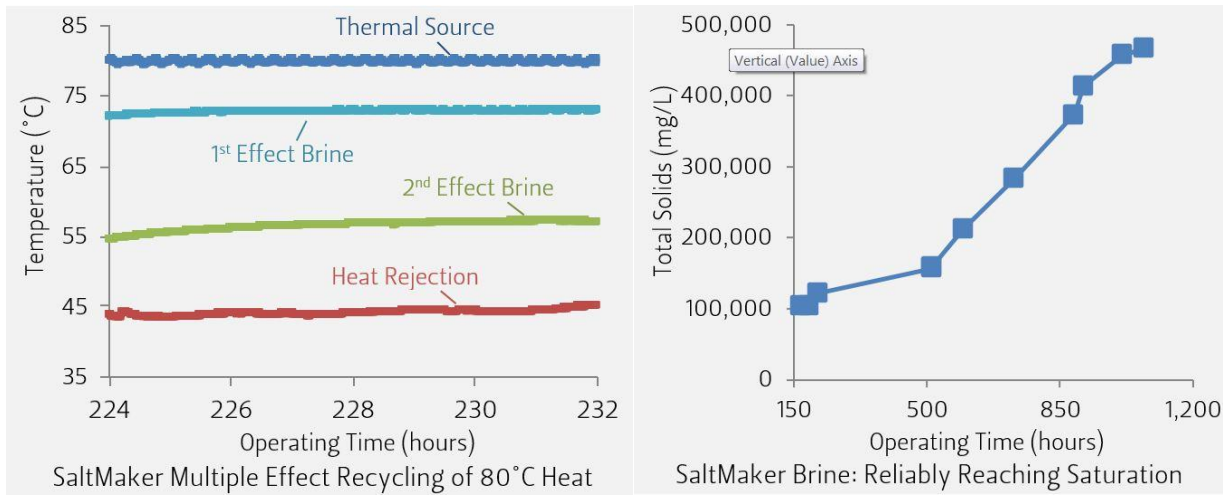
Results from Four SAGD Evaporator Blowdown Treatment Pilots

Three different sources of SAGD evaporator blowdown were tested, alongside one source of OTSG blowdown. The testing included a 60 day onsite pilot test at a SAGD facility in Fort McMurray in the middle of winter. All SaltMaker pilot tests reliably operated 24/7. Saltworks' patented non-scaling design and self-cleaning systems were paramount to operations. In addition, when coupled with the SaltMaker's patented low temperature solids production and extraction system, the plant solved a major SAGD problem: continuous solidification and extraction of both ionic and organic components preventing accumulation that results in gelling or plugging of conventional systems.

The project results are as follows:

- High quality freshwater recovered (<500 mg/L TDS).
- Continuous and reliable production and extraction of solids. Analytical tests demonstrated solids met applicable requirements (e.g., paint filter test, leachable metals, BTEX, pH, and flashpoint) for disposal at a non-hazardous Class II landfill.
- Reliable operation and non-scaling / no-plugging with automated self-cleaning, confirmed by complete plant autopsies after each trail.
- Recycling of the heat through multiple effects for energy efficiency.

CASE STUDY: Treating SAGD Blowdown with the SaltMaker Evaporator Crystallizer



Raw blowdown (left) and SaltMaker condensed water (right)



SaltMaker solids suitable for Class II landfill disposal

Parameter (mg/L)	Raw Evaporator Blowdown	SaltMaker Concentrated Brine	SaltMaker Recovered Freshwater
pH	9.5 - 11.5	9.23	7.44
Total Dissolved Solids	90,000 - 300,000	413,000	55.6
Total Suspended Solids	50 - 30,000	2,152	<2
Hardness (as CaCO ₃)	35 - 1,500	3,960	1.00
Total Organic Carbon	15,000 - 50,000	60,500	133
Alkalinity	25,000 - 70,000	81,400	43.0
Calcium	10 - 400	1,580	0.313
Chloride	5,000 - 150,000	137,000	11.9
Magnesium	1 - 5	3.7	<0.05
Silica (Reactive)	100 - 25,000	379	0.317
Sodium	15,000 - 150,000	140,000	12.5
Sulfate	500 - 15,000	2,490	2.57

Data from treating raw evaporator blowdown using the SaltMaker Evaporator Crystallizer

The pilot projects demonstrated that the SaltMaker can reliably and efficiently recover freshwater and produce solids from SAGD blowdown waters. Saltworks can complete a SaltMaker performance and economic assessment of your blowdown water treatment project. Contact us today to get started on your project: projects@saltworkstech.com.