

CASE STUDY: SAGD Blowdown

At a Glance

Industry:

Steam assisted gravity drainage (SAGD)

Wastewater:

Evaporator & once through steam generator (OTSG) blowdown water

Treatment

Requirements:

Production of freshwater for reuse or surface discharge and solids

Product:

SaltMaker

Results:

Produced high quality freshwater (<500 mg/L TDS) and compact solids for non-hazardous landfill disposal

Economics:

Water chemistry and scope dependant. Lower cost than operating a crystallizer or trucking offsite to a deep well.

Challenge

Steam assisted gravity drainage (SAGD) uses injected steam to reduce bitumen viscosity and increase oil production. SAGD generates produced water alongside oil production, with the water recycled 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. The vast 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 must truck their blowdown water to deep wells, resulting in high operating costs and the 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 seeking at-site blowdown water treatment to remove freshwater from the blowdown for re-use, and condense all waste to solids for safe and low volume disposal in certified landfills.

Conventional crystallization 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. SAGD sites often have abundant waste heat in the 80°C range and require large cooling systems to reject this heat. Ideally, this heat would be rejected through a water recycling system that would beneficially produce freshwater and reduce waste volume to a stable and packable solid.

Solution

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

The SaltMaker is a low temperature crystallizer (<85°C) that was designed from the ground up to treat and produce solids from the toughest waters. The SaltMaker uses low grade waste heat in a multiple effect system to reduce energy consumption and operating costs. Since there is no steam in the process, steam ticketed operators and time consuming certifications during installation and maintenance are not required.

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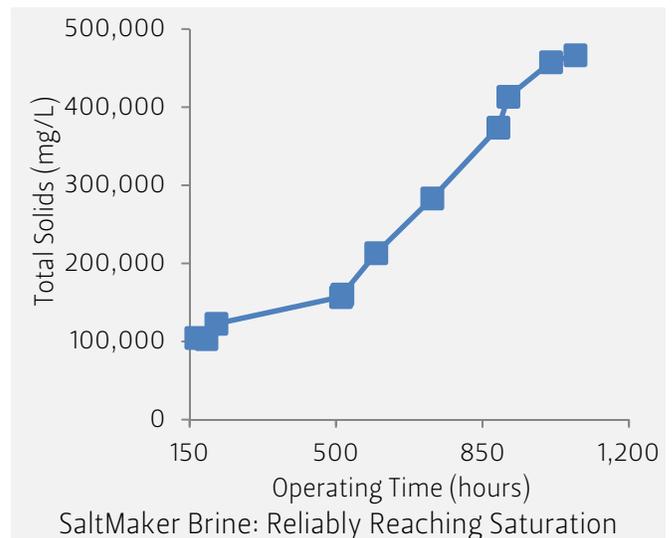
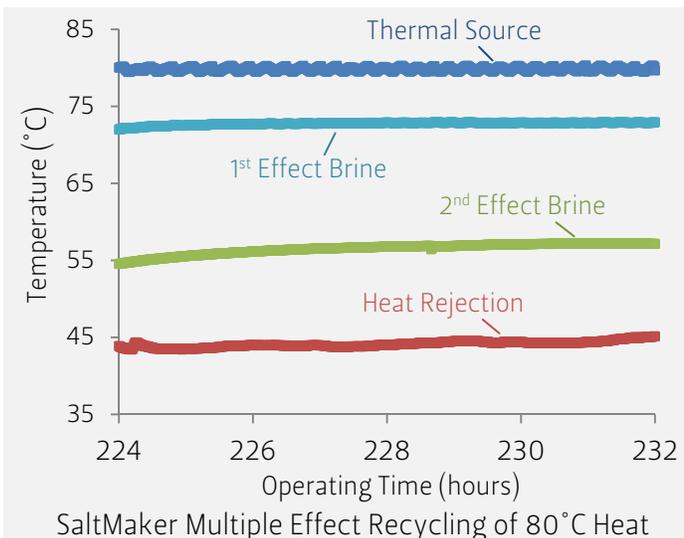
The SaltMaker uses humidification-dehumidification (HDH) principles for low temperature operation, providing three fundamental design benefits at the expense of footprint: (1) process components built from engineered plastics removing corrosion concerns and “sticking” concerns; (2) high circulation rates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

The SaltMaker incorporates full automation and intelligent cleaning operation that measures scaling potential and initiates 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 may be removed for inspection by use of a simple trolley without confined spaces. A standard S100 SaltMaker has a capacity of 100 m³/day water removed with the footprint of four 40ft ISO shipping containers. Larger plants can be assembled from the low cost, mass produced S100 blocks. The SaltMaker is a repeatable, scalable solution to an industry previously based on more costly, custom “site stick built” systems

Results

Three different sources of SAGD evaporator blowdown were tested, alongside one source of OTSG blowdown. The SaltMaker consistently and reliably operated 24/7 on 80°C heat. Saltworks’ patented non-scaling design and self cleaning systems were paramount. 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)
- Solids reliably and continuously produced and extracted. Analytical testing demonstrated solids met applicable requirements (e.g., paint filter test, leachable metals and BTEX, pH, and flashpoint) for disposal at a non-hazardous Class II landfill
- Concentrated blowdown reached saturation at around 413,000 mg/L TDS
- Reliable operation and non-scaling / no-plugging with automated self cleaning, confirmed by complete plant autopsies after each trail
- Use of 80°C heat and recycling of the heat through multiple effects for energy efficiency



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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



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



SaltMaker solids suitable for Class II landfill disposal

Summary

The pilot project demonstrated that the SaltMaker can reliably and energy efficiently recover freshwater and produce solids from SAGD blowdown waters. Saltworks would be pleased to complete a SaltMaker performance and economic assessment of your blowdown water treatment project. Please contact projects@saltworkstech.com. Lease and pilot plants are available.