



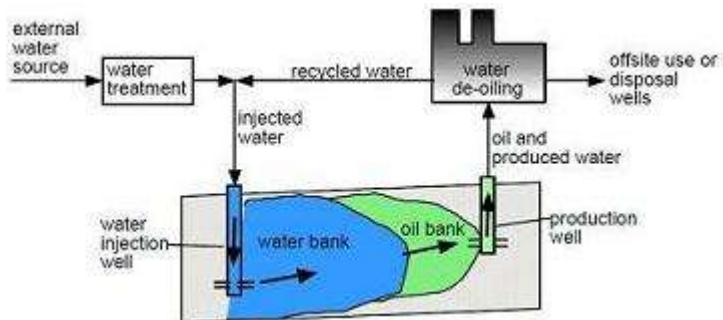
talk about Water and the Oil Patch

April 2011

Oil and gas industry water use is regulated by Alberta Environment under the *Water Act*. Companies are licensed and responsible users of water and abide by the same rules and regulations, standards and penalties as other licensed users. The use of water is essential to Alberta's energy and mineral industries.

How Water is Used for Oil Recovery:

- Heating of bitumen by steam injection to enable it to flow to a well through cyclic steam stimulation (CSS) or steam-assisted gravity drainage (SAGD).
- Processing of oil sands from mining operations to extract bitumen (hot water process).
- Water is injected to improve oil recovery by pushing (displacing) oil towards producing wells in suitable conventional oil reservoirs.



Typical Water Cycle in Oilfield Watershed Operation (above)

In some reservoirs, additional oil may be recovered by injecting hydrocarbons, carbon dioxide, nitrogen, chemicals or other approved substances, through Enhanced Oil Recovery (EOR).

Non-Saline Water vs. Saline Water

External water sources are usually required in larger quantities at the beginning of an injection project, this water may be either non-saline or saline.

The choice between non-saline and saline water or a mixture of both for oilfield injection is based upon a number of factors, such as: legislation and

regulations, policy, compatibility with the reservoir, economics, location, and quantity and quality.

Non-saline water may come from lakes, rivers or shallow (ground water) wells. It is not necessarily potable and may require further treatment to meet drinking water standards. Saline water is deeper groundwater that comes from zones not necessarily containing oil or gas.

Desalination of oilfield produced water may be technically viable, however its economic advantages have not yet been proven. It is also unclear whether desalination alone would provide adequate supplies of source water.

Non-saline water injection for conventional oil recovery has been cut in half from 40 years ago, largely by replacement with saline water and by increased recycling of produced water.

Oil and gas reservoirs contain saline water, which is sometimes produced along with the oil and gas. This saline produced water is then either re-injected as recycled water as part of the waterflood process, or sent to a deep disposal well. Recycling rates for water use by the oil and gas industry within Alberta average from 70 to 90 percent.

Treatment of Water for Injection

External source water must be treated before injection by removing oxygen, non-organic and organic solids and in many cases treating with biocides and corrosion inhibitors. Saline produced water requires treatment similar to that for external source water.

Additionally, produced water contains small amounts of oil that must be removed before the water is recycled for injection.