



talk about oil & gas.

October 2006

Water and the Oil Patch

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 and is both legitimate and of significant economic value. For example, the Government of Alberta's oil and gas revenue for 2005/2006 was about \$10.8 billion, an important part of which is generated from oil produced using water.

How Water is Used

Water is used for the recovery of oil in the following ways:

- Water is injected to improve oil recovery by pushing (displacing) oil towards producing wells in suitable conventional oil reservoirs (waterflooding, see Figure 1). In some reservoirs, additional oil may be recovered by injecting solvents, gases or other chemicals, alternating with water.
- 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).

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 30 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.

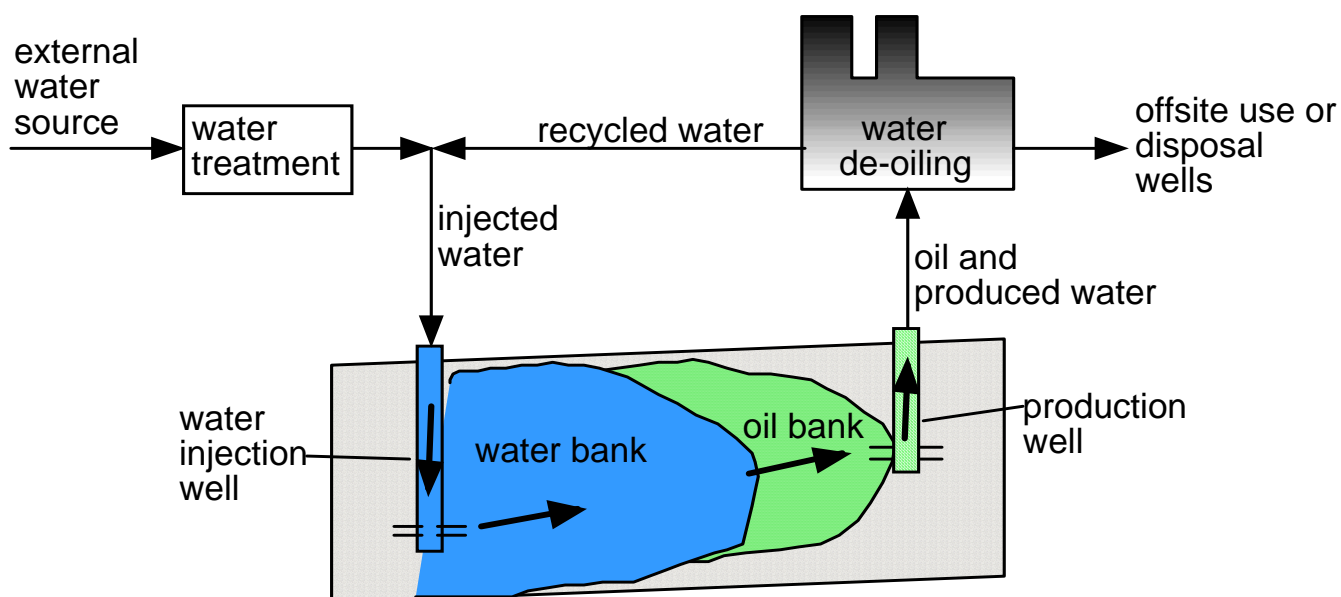
...2

Options for Returning Saline Water to the Hydrogeological Cycle

Water can be desalinated through two principal processes:

- Reverse osmosis: water is forced through membranes to remove salts.
- Distillation: water is heated and then condensed to remove any solids and salts.

These technologies are currently applied to the conversion of seawater into municipal potable water in some areas of the world. However, the process is relatively expensive and produces quantities of concentrated saltwater that must be disposed. Designs for treating saline oilfield produced water for surface use are in the early stages and are expected to be more complex because of the oil content of produced water.



(Figure 1) Typical Water Cycle in Oilfield Waterflood Operation