

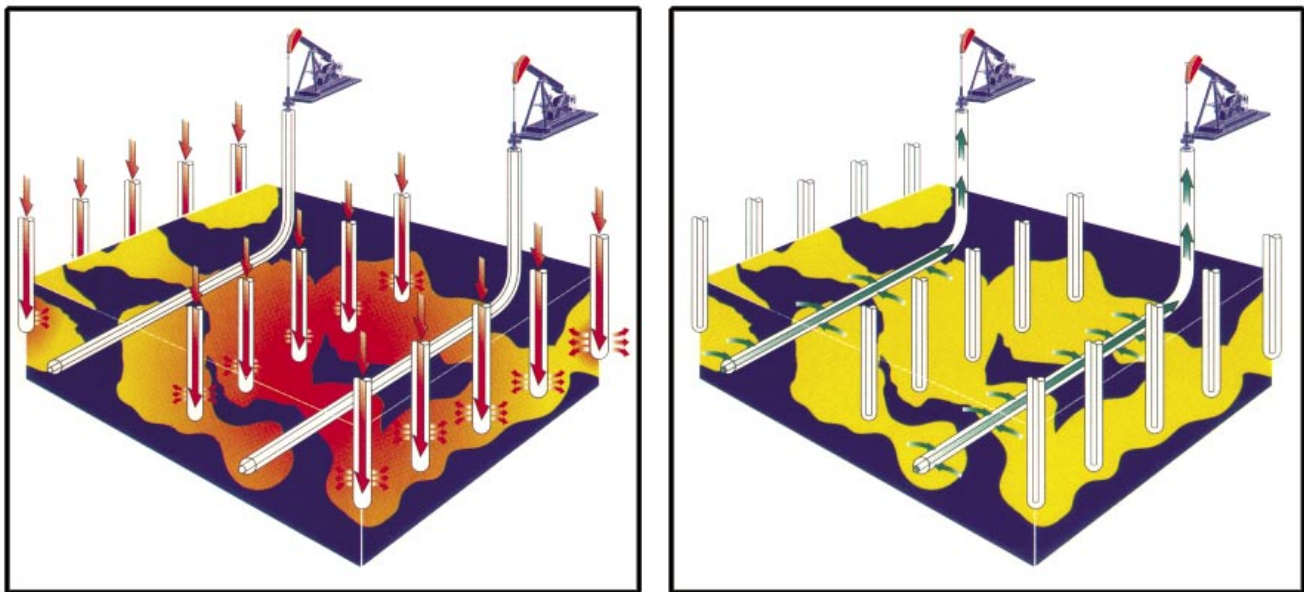


APPLICATION NOTE #11

CANADIAN STEAM FLOOD PROJECTS—HEAVY OIL

As the oil becomes heavier, it is more and more difficult to get the oil to flow into the well bore where it can be pumped to the surface. This heavy Canadian oil is often referred to as bitumen and has an API gravity ranging from 8—14. Bitumen has the consistency of thick molasses at room temperature. It is so heavy that it will not flow naturally from the underground formation to the surface without being heated. These oil-bearing formations/sands are often located several 100 meters below the surface—these deep oil sands can not be surfaced mined like the shallow oil sands in the Ft McMurry area.

Instead, production is achieved through wells drilled from the surface. One of the processes used to produce Bitumen is a cyclic steam stimulation (informally known as “huff and puff”) where steam is injected into the formation to heat and thin the bitumen so that it can be produced by conventional means.



Wells are clustered together in pads consisting of 20-40 wells. Each well is directionally drilled to minimize surface disturbance and are configured to provide access to the largest area of the underground oil-sands formation as possible.

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Steam is produced in large boilers at central locations and carried to each well pad through above ground insulated pipes. The steam is injected down the well bores and into the underground formation at temperatures up to 300 C (570 F). The steam heats the bitumen and allows it to flow to the well bore. After a “soak” phase, which can last several weeks, the wells are switched from steam injections to production. The process uses periods of steaming (usually 4-6 weeks), followed by periods of “soaking” (usually 4-8 weeks), followed by long periods of production.

The heated bitumen and water/steam is pumped to the surface at temperatures up to 230 C (450 F). These high temperature well streams have to be metered for oil and water production rates. Since the oil and water density is so close, it is impossible to use 3-phase well test separators. The industry’s choice has been to use either 2-phase well test separators with a 0—100% Oil/Water Monitors on the liquid leg or MultiPhase Flow Meters (eliminating the need for the 2-phase separator).

One of the major problems of well testing is the issue of changing salinities in water and steam flood production. If the Oil/Water monitor selected does not automatically compensate for changing salinities/densities—large measurement errors will occur. The Oil/Water monitor of choice has been the Agar OW-201 Hi-Temp—it has been field proven operating in temperatures up to 230 C (450 F). Its patented ability to measure changing salinities and compensate automatically has made it the industry’s leader.

Because there is always some gas that can not be removed from the liquid leg of a 2-phase separator, the 2-phase well test separator will often over-estimate the total production, over-estimate the total oil produced, and under-estimate the total water produced. Because of the errors inherent to the 2-phase separator, many producers are looking at multiphase well testing. The Agar MultiPhase Flow Meter (MPFM) will measure the Oil, Gas and Water in the flow stream with separating the phases. These MPFMs are small, compact and portable. They can be less than 1/10th the size of a conventional 2-phase test separator while providing better well test accuracy. The units can be used in production temperatures up to 230 C (450 F).



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