

TECHNOLOGY

Real-time Monitoring of SAGD Wells

The value of continuous monitoring in SAGD (steam assisted gravity drainage) wells has been documented in various technical literature over the last two years.

Of the 39 SAGD well pairs that have been drilled in Alberta to date, many have incorporated pressure and temperature monitoring as part of the assessment of SAGD effectiveness⁽¹⁾. Real-time monitoring has provided operators increased understanding as to the overall development of the steam chamber and the operational balance that must be achieved between injector and producer wells.

Monitoring systems have consisted of thermocouples, bubble-tubes, high temperature pressure sensors, and fiber optic DTS (distributed temperature systems). Various conveyance technologies have been used to instrument injector, producer, and observation wells including casing, tubing, suspended, and coil-tubing systems. The latter is emerging as the system of choice where operators want complete understanding of horizontal pressure and temperature profiles from heel to toe, primarily in producer wells.

As indicated by several early adopters of SAGD technology real-time monitoring has provided a number of benefits, which can be summarized as follows:

- Real-time pressure and temperature is used to obtain operational data for the design and drilling of horizontal wells and for containment and control of SAGD producers⁽²⁾.
- Horizontal well length can be optimized based on a better understanding as to the in situ pressure drop that occurs from heel to toe of SAGD wells⁽¹⁾.
- Monitoring of multipoint pressure and temperature confirms the existence of thief zones, which can adversely affect the balance between injected steam and produced oil.

- Heel pressure monitoring is used to understand pumping system efficiencies and to confirm pressure and temperature distribution from the toe to heel of the well.
- SAGD reservoirs tend to be somewhat unconsolidated in nature and thus injection pressures must be monitored (in situ) to remain under the known frac gradient in the area. Exceeding frac pressure can cause the loss of steam to adjacent thief zones, adversely affecting well production.

As SAGD technology evolves from the pilot to commercial stages of development, there exists several viewpoints as to the amount and type of instrumentation necessary to successfully develop and operate a SAGD project. It is certain, however that continuous monitoring plays a key role in successfully producing SAGD wells.

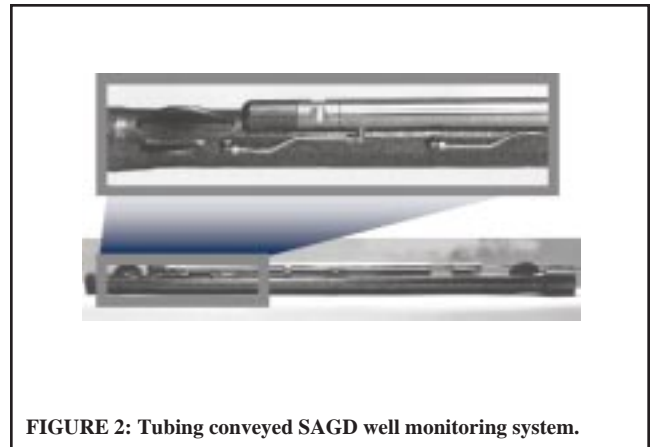


FIGURE 2: Tubing conveyed SAGD well monitoring system.

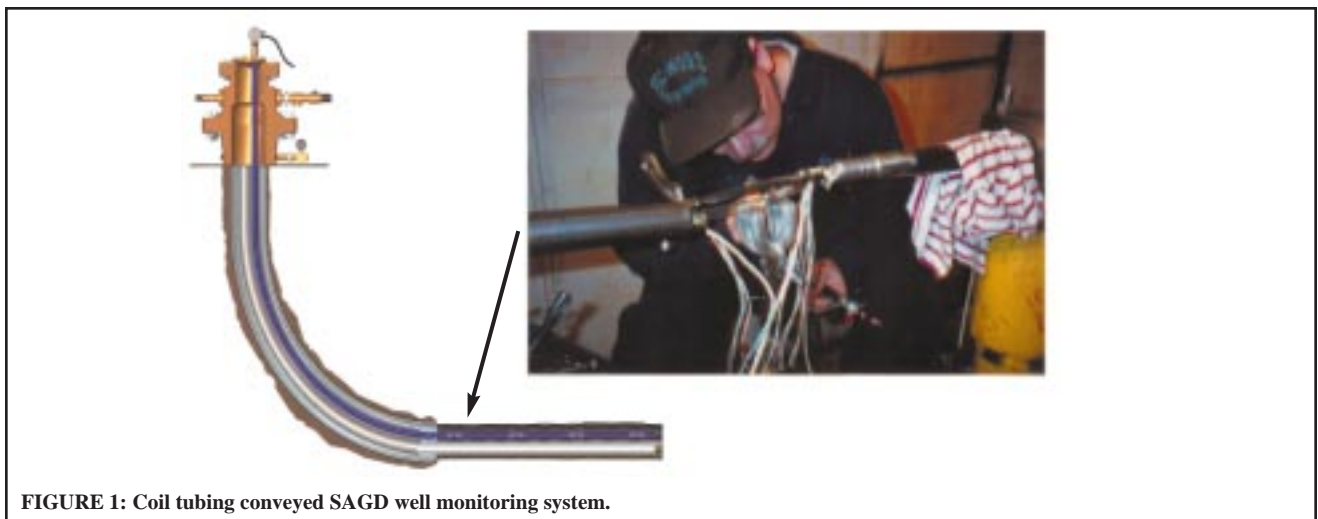
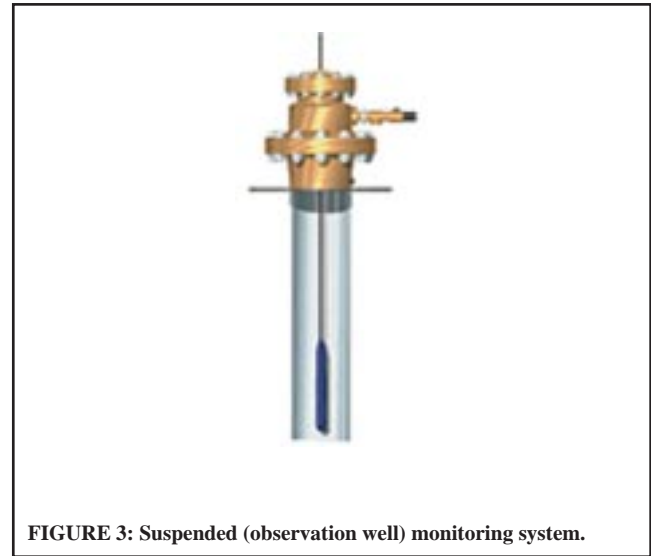
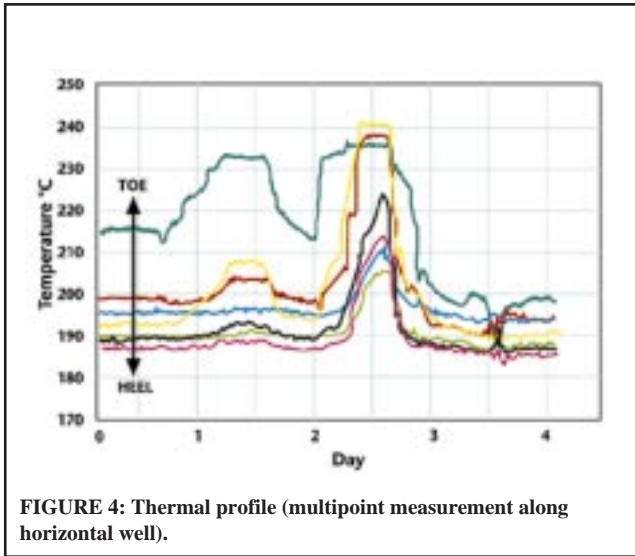



FIGURE 1: Coil tubing conveyed SAGD well monitoring system.



REFERENCES

1. KNOLL, R. and YEUNG, K.C., Drilling Engineering Challenges in Commercial SAGD Well Design; *Horizontal Wells SPE/CIM 7th Annual One-day Conference, Calgary, AB, November 3, 1999.*
2. SALTUKLAROGLU, M., Mobil's SAGD Experience at Celtic Saskatchewan; *Petroleum Society Paper CIM 99-25, presented at the 50th Annual Technical Meeting of the Petroleum Society, Calgary, AB, June 14 – 18, 1999.*

PROMORE Engineering Inc. is an industry leader in the design, deployment and service of SAGD well monitoring systems incorporating pressure and temperature sensors, fiber optics, thermocouple and bubbletube technologies. 

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