

# SAGD Perimeter Observation Wells & Water Source Well Monitoring



Pictured—Suspended Thermocouple Bundle.



Pictured—Cementing Sensors behind casing.

## Perm Offers Multiple Deployment Methods & Multiple Downhole Sensor Technologies

Perm Services has specialized in installing downhole instrumentation for SAGD Observation wells since 2005. Our clients use the data for multiple reasons including:

- Interference / Fracture Monitoring
- Water Source Well Monitoring
- ERCB Data Requirements
- Cap Rock Monitoring
- Steam Chamber Modeling
- Injectivity Testing

Perm has developed customized installation tools and procedures to make installations more reliable, quicker, and more cost effective

### Deployment Method Overview & Benefit

Deployment Method	Overview & Benefit
Retrievable Pump Down Instrumentation	<ul style="list-style-type: none"> <li>• Perm has designed observation specialized well completion s where the instrumentation is pumped down coiled tubing.</li> <li>• Reduces well intervention costs—no rig required.</li> </ul>
Cemented In Sensors	<ul style="list-style-type: none"> <li>• Perm is experts at cementing in single or multiple sensors (internal or annual sensing) behind the casing.</li> <li>• Reduced well intervention costs.</li> </ul>
Retrievable Suspended Systems DROP SPOOL	<ul style="list-style-type: none"> <li>• System is deployed by Perm Services specialized back pressure spool unit and picker. Instrumentation is suspended in tubular and can easily be retrieved without a rig.</li> <li>• Extremely cost effective.</li> </ul>
Tubing Conveyed	<ul style="list-style-type: none"> <li>• Instrumentation string is attached to the outside of the tubing.</li> <li>• Perfect for multiple zone measurement separated by packers and Downhole Pump instrumentation.</li> </ul>

There are several technologies for measuring downhole pressure and temperature in a SAGD observation well environment. Perm Services offers a wide range of downhole sensor solutions perfect for the following applications:

**SAGD** – High Temperature      **WS** – Water Source Wells      **CEM** – Cemented in behind casing  
**↓Pump** – Downhole PCP or ESP      **DT** – Distributed Temperature      **INT** – Interference Monitoring

Technology	Max Temp	Measurements	Applications
Piezometers (Vibrating Wire)	250°C	P&T. Accurate to 0.20% FS	SAGD, CEM
Bubble Tube (Nitrogen Injection)	500°C	Pressure. Accurate to 0.10% FS	SAGD, ↓Pump
Digital Quartz	170°C	P&T. Accurate to 0.02% FS	INT, CEM, WS
Digital Piezo	150°C	P&T. Accurate to 0.05% FS	INT, CEM, WS, ↓Pump
4-20 mA Analog Sensor	105°C	Pressure. Accurate to 0.5% FS	WS, ↓Pump
Resistivity Sensors	85°C	Pressure, Temp, and Resistivity.	WS, INT

## About Perm Services

Perm Services is a North American based service company specializing in downhole instrumentation installation and support. The Perm Services technical team has installed over 450+ continuous downhole pressure systems in the past 5 years with all types of completions.

Perm Services has specialized installation equipment based in North Dakota and the Western Canadian Sedimentary Basin that both ensures personal safety and rapid deployment.

### A system installed by Perm is:

- Reliable
- Cost Effective
- Innovative
- Proven

# The Future is Real Time™

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