

**CAPROCK INTEGRITY****Alberta's SAGD and CSS operators reliably measure surface heave using MDA's proven InSAR solutions.**

Maintaining caprock integrity is vital to operations and is a critical element in regulatory compliance for heavy oil fields. Excessive caprock deformation can potentially lead to surface breaches, with associated detrimental environmental and operational impacts. MDA's proven Interferometric Synthetic Aperture Radar (InSAR) solutions enable Alberta Steam Assisted Gravity Drainage (SAGD) and Cyclic Steam Stimulation (CSS) operators to identify anomalous surface deformations and adjust operations to prevent surface breaches.

**MDA's InSAR Solution**

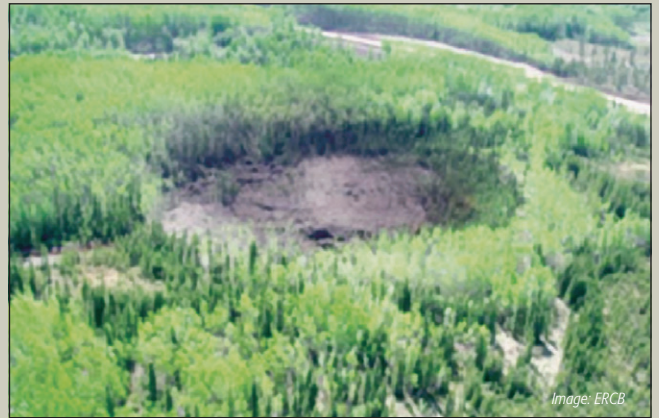
Using RADARSAT and other SAR satellite imagery, MDA is able to accurately monitor surface deformations at regular intervals, covering oil fields in a cost-effective manner. As the Alberta Energy Regulator (AER) Joslyn Creek report shows, surface deformation is a prominent indicator of the location and extent of pressure on caprock. It identifies InSAR as a technique well suited to "...detect containment issues and to track the rise of the steam chambers over time."

MDA's InSAR solutions identify anomalous and unexpected surface movement, such as heave and subsidence, allowing operators to adjust production operations to relieve unwanted pressures on the caprock and prevent surface breaches from occurring.

**Caprock Integrity**

SAGD and CSS operations create subsurface pressures that can compromise the integrity of the caprock and lead to surface breaches, which in turn can cause significant environmental damage. Large-scale environmental damage is a threat to continued operations and profitability.

On a site with an average production rate of 7,000 barrels per day, even a temporary cessation of operations can cause daily losses approaching \$1 million. The additional costs associated with surface breaches can include longer-term shutdowns, environmental remediation, increased oversight and reporting commitments, strained stakeholder relationships, and increased public relations efforts.



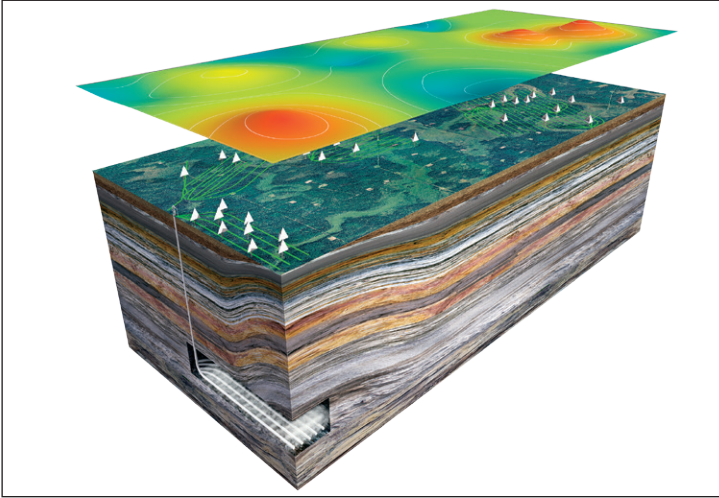
*The Alberta Energy Regulator (AER) conducted an extensive investigation on the May 2006 Joslyn Creek SAGD Surface Steam Release incident. The investigation assessed the catastrophic failure of the caprock and subsequent steam release that generated a surface disturbance which measured approximately 125 metres by 75 metres. The major sinkhole feature includes a large triangular surface crater at the major steam release zone. The steam release lasted only a few minutes, but resulted in a significant surface disturbance.*

*Evidence of significant soil and bedrock ejection was found in the immediate area, and originating from the release point, a fine dust spread across an area 1 kilometre long by 100 metres wide. Rock projectiles traveled as much as 300 metres horizontally, and the total volume of displaced material is estimated between 1,400 and 1,700 cubic metres.*

*– Summarized information from the AER Joslyn Creek report, February 11, 2010*

Many of Alberta's SAGD and CSS operators use MDA's proven InSAR solutions to monitor surface deformation to ensure caprock integrity and prevent surface breaches.

Alberta's SAGD and CSS operators can actively mitigate the risks of caprock failure with MDA's cost-effective InSAR solution.



The image above shows MDA's InSAR product capability of detecting millimetre-level changes in surface movement. Surface movement is a prime indicator of changes in caprock integrity.

### The MDA Advantage

With more than 15 years of experience serving the Alberta oil and gas industry, MDA is the largest provider of satellite-based monitoring products in Canada, with a large InSAR production capacity and a reputation for cost effectiveness, consistent results, and reliable service delivery.

As a result of MDA's operational experience, Alberta operators and the AER now recognize MDA's InSAR products as an effective and reliable surface movement monitoring tool.

### Canadian Technology

MDA is a Canadian company with production, processing, and targeted R&D teams in Canada that operate across the entire satellite remote sensing value chain from building satellites, launch services, mission operations, and data processing.

For over 40 years, the company's focused RADAR and remote sensing technology projects have been backed by significant internal investments and garnered international awards and recognition. With over 4,800 employees worldwide, MDA has the resources and experience to ensure the continuity of our monitoring services throughout the lifecycle of oil and gas projects which makes us the most reliable partner in InSAR monitoring.

MDA InSAR Provides	Customer Benefits
Accurate surface movement measurements reported at regular intervals	Useful boundary condition data for tuning and calibration of geomechanical models
Reliable surface movement monitoring and reporting	Compliance with regulator (e.g. AER) requirements for surface heave monitoring and reporting
15 years of experience providing InSAR in Alberta	Lowest cost solution to deliver accurate results in the challenging Alberta terrain
20 years of InSAR experience providing commercial service to oil companies	Tailored monitoring programs to deliver the specialized data required for each project
Ability to process data from multiple satellites	Increased options for lowering cost, increasing accuracy, and satisfying specific client requirements
Direct control of RADARSAT-2 satellite operations	Reliable data delivery to commercial clients, plus client access to new imaging modes from continuous upgrades to the RADARSAT-2 control software
Surface movement information over a large region with many measurement points	Monitoring information from outside of the operating area to detect impact from surrounding operations and impact to surrounding areas
Accurate monitoring of surface motion to detect excess heave and movement anomalies	Detection of surface movement that may indicate excess caprock strain

### CUSTOMER SATISFACTION

For more than four decades, MDA has worked with its worldwide customer base to provide information solutions that leverage advanced technologies and improve business efficiency.

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