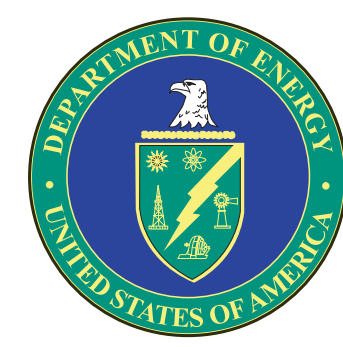


Zama Acid Gas EOR, CO₂ Sequestration, and Monitoring Project



In October 2005, the Zama oil field in northwestern Alberta, Canada, became the site of acid gas (approximately 70% CO₂ and 30% H₂S [hydrogen sulfide]) injection for the simultaneous purpose of enhanced oil recovery (EOR), H₂S disposal, and CO₂ storage. Injection is taking place at a depth of 4900 feet into a carbonate pinnacle reef structure.

The Plains CO₂ Reduction (PCOR) Partnership conducted monitoring, verification, and accounting (MVA) activities at the site through September of 2009, while Apache Canada, Ltd., managed the injection and hydrocarbon recovery processes.

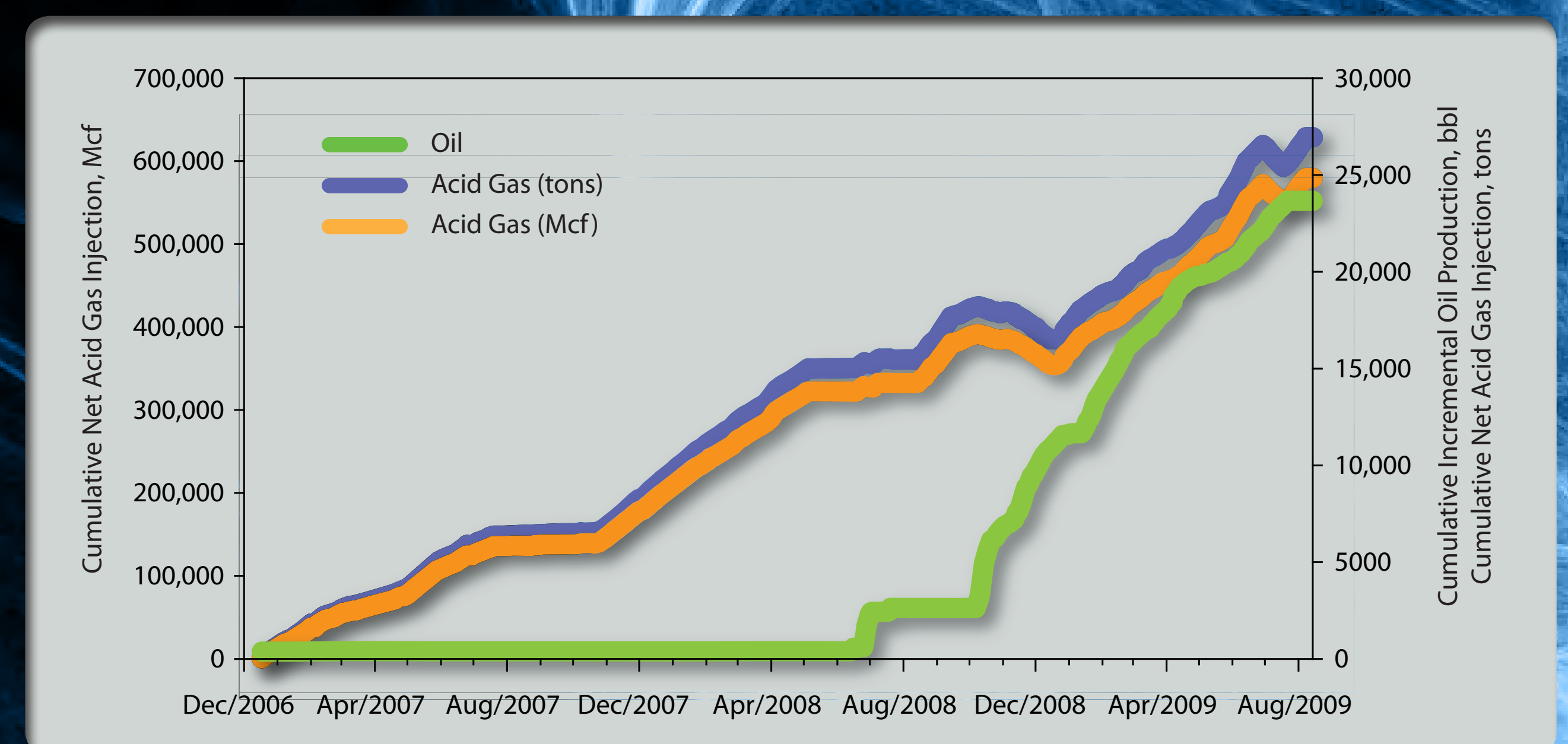
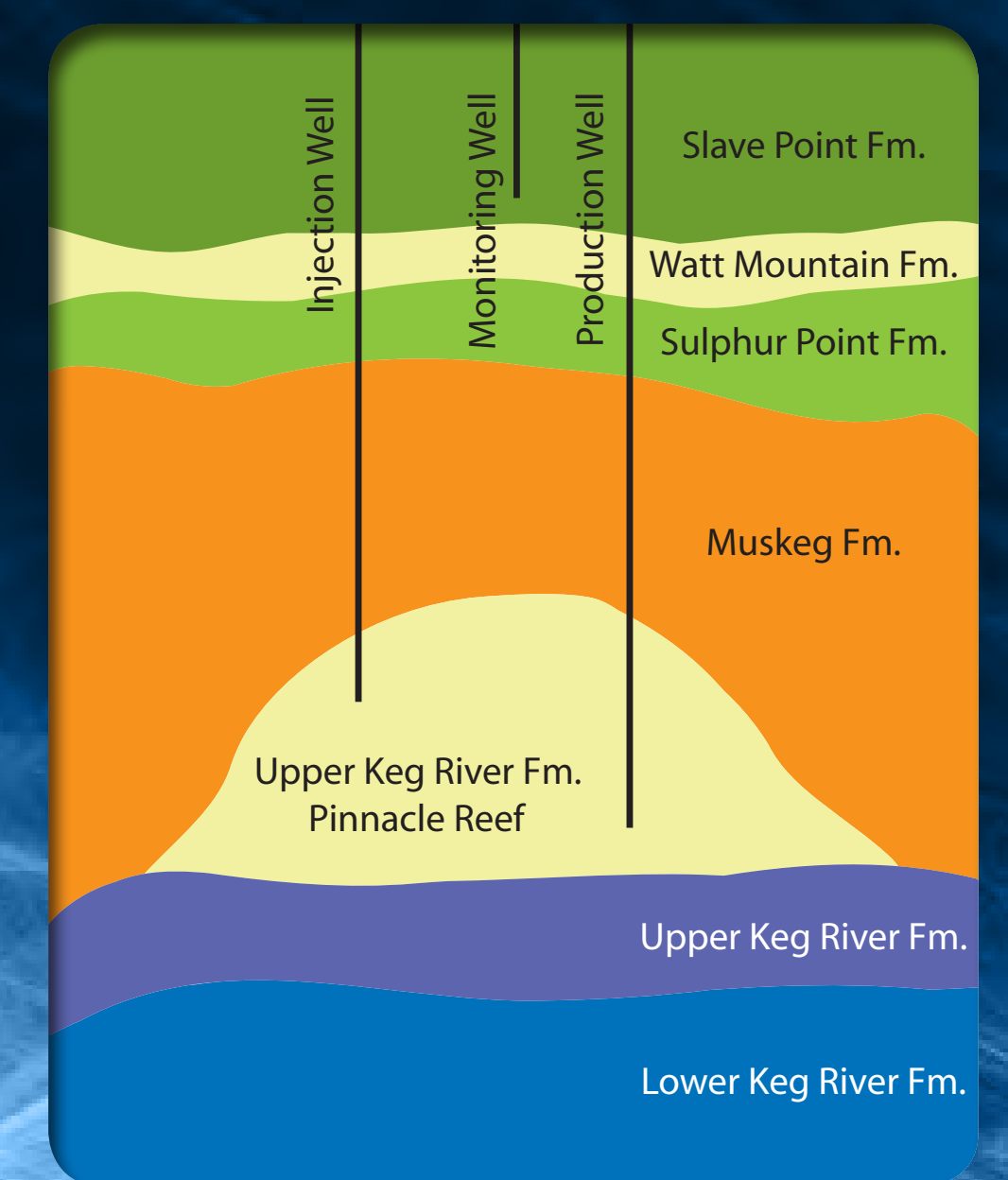
Acid gas is a by-product of oil production in the Zama Field and a subsequent fluid separation process at the on-site facilities. During the separation process, oil and gas are sent to market while acid gas is redirected back to the field for utilization in EOR operations. Prior to this project, the CO₂ portion of the acid gas was vented to the atmosphere, and sulfur was separated from the H₂S and stockpiled in solid form on-site. This project has enabled the simultaneous beneficial use of each of these materials to produce more oil and reduce GHG emissions.

The MVA portion of the Zama project was designed to address three primary issues at EOR sites: 1) determination of CO₂ and/or H₂S leakage, or lack thereof; 2) development of reliable predictions regarding the long-term fate of injected acid gas; and 3) generation of data sets to support the development and monetization of carbon credits associated with the geologic storage of CO₂.

The geological and geochemical investigations were conducted at local and regional (subbasinal) scales. Geological results indicate that the likelihood of natural leakage from this system is low and regional flow is extremely slow, on the order of thousands to tens of thousands of years to migrate out of the basin.

Monitoring of the site is achieved primarily through fluid sampling and pressure monitoring in both the target pinnacle reef and overlying strata. To more readily identify any leakage that might occur, a gas-phase tracer was injected early in the project.

As of September 2009, 27,000 tons of acid gas have been utilized for EOR operations, resulting in an additional 24,000 barrels of oil production. While this project has been focused on one of the hundreds of pinnacle reefs that exist in the Zama Field, many of the results obtained can be applied not only to additional pinnacles in the Alberta Basin, but also to similar structures throughout the world.



Zama Acid Gas Injection Site