QUEST CCS PROJECT

PIPELINE CONSTRUCTION & OPERATION

QUEST IS BEING ADVANCED ON BEHALF OF THE ATHABASCA OIL SANDS PROJECT, A JOINT VENTURE AMONG SHELL CANADA (60 PER CENT), CHEVRON CANADA LIMITED (20 PER CENT) AND MARATHON OIL CANADA CORPORATION (20 PER CENT)

GREENHOUSE GAS MANAGEMENT PATHWAY
JANUARY 2010
Shell Canada Energy, on behalf of the Athabasca Oil Sands Project, a joint venture among Shell Canada Energy (60 per cent), Chevron Canada Limited (20 per cent) and Marathon Oil Canada Corporation (20 per cent), is developing a carbon capture and storage (CCS) project called Quest. Quest will help reduce greenhouse gas emissions from its Scotford Upgrader by capturing carbon dioxide (CO₂), transporting it via a pipeline and storing it deep underground.

Upon receipt of regulatory approvals, construction of the CO₂ pipeline is planned to begin around 2013 and become operational around 2015.

As part of Quest, Shell will build a carbon steel pipeline between the Scotford Upgrader and the injection locations. The pipeline diameter will be 16 inches, and will be buried 1.2 metres (4 feet) underground. The north end injection well is proposed to be located near section 9-62-22 W4M.

The Quest Pipeline will include the following facilities:

- Approximately 100 km (60 miles) of 16 inch diameter pipeline with a maximum allowable operating pressure of 20 MPa (2,900 psi) from Shell Scotford to the injection wells.
- Initial plans for 3 to 15 wells along the pipeline route.
- Wellsite surface facilities will consist of short above ground piping to the wellhead and a small enclosure for instrumentation, controls and communications back to a central control room in Scotford for continuous monitoring.
- Line block valves and pigging facilities: Line Block valves will be located along the pipeline with a maximum distance of 15 km (9.5 miles) apart. These line block valves will automatically close to isolate a leak or rupture. The pigging facilities will be used for pipeline inspection and maintenance.

Once operational, Quest will capture more than 1 million tonnes of CO₂ per year from the Scotford Upgraders. This project will potentially reduce CO₂ emissions from the Scotford Upgrader by approximately 35 per cent.

PIPELINE CONSTRUCTION

A Conservation and Reclamation Report will include an Environmental Protection Plan that will identify mitigative measures to be utilized during construction of the pipeline in order to minimize environmental impacts to the area.

PREPARING THE RIGHT-OF-WAY

The process begins with clearing the right-of-way of vegetation and salvaging top soil. Plans are to acquire a 20 meter permanent right-of-way and 5 meter temporary work space. Shell understands the natural resource value of topsoil and will use proper soil handling techniques. The topsoil and trench soil are stored along the side of the right-of-way and temporary work space. During this process, our workers will be careful to ensure they keep topsoil separate from trench soil so it can be replaced during reclamation. To minimize the spread of noxious weeds and diseases, all equipment brought on-site or moved from site to site are thoroughly cleaned. Shell representatives will work with landowners to address particular needs where appropriate, such as temporary fences, gate closure, moving livestock, etc.

DIGGING TRENCHES

Trenchers and backhoes will be used to dig the trench for the pipeline. To minimize settlement, we will compact the spoil material back into the trench.

STRINGING PIPE

Using local roads, trucks will deliver pipe to the site. The pipe is laid adjacent to the trench along the right-of-way.

BENDING AND WELDING THE PIPE

In order to follow the contours of the land, some sections of pipe must be bent. Once bending is complete, sections of the pipe will be welded together to form a continuous pipeline and a coating will be applied to protect the welds from corrosion. All welds are visually inspected and x-rayed.
LOWERIng THE PIPE
After the pipeline is welded together, it will be lowered into the trenches using side booms. The trench will be backfilled with the excavated spoil material. The subsoil is then decompacted, the topsoil is evenly placed on the surface and the land is seeded. Special care will be taken to remove rocks so they do not fall onto the pipe or remain in the topsoil during reclamation. Before the pipeline becomes operational, the line will be hydro tested. In addition, Shell will place pipeline signage to mark the location of the pipeline and conduct a thorough inspection of the right-of-way.

RESTORING THE LAND
Shell puts high value on ensuring we reclaim the land as close to its previous state as possible. We will work with landowners to make sure that the reclamation work is completed as quickly and thoroughly as possible. The first spring after the right-of-way has been restored, we will conduct a land monitoring study to confirm reclamation success including proper topsoil replacement, trench line stability and drainage.

In accordance with the Province of Alberta environment regulations, a post construction/reclamation assessment will be completed within one growing season following the pipeline construction. Feedback regarding any ongoing issues with land reclamation will be resolved as quickly as possible and we will continue to communicate with landowners during the operation phase of the pipeline.

SAFETY
Thousands of kilometres of CO2 pipelines are in safe and reliable operation in North America today, mostly in the United States. Shell is familiar with both the construction and operation of CO2 pipelines, which have been in use since the early 1970s in the enhanced oil recovery industry in Texas and New Mexico. The pipeline for Quest will be designed to meet the latest safety specifications. Experienced pipeline technicians will monitor the pipeline 24 hours per day, every day of the year. In the unlikely event of a leak, valves will be closed automatically to isolate the section of the pipeline, minimizing any release of CO2. In addition, the pipeline will have routine aerial surveillance, ground surveillance and Shell will cooperate with other pipeline owners who share the same utility corridor.

Quest plans to follow all industry best practices when building and operating the pipeline:

1. Shell will design, construct, operate and maintain the Quest facilities using best practices to meet the highest safety standards.
2. There will be no flaring or odours from the Quest pipeline system.
3. Experienced pipeline technicians will monitor the pipeline and conduct maintenance work. The pipeline will have routine ground and aerial surveillance, and Shell will cooperate with other pipeline operators who share the same utility corridor.
4. The Quest control room will be constantly monitored. Shell will continuously gather data and monitor the Quest facilities and pipeline system for leak detection. An alarm system alerts control room operators to system changes.
5. If a leak is suspected, valves will automatically close to isolate the section of the pipeline and the Emergency Response Plan (ERP) will be activated. The release of CO2 into the environment will be minimized.
6. While Quest will be incorporated into Shell’s existing local and regional emergency response plan and procedures, Shell will also develop a specific pipeline ERP to meet the latest regulatory emergency response requirements.
7. The CO2 pipeline will be designed, submitted for regulatory approval, constructed and operated as a high vapour pressure pipeline, which requires an Emergency Planning Zone (EPZ) and an Emergency Awareness Zone (EAZ) calculation for the pipeline system. Initial calculations for a 16 inch pipeline have indicated an EPZ of about 800 metres, and an additional 400 metre EAZ, on each side of the pipeline. All residents and other public land users within the EPZ will be contacted and provided with details on the ERP during the project consultation phase.
8. The injected CO2 will be greater than 98% pure.

At a properly designed and well-managed CO2 storage site, the chance of CO2 leakage is very small, and highly unlikely to raise concentrations above normal atmospheric levels.
Topsoil salvage to full right-of-way

Typical water course crossing

Stringing and welding pipe along right-of-way

Reclamation of full right-of-way topsoil salvage

Fully reclaimed right-of-way
The proposed pipeline route (shown above in orange) will travel approximately 100 kilometres north of Shell Scotford to the chosen injection locations.

Quest CCS Project is located next to Shell Scotford, in the Industrial Heartland Region, approximately five kilometres northeast of Fort Saskatchewan, AB.