[Form 2 (to be reported to Committee on Countermeasures for Contaminated Water Treatment and to be disclosed to public)

Technology Information	
Area	5 – Management measures to curb underground water into the site
Title	5-1 – Construction technologies for impervious walls
Submitted by	Candu Energy Inc., SNC-Lavalin, Atomic Energy of Canada Ltd., Canadian Nuclear Partners

Slurry-Grouted Wall Technologies

1. Overview of technologies (features, specification, functions, owners, etc.)

We are proposing three potential technologies:

Technology No. 1: *Slurry walls* – constructed by excavating a narrow trench under an engineered fluid, the slurry trench technique permits the installation of deep barriers in all types of soil and groundwater conditions. Slurry mixes can include: specialist clay materials (such as bentonite and attapulgite), cement and use of existing soils.

The advantages of this technology are:

a) Can achieve permeabilities less than 10^{-9}m/s.
b) Eliminates the need for excavation and disposal of impacted soils and contaminants;
c) Eliminates the need for shoring;
d) Can achieve depths up to 50 to 60 metres.

Technology No. 2: *Jet Grouting* – use of ultra-high pressure injection of cement grout to cut and mix soil in-situ. Grout is fed, by a specialized high pressure jet pump, through a rotating drill pipe and forced out laterally through small jet ports at the bottom of the drill pipe. Jet grout columns are typically formed from the bottom up providing a column of fully mixed soil.

The advantages of this technology are:

a) Provides a continuous barrier or homogeneous soil-mixed monolith.
b) Can be used in areas with difficult or limited surface access, subsurface obstructions, or sensitive utility locations.

Technology No. 3: *Chemical grouting* – use of silicate-aluminate / poly-phosphate / calcium-barium grouts. Silicate aluminate grouts use dilute solutions of sodium aluminate (hardener) and sodium silicate to penetrate and plug the aquifer matrix. Poly-phosphate grouts use the hydrolysis of ortho-phosphate polymers and existing dissolved calcium to precipitate synthetic apatite in the aquifer. Calcium-barium grouts use super saturated concentrations of calcium or barium to promote the growth of gypsum, anhydrite or barite in the aquifer. Chemical grouts are typically injected into a groundwater well or trench.

The advantages of this technology are:

a) Precipitation processes can be controlled to deeply penetrate the aquifer.
b) Can use existing groundwater wells or trenches.
c) Can be undertaken very quickly with minimal ground disturbance.

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2. Notes (Please provide following information if possible)

- *Technology readiness level (including cases of application, not limited to nuclear industry, time line for application)*
  All technologies are readily available and have proven application at various uranium and potash mines in Canada and the United States. The Candu consortium has extensive experience with groundwater control and barrier projects, plus operation in and management of radioactive sites. Our key personnel have several decades of experience with cut-off wall and grouting techniques, particularly at mine sites requiring the control of groundwater contaminated with uranium and other nuclides. This has included research into groundwater control (60 m deep slurry wall) around a large uranium mine in northern Saskatchewan, Canada. It has also included the design, permitting and construction management of one of the largest cut-off wall projects ever constructed (10.7 kms long and 50 m deep) in Saskatchewan, Canada. Our key personnel also have extensive knowledge and expertise in the design, construction and monitoring of waste containment facilities as well as the geotechnical engineering, geochemistry and modeling groundwater and contaminant transport required to support these technologies.

- *Challenges*
  For Technology No. 1 and 2:
  - Large plant and considerable volumes of grouting materials required within a limited work area.

  For Technology No. 3:
  - Requires groundwater well / trench in appropriate position for injection;
  - Requires periodic re-injection of chemicals as precipitates are subject to dissolution and dispersion processes over time.

- *Others (referential information on patent if any)*
  No specific patent issues.