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

Technology Information	
Area	1 – Accumulation of Contaminated Water
Title	1-2 – Other requirements for tanks
Submitted by	Candu Energy Inc., SNC-Lavalin, Atomic Energy of Canada Ltd., Canadian Nuclear Partners

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

The following is a conceptual consideration for providing a suitable storage capacity for the contaminated and filtered water on the Fukushima site.

Technology No.1 : Barges, off shore tankers and large volume tanks

The task is to provide new temporary storage capacity (other than stated in Technology Information 1.1) for the water which is stored in the suspected tanks (flanged) to provide new space within the designated area for storage.

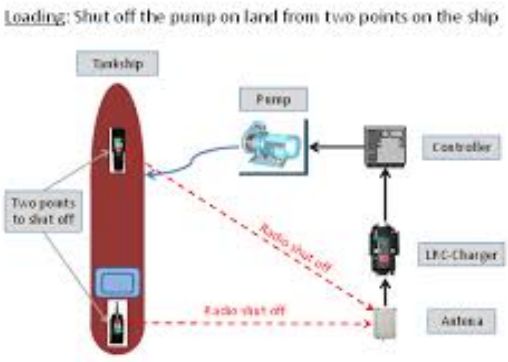
Description

A. Use barges (flat bottom) with suitable storage capacity installed and anchored in the plant intake bay for temporary water storage complete with floating loading unloading facilities.
B. Off shore tankers (see picture below) could be used, without permanent harbor anchorage, provided that they are near to shore to provide overhead or floating piping system. The on shore facility will require pumping, monitoring and power supply system with suitable maintenance for distribution and servicing. The tankers should be double hull with imprinted cathodic protection, which may be the fastest means of securing capacity. Nevertheless it should be considered only as an intermittent measure or overflow capacity – security concerns.
C. For large volume and short term use consider installing an emergency water reservoir, lined, and covered, similar to the one installed in Wolsong (2) or Point Lepreau NPP or fire water tanks in Darlington NPP.

Typical specification for temporary tanks located on barges:

a) Sea water exposed Storage Tanks and Accessories
Contaminated water storage tank of 100,000L capacity, complete with attachments suitable for securing on an anchored barge

b) Cathodic Protection Equipment
Magnesium anodes, (17 Lb/ea) per tank
Zinc, reference electrode
Test station in a water proof box with a terminal strip for 10 terminals.



Technology No. 2: Disposal of wastewater in deep geologic formations

Description

One other approach for the storage of large volume of wastewater is to dispose it underground in a deep suitable geologic formation where it will be isolated from the general environment and human consumption for an extended period of time. This waste mitigation approach is known as deep-well injection disposal which is used on a large scale by the petrochemical industry in the USA since 1950. Petrochemical industries produce substantial quantities of saline formation brines from drilling. Currently, more than 1.1 billion m^3 of brine are injected yearly into approximately 175,000 wells in the USA.

2. Notes (Please provide following information if possible)

- *Technology readiness level (including cases of application, not limited to nuclear industry, time line for application)*
- *Challenges*
- *Others (referential information on patent if any)*

Technology No.1 : Barges, off shore tankers and large volume tanks

Benefits

Option "A" Barges: Most practical means of providing as close to shore storage, these barges may also be used as a transporters for prefabricated new welded tanks. Duration of use is not relevant.
Option "B" Off shore tankers: Not readily available for a long duration, however will prove insanely large storage capacity.
Option "C" Emergency water reservoir: long term solution which would provide a suitable future barrier and storage for surface run of water.

Issues

Scheduling; to be able to provide temporary storage capacity for the cooling water demand.

Construction of the required transfer and docking facilities coupled with the logistics of vessel acquisition and management need to be addressed, as does the licensing and radiation-protection aspects of such an approach. The consortium consisting of SNC, Candu Energy, AECL and OPG offer such experience.

Project Examples of Application and Readiness

Option B: See any petroleum refinery – off shore tankers
Option C: For large volume tanks that have been installed in Wolsong NPP (2) (South Korea), Point Lepreau NPP (New Brunswick, Canada) at Darlington NPP (Ontario, Canada).

Challenges
To meet environmental compliance and provide timely loading and anchorage facilities.

Intellectual Property/Patent Aspects
No specific patent issues.

Technology No.2: Disposal of wastewater in deep geologic formations

Benefits

This approach has the advantages of low cost and low energy consumption provided a suitable storage location is available. Pre-treatment might be required to remove Sr-90 which has a long half-life (28.1 years).

Issues/Challenges

Regulatory approval by various agencies (for siting, construction, operation, monitoring, reporting, decommissioning and post-closure).

The project proponent must demonstrate that "No Migration" of the tritiated wastewater will occur outside of the formation into which it is injected. Extensive geologic evaluation/testing (e.g., structural and stratigraphic geology, hydrogeology, and seismicity of the region and well site, etc.) and groundwater modelling will be required to identify a suitable geologic formation for the long-term storage of tritiated wastewater. A public, worker and environmental dose modeling and assessment, including pathways analysis must be performed to implement the deep-well-injection disposal solution.

Extensive monitoring will be required for the operating site.

Project Examples of Application and Readiness

Currently, 123 Class I hazardous waste wells (i.e., wells injecting hazardous waste below the lowest aquifer containing a potential source of drinking water) are operating in the USA Most of these wells are found in Texas (64) and Louisiana (17). Another 221 facilities comprising 350 Class I wells injecting nonhazardous waste are also in operation, most of which are found in Florida (122) and Texas (49). In the USA, deep injection well depths range from 520 to 2,740 meters.

Intellectual Property/Patent Aspects

No significant issues.