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

Technology Information	
Area	2 (Select the number from “Areas of Technologies Requested”)
Title	Process modelling to assess tritium removal processes and feasibility
Submitted by	National Nuclear Laboratory

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

Separation of tritium from contaminated water presents a serious issue for all of the common technologies generally applied to chemical separation and decontamination, due to the high specificity required to remove tritium from other hydrogen isotopes in water. Not only does this present a problem on a technical level it also is a major issue of public perception, as a conscientious operator or regulator needs to be able to provide evidence for the efficacy of proposed processes (or the lack of performance).

The UK National Nuclear Laboratory (NNL) has a long track record of developing dynamic flowsheets of nuclear separation and effluent treatment technologies, which are used to provide a proof of best practice in plant operation, to develop improvement strategies for plant, for understanding robustness of plant and processes to changes in feed or environment and to interface with regulators on the likely effect of new feeds or technologies. These flowsheets are underpinned by good science and more fundamental modelling and experiment and are quantitatively accurate and predictive.

The strength of NNL’s process modelling capability is not only in its strong links with plant and laboratory based support, but in the depth of fundamental understanding of separation processes – from the atomic scale up.

NNL would evaluate a range of technology options using dynamic process modelling tools to ascertain whether separation is feasible using these technologies, building on a the knowledge and experience of evaluating such processes over many years for the requirements of the nuclear industry and regulatory bodies.

NNL will evaluate a range of possible technologies currently available and under development within the NNL that may be applied to tritium removal, but are also happy to use the same approach to work with other technology suppliers to evaluate their processes, or apply to technology already being considered by the customer.

2. Notes (Please provide following information if possible.)

- Technology readiness level (including cases of application, not limited to nuclear industry, time line for application)

This will vary depending on the technologies being evaluated. Some of the technologies (e.g. ion

exchange and variants of solvent extraction) are very mature, both within the nuclear industry and outside, some technologies will be at much earlier readiness levels. Undertaking this work has in the past been used to clarify the actual TRL of process designs.
The modelling approach however is well-established and well-used.

- Challenges

The main challenges faced are in the availability of supporting data. Data is used to develop the model, but more importantly to validate any models. More mature processes will already be well validated and therefore will require less data. Model development of this kind can be used through to the development of a detailed process (as there is always fundamental modelling to back up mechanistic understanding), however without supporting data there will always be less confidence in the output. Hence this approach is also very good in establishing a technologies TRL, and for development of data to directly support commissioning of processes.

- Others (referential information on patent if any)

No intellectual property associated with the modelling output, though depending on how the customer wishes to use the product models, there may be ongoing license issues to be considered. The work proposed is separate to any patent issues that might arise as a result of any materials or processes suggested in the evaluation.

【Areas of Technologies Requested】

(1) Accumulation of contaminated water (Storage Tanks, etc.)
(2) Treatment of contaminated water (Tritium, etc.)
(3) Removal of radioactive materials from the seawater in the harbor
(4) Management of contaminated water inside the buildings
(5) Management measures to block groundwater from flowing into the site
(6) Understanding the groundwater flow