## 5. CONCLUSIONS AND RECOMMENDATIONS

The main objective of ISP exercises is to increase confidence in the validity and accuracy of the tools that are used in assessing the safety of nuclear installations. The secondary objective is to enable code users to gain experience and demonstrate their competence. Due to the complexity of iodine behaviour in containment, the ISP 41 exercise on iodine requires three steps, in order to achieve these objectives. These steps are

1. ISP 41: Computer code exercise based on a simple RTF experiment on iodine behaviour in containment under severe accident conditions.
2. ISP 41 Follow-up Phase 1: Parametric calculations.
3. ISP 41 Follow-up Phase 2: Computer code exercise based on complex experiments performed at the RTF and Caiman facilities.

We have completed the first two steps, and recommend completing the final step.

The first step of the ISP 41 exercise demonstrated that all of the iodine behaviour codes had the capability of reproducing experimental results obtained from the RTF. However, the first step also demonstrated that the performance of these codes is extremely reliant upon the judicious choice of user-defined kinetic parameters, many of which have been chosen to provide a best fit of the code output to experimental data obtained under a narrow range of conditions (e.g., temperature, dose rate, iodide concentration, etc.). The conclusion of the exercise was that, in order to use code calculations as predictive or interpretive tools, it must be demonstrated that the kinetic parameters used in the codes are applicable to the entire range of conditions anticipated in post-accident containment.

The second step (the work reported in this document) was the first opportunity for iodine behaviour code users to assess their codes over a wide range of accident conditions. The comparison exercise allowed the code users to develop an understanding of the sensitivity of the code output to input parameters, i.e., the manner in which the predictions change as a function of each of these parameters. The parametric exercise identified several areas of discrepancy between the various codes. Most of the discrepancies appear to be quantitative in nature, i.e., the codes agree regarding the trends, but the actual amount of volatile iodine predicted by each of the codes varies considerably. The largest source of the discrepancies between code predictions appears to be the different sub-models in each code for the formation and destruction of organic iodides.

Although the current ISP exercise identified the organic iodide sub-model as contributing significantly to the discrepancy between the code predictions, parametric calculations cannot tell us which (if any) of the sub-models are correct, and what the range of user-defined input parameters for each of the sub-models could be. Therefore, we recommend that the final step of ISP 41 be a code comparison against four intermediate scale studies—two Caiman facility experiments and two RTF experiments—which examine iodine volatility over a very large range of experimental conditions (dose rate, painted surface area, temperature, pH, etc.). In each experiment, organic iodides contributed significantly to the volatile iodine fraction.

It is recommended that the calculations first be performed as blind calculations (i.e., each code is used with default parameters). Subsequently, the results can be made available to each of the participants, and a second set of calculations can be performed, with the organic iodide models in each code being optimized (i.e., user-defined parameters being tuned to give a best fit to all of the experiments), or modified (i.e., mechanisms, or relative contributions of individual mechanisms being changed). This comparison will allow each of the code users to realistically evaluate and improve the organic iodide behaviour sub-models within each of their codes. At the least, the exercise will provide code users with optimum values for the user-defined input parameters in their iodine behaviour codes. At best, the exercise may provide insight into the organic iodide formation and destruction mechanisms themselves, and clearly identify if future experiments or changes in modelling strategy are required.