

## CHAPTER V

### CONCLUSIONS AND RECOMMENDATIONS

#### 5.1 Conclusions

The test cell, the model from a small section of the vertical flux detector assembly (VFD), was used to study the heat transfer behavior and the temperature distribution of moderator in the CANDU, Point Lepreau plant along with using the FLUENT, numerical calculation.

The results for the behavior of the system obtained from the experiments show that the changing velocity of the water flowing along the test cell has a small effect on the temperature distribution between the water and the position within the bundle of detector wells.

In case of the heating rate, the temperature difference between the contacting moderator and the positions within the cluster of detector tubes measured by the thermocouples is directly proportional to the internal heat generation rate.

For other parameters, the position the thermocouples, the heaters and the strap within the test cell, this test cell is not able to support precisely enough information for evaluating their effect. However, there will be a significant temperature alteration recorded by the thermocouple in the flux tube at the straps and all along the assembly straw. This temperature change needs to be assessed quantitatively in more detail. This requires a larger section of the flux tube assembly with the water passing over the outside assembly tube.

The computer model, FLUENT, was used to consider the temperature distribution of the larger part of the flux tube under two-dimensional steady-state conditions with enable heat source. The strap play a important role in the behavior of the heat transfer system by strongly influencing the temperature

distribution within the detector wells. However, heat can flow in two directions. Most of heat can pass along the strap to the neighboring area and some heat can flow across the next fluid gap to the next part. Due to the behavior of the heating flow, the hot spot is occurred within the model.

The temperature distribution along the straw can be able to give an accurate determination of the level of irradiative heating within the flux tube assembly used in the station reactor moderator. The result of system manners obtained by FLUENT need to be validated with the experimental data.

## 5.2 Recommendations

Future work would consider the new test cell simulated a larger section of the vertical flux tube assembly in order to study the effect of various factors on the temperature change along the flux tube assembly relative to the strap for improving the operation safety in CANDU.

The new test cell would use the electrical heating to simulate the irradiative heating. Besides, this test cell would be available to:

1. Determine the effect of the flow rate on the external resistance on the outside surface of the vertical flux tube assembly over a wider range of moderator velocities.
2. Determine the temperature distribution as a function of a position from the strap.
3. Determine the possibility of using the temperature distribution to determine the level of irradiative heating of the vertical flux tube assembly.

In order to create the new test cell, the mechanical mechanism should be developed to move the thermocouples along the straws. Due to the error of the inaccurate position of thermocouple within the test cell bundle, the technique, which can determine the precise location of thermocouples inserted in straws,

should be concerned. Moreover, the test of the mechanical device for driving and accurately judging the position of a thermocouple within a full reactor length straw of a flux tube bundle must be applied.