

## Reflood Model Activation Exercise

Previous exercises for the PWR model included achieving steady-state target conditions, debugging model input errors and break modeling and validation. The PWR model has been set up to perform a cold leg small break loss-of-coolant-accident. It is expected that during this transient, core uncovering will occur and the fuel rods will heat up. Emergency core cooling systems are expected to activate, injecting coolant into the primary system. Core reflood is expected to occur, stop the fuel rod heatup process, and subsequently quench the fuel rods

### OBJECTIVES

- Activate the reflood capability in the VESSEL component.
- Activate the fine-mesh reflood capability in the fuel rod heat structures.

### OVERVIEW OF STEPS

1. Preliminary Setup (Open the PWR Model).
2. Prepare the VESSEL Component for Reflood Capability.
  - A) Activate the VESSEL Reflood Option
  - B) Define Reflood HTSTR Components Connected to the VESSEL
3. Activate the Fine-mesh Reflood Option in the Fuel Rod Heat Structures.
  - A) Activate the Fine-mesh Reflood Model
  - B) Set the Maximum Reflood Axial Nodes
  - C) Set the Minimum Reflood Node Length
  - D) Set the Permanent Number of Fine-mesh Node Rows

## STEP 1 PRELIMINARY SETUP (OPEN THE PWR MODEL).

1. Close all Model Editor files that are open.
2. Go to the Day4/Morning/PWR\_Steady-State folder and double-click on the file “**PWR-SS1.med**”. This will open the PWR model that will be used for this exercise.


## STEP 2 PREPARE THE VESSEL COMPONENT FOR REFLOOD CAPABILITY.

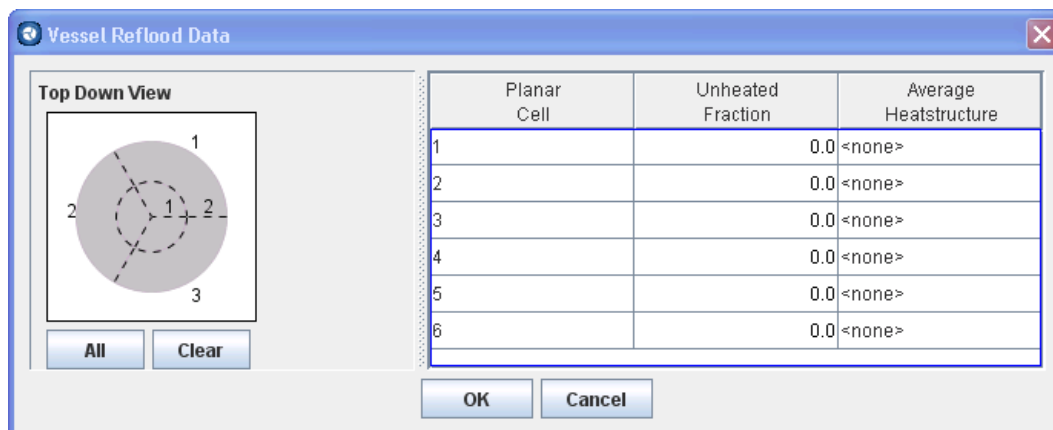
When the reflood capability is activated in the VESSEL component it associates the fine-mesh reflood HTSTR components with the vessel. The model changes implemented in this step will flag TRACE that a reflood calculation may be needed during a transient calculation.

### STEP 2.A ACTIVATE THE VESSEL REFLOOD OPTION

1. On the Hydro Comps tab, click on the VESSEL component.
2. In the **Properties Window**, locate the Use Reflood option, check mark the box, and set the value to **True**.

### STEP 2.B DEFINE REFLOOD HTSTR COMPONENTS CONNECTED TO THE VESSEL

1. In the Properties Window, locate the Core Reflood Heating option and expand  the dialog. The following dialog should appear.



Note that there are 6 cells to which reflood HTSTRs can be attached. Click on the numbers 1 through 6 in the table and the associated cell will be highlighted in the vessel cross section diagram to the left.



Note that the placement of heat structures in this Vessel Reflood Data table is important since each number in the table is mapped to a specific radial and azimuthal cell in the vessel. The heat structures cells are also mapped to specific a specific radial and azimuthal sector of the vessel. Thus the heat structures map to a specific location in the table.



The "Unheated Fraction" input is the fraction of the reflood HTSTR that is not powered. Since the reflood HTSTRs in this model do not have unheated sections, this input is set to 0.0.



The reflood HTSTRs in this model are the HTSTR components that model the fuel rods. These HTSTR components are number 41, 43, and 45. Htstr 41 is connected to Sector 1, HTSTR 43 is connected to Sector 2, and HTSTR 45 is connected to Sector 3.

2. Set the Average Heatstructure value for planar Cells 1, 2, and 3 to HTSTR 41, 43, and 45 respectively and click OK.



Note that planar cells 4, 5, and 6 are in the downcomer region rather than the core region, and do not contain heated rods. Thus there is no heat structure mapped to these planar cells in the table.

### STEP 3 ACTIVATE THE FINE-MESH REFLOOD OPTION IN THE FUEL ROD HEAT STRUCTURES.

This step will activate the fine-mesh reflood capability in the fuel rod HTSTRs. In a reflood situation, TRACE will divide the HTSTR axial cell lengths into a user specified

number of permanent fine mesh cells. TRACE will further divide the mesh cells into finer cells. The minimum fine-mesh node length is a user input parameter. The maximum number of fine mesh cells that can occur at a given time is also a user input value. These values are set for the three fuel rod heat structures in the following steps

### STEP 3A ACTIVATE THE FINE-MESH REFLOOD MODEL

1. In the View Window click on the “Heat Structures” tab at the bottom of the window. Locate the Fuel Rod heat structures (HTSTRs 41, 43 and 45).
2. Click on fuel rod HTSTR component 41.
3. In the Properties Window, locate the “Fine Mesh Reflood” box and click the “True” button. This activates the fine-mesh reflood capability (FMON).

### STEP 3B SET THE MAXIMUM REFLOOD AXIAL NODES

1. Locate the “Maximum Axial Nodes” box in the Properties Window. Change the number to 120 (NZMAX).



The recommended maximum number of fine-mesh node rows is between 100 and 250.


### STEP 3C SET THE MINIMUM REFLOOD NODE LENGTH

1. Locate the “Minimum Node Distance” box in the Properties Window. Change the number to 1.0e-3 m (DZNHT).



The recommended value for the minimum temporary node size TRACE is allowed to use during the reflood calculation is 1.0e-3 m,

### STEP 3D SET THE PERMANENT NUMBER OF FINE-MESH NODE ROWS

1. Locate the “Axial Properties” box in the Properties Window. Expand  the input box.

2. In the left section of the popup window, select the “Fine Mesh Count” item.
3. In the right section of the of the window modify the “Fine-Mesh Count” number in the column titled “Average Rod” to 5. This sets the number of permanent fine-mesh node rows the coarse HTSTR cells are divided into.
4. Click the Close button at the bottom of the window.

This completes the activation of the fine-mesh reflood model for HTSTR 41.

**Repeat Steps 3A through 3D for HTSTR component 43 and 45.**