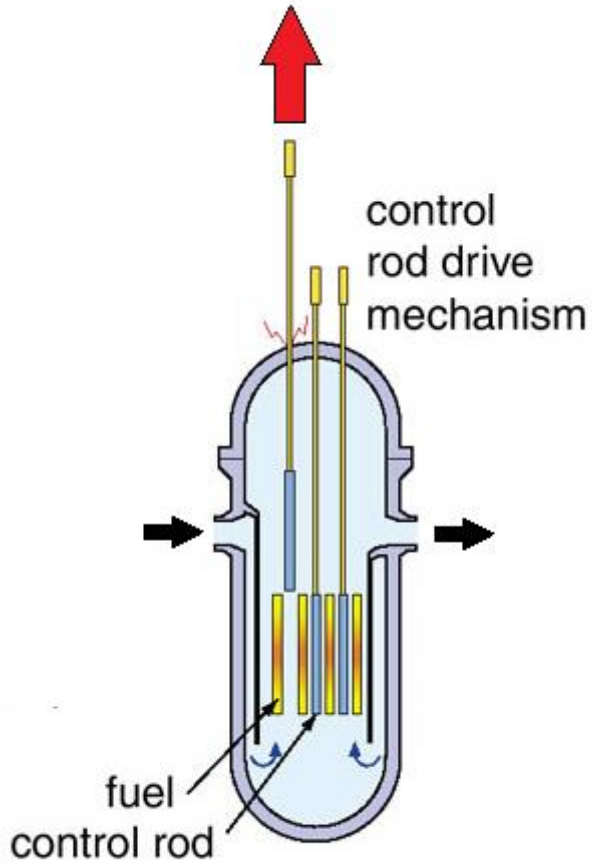
SNAP/RADTRAD Exercise 3:

Converting our FHA Model to a Rod Ejection Accident Model

Rod Ejection Accident Overview

- It is assumed that a mechanical failure of the pressure housing of a control rod mechanism has resulted in the ejection of a rod cluster assembly
- We will use analytical assumptions outlined in RG 1.183, Appendix H
- One pathway considered for radiological release – containment to environment
- We will credit the emergency mode of operation for the control room
- Doses examined at EAB, LPZ, and CR at end of accident

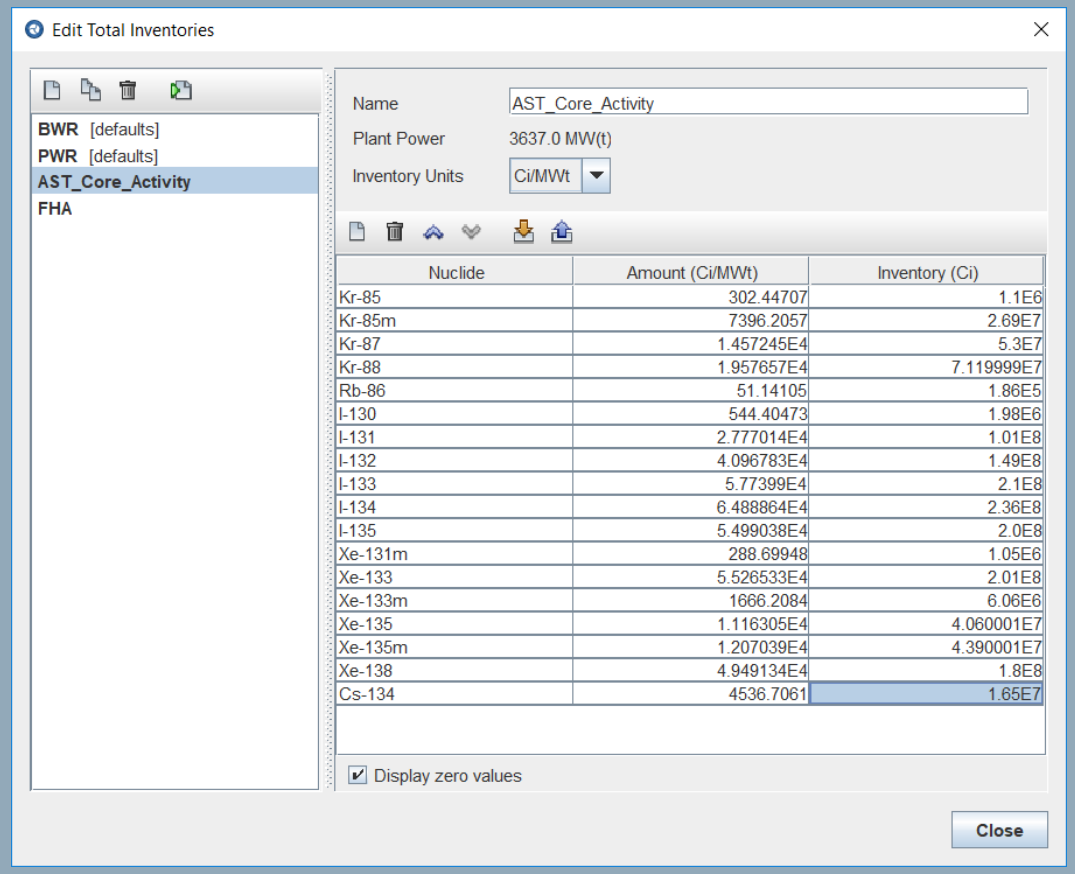


Step 1: Preliminary Setup

- You should have Exercise 2 open in your Model Editor
- In the Navigator Window, select “Model Options”
- Change the Title to “PWR_REA_simple”
- Select the job stream in the Navigator Window and change the “Name” to “PWR_REA_simple”
- Change the “Relative Location” in your job stream
  - Consider changing the location to “PWR_REA_simple” in order to prevent the files from the previous exercise from being overwritten
- Save the model as “PWR_REA_simple.med”

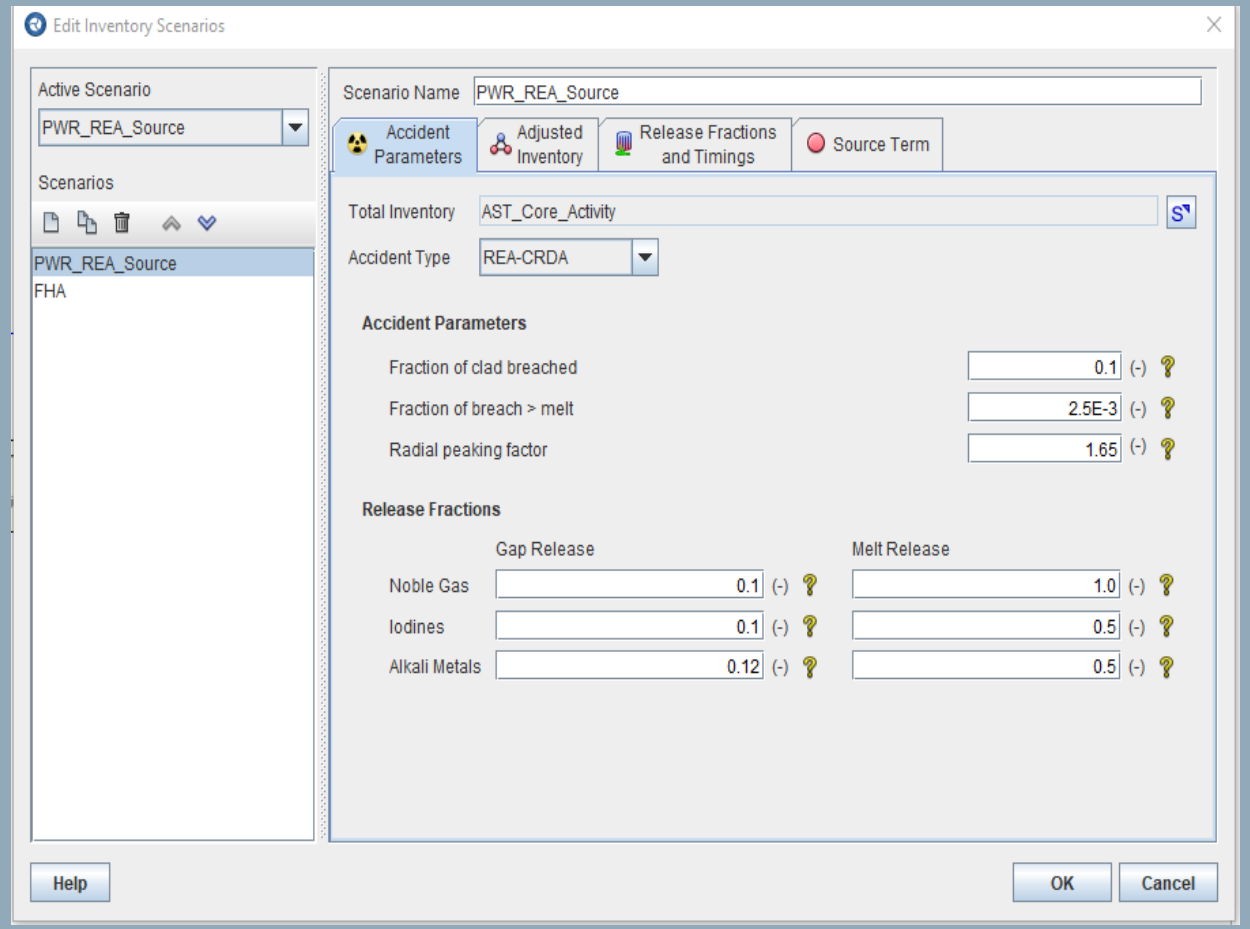
Step 2: Adding an Inventory

- Create a new inventory under “Nuclide Data” titled “AST_Core_Activity” and press the icon and select REAInventory.icx if provided. If the inventory file isn’t provided, the values located will need to be entered manually.



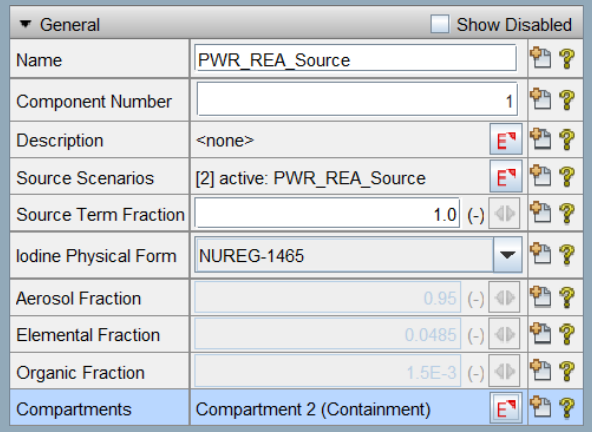
Step 3: Changing the Source

- In the Navigator Window, select “Source 1 (FHA Source)” rename the source to PWR_REA_Source.
- Next expand ( ) the Source Scenarios window and click on Create a New Scenario (the icon) and select the AST_Core_Activity inventory we created.
- Next switch the Active Scenario to PWR_REA_Source and change the Accident Type located in the Accident Parameters tab to REA-CRDA. Then fill out information to match the image:

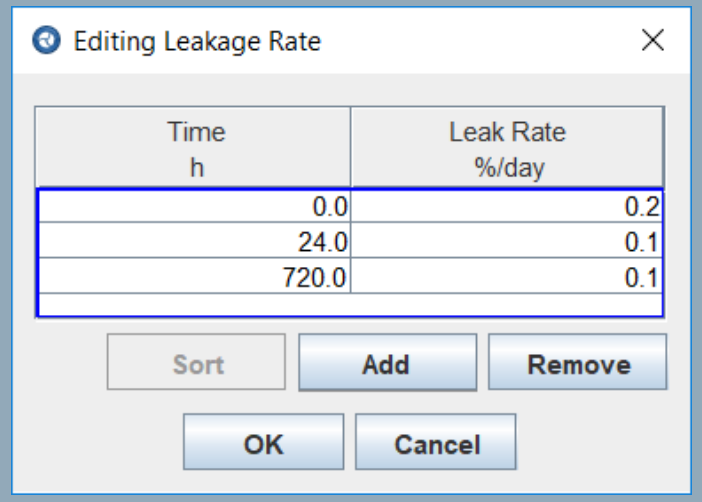


Step 3: Changing the Source (cont.)

- Press OK on the Edit Inventory Scenarios tab and Change the Source Term Fraction and the Iodine Physical Form in the Source to match the image below.



- Select the Leak to Environment Pathway and expand the Leakage Rate table. Then fill the table with the values shown in the image to the right.
- NOTE: an excel spreadsheet ExerciseData has been provided so you can copy (Ctrl + c) and paste (Ctrl + v) table values directly into the model editor.



Step 4: CR Emergency Mode

- Create another pathway (right-click pathway > new) and rename it CR_filtered_inflow. Then drag and drop it to add it to the view and connect ( ) the flow from the Environment compartment to the Control Room compartment just like the CR_unfiltered_inflow pathway.
- Create two new filters (right-click filters > new): CR_filtered_inflow and CR_recirc_flow.
- If the Spreadsheet ExerciseData is provided, copy and paste values into the corresponding filter tables (select a filter, expand filter table), otherwise values can be entered manually.

CR_unfiltered_inflow

Time h	Flow Rate ft^3/min	Aerosol Rem... %	Elemental I R... %	Organic I Re... %
0.0	2000.0	0.0	0.0	0.0
0.0333	20.0	0.0	0.0	0.0
720.0	20.0	0.0	0.0	0.0

CR_to_environ

Time h	Flow Rate ft^3/min	Aerosol Rem... %	Elemental I R... %	Organic I Re... %
0.0	2000.0	0.0	0.0	0.0
0.0333	570.0	0.0	0.0	0.0
720.0	570.0	0.0	0.0	0.0

CR_recirc_flow

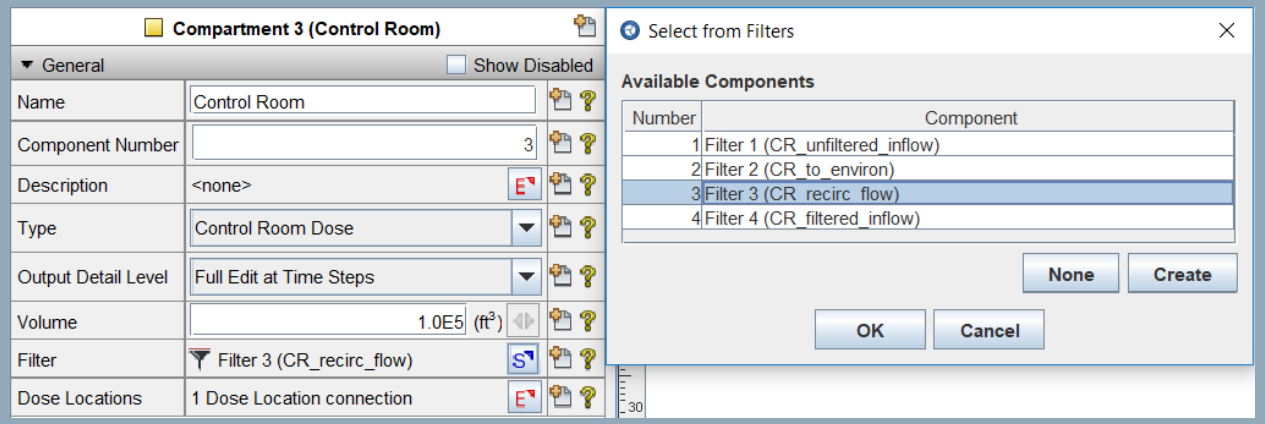
Time h	Flow Rate ft^3/min	Aerosol Rem... %	Elemental I R... %	Organic I Re... %
0.0	0.0	0.0	0.0	0.0
0.0333	1250.0	95.0	95.0	95.0
720.0	1250.0	95.0	95.0	95.0

CR_filtered_inflow

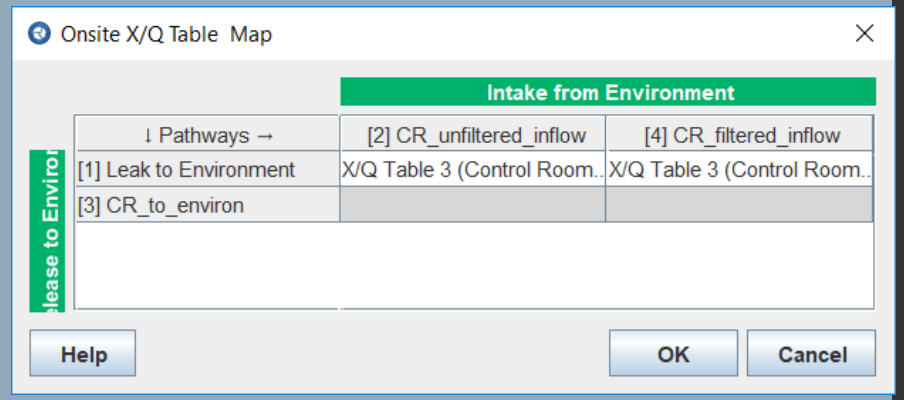
Time h	Flow Rate ft^3/min	Aerosol Rem... %	Elemental I R... %	Organic I Re... %
0.0	0.0	0.0	0.0	0.0
0.0333	550.0	95.0	95.0	95.0
720.0	550.0	95.0	95.0	95.0

Step 4: CR Emergency Mode (cont.)

- Select the CR_filtered_inflow pathway and press the select (S) icon under filter and select CR_filtered_inflow filter.
- Do the same for the CR compartment, as shown below:

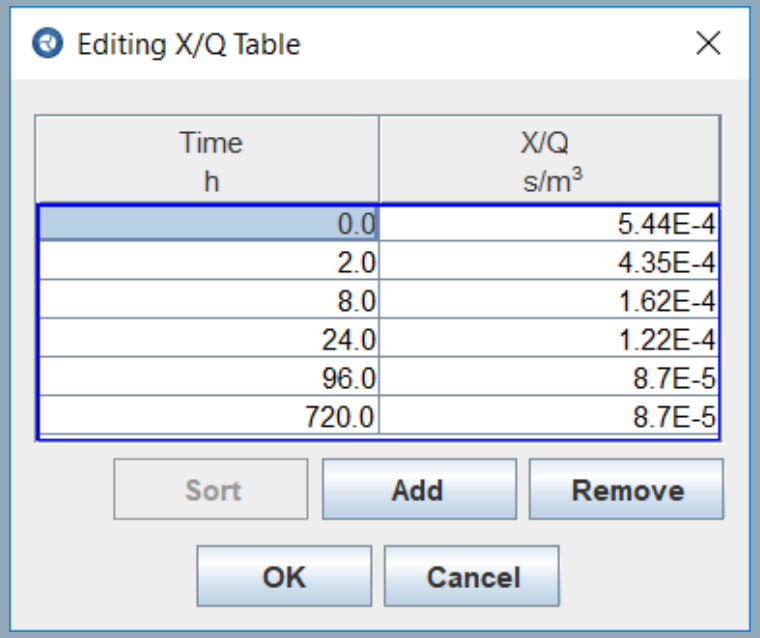


- At the environment compartment, expand the Onsite X/Q Tables and select the Control Room X/Q table as shown to the right.



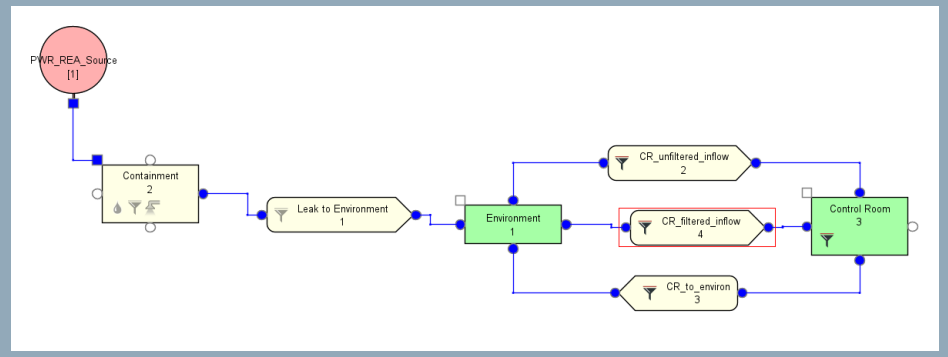
Step 4: CR Emergency Mode (cont.)

- Expand the X/Q Tables in the Navigator Window and select the Control Room X/Q Table.
- If the ExerciseData spreadsheet is provided, copy and paste the values into the table, otherwise enter them manually as shown in the image below.



Step 5: Running the Simulation

- Check the model in your View Window against the image below, paying attention to the connections and which components have filters:



- If it looks the same, try running the simulation as we did in Exercise 1 and 2
- Check the results of the simulation against the values to the right:

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################################################################################
                        Worst Two-Hour Doses
################################################################################

Exclusion Area Boundary
     Time          Whole Body     Thyroid         TEDE
     (hr)            (rem)         (rem)          (rem)
    0.0-2.0        9.1106e-02    2.0840e+01    8.6876e-01

################################################################################
                             Final Doses
################################################################################

Low Population Zone
   Time    Whole Body     Thyroid         TEDE
   (hr)      (rem)         (rem)          (rem)
  720.0    7.3207e-02    3.4435e+01    1.4817e+00

Control Room
   Time    Whole Body     Thyroid         TEDE
   (hr)      (rem)         (rem)          (rem)
  720.0    7.1217e-03    2.0504e+01    8.7598e-01

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