



SNAP/RADTRAD

Exercise 1:


Building a Simple Fuel Handling Accident (FHA) Model

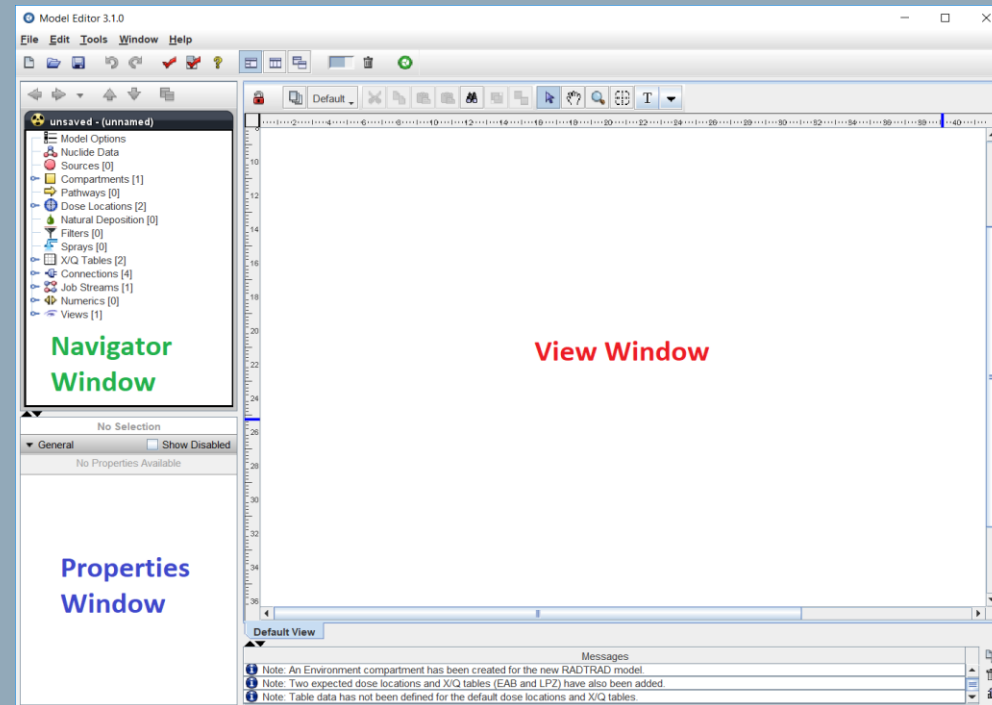
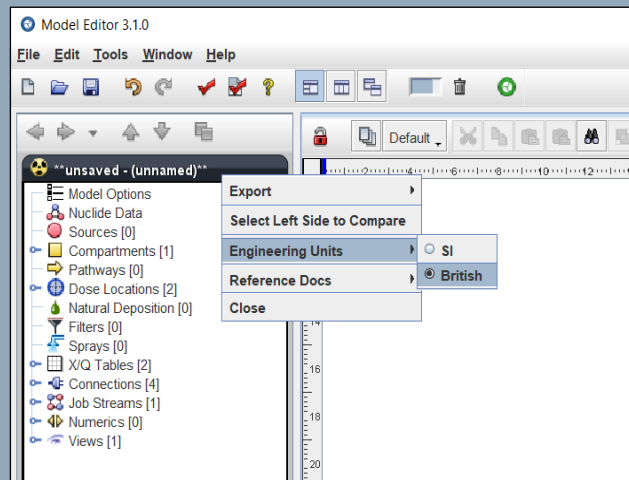
Fuel Handling Accident Overview

- A fuel assembly is assumed to be dropped and damaged
- No credit for containment isolation or pool filtration is taken
- A source from a representative PWR plant is used
- Simple model – a containment with a source, environment, and leakage pathway
- Doses examined at EAB and LPZ at end of accident



Step 1: Preliminary Setup

- Open the SNAP Model Editor: 
- Select “Create a New Model” and choose RADTRAD
- Examine the SNAP interface and its three primary windows
- Verify that the model units are set to British by right clicking on the black title bar





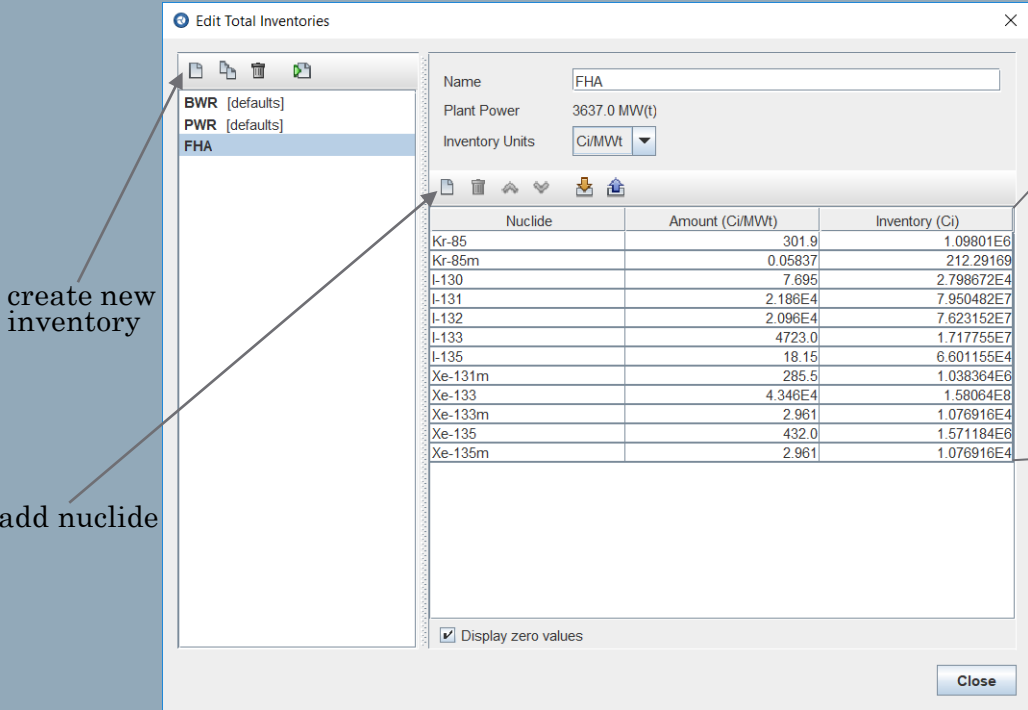
Step 2: Setting the Model Options

- Click “Model Options” in the Navigator Window
- Notice that the Properties Window now shows the “Model Options” input parameters
- Set the unknown values for the model as shown below:

Model Options	
▼ General <input type="checkbox"/> Show Disabled	
Title	FHA_simple
Description	FHA for PWR plant
Plant Power Level	3637.0 (MW(th))
Decay	Decay and daughtering
Onset Gap Release	0.0 (h)
Start of Accident	0.0 (h)
Duration of Accident	720.0 (h)
Dose Conversion Type	FGR 11 & 12
Dose Conversions	View "FGR 11 & 12" Defaults
Time Step Algorithm	Default
Time Step Table	Rows: 0 []
► Output Parameters	
► NRC Output Flags	
► Diagnostic Flags	

Step 3: Setting the Nuclide Data

- Click “Nuclide Data” in the Navigator Window
- In the Properties Window, select the “Total Inventories” tab: 
- Create a new inventory and select the  icon to import the FHAInventory.icx file. If the file is not available, the nuclides and concentrations will need to be manually filled out.

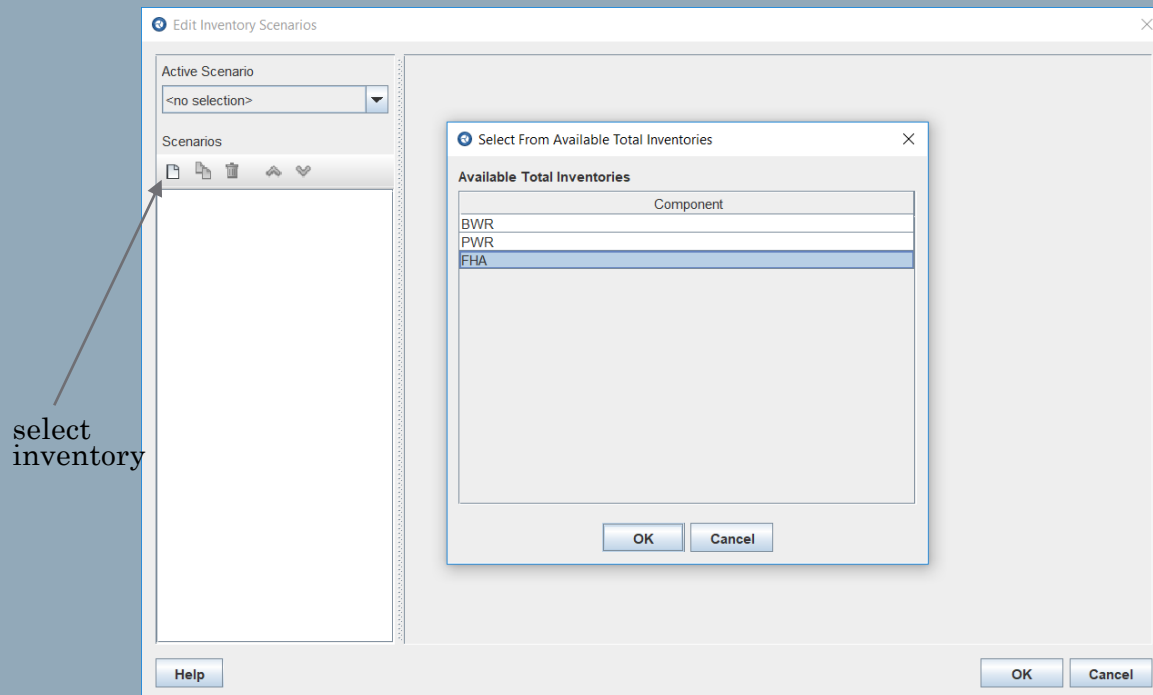


Nuclide	Amount (Ci/MWt)	Inventory (Ci)
I-130	7.695	2.798672E4
I-131	2.186E4	7.950482E7
I-132	2.096E4	7.623152E7
I-133	4723.0	1.717755E7
I-135	18.15	6.601155E4
Kr-85	301.9	1.09801E6
Kr-85m	0.05837	212.29169
Xe-131m	285.5	1.038364E6
Xe-133	4.346E4	1.58064E8
Xe-133m	2.961	1.076916E4
Xe-135	432.0	1.571184E6
Xe-135m	2.961	1.076916E4

Note: When adding nuclides, hold the ctrl key while clicking in order to select multiple at once.

Step 4: Setting the Source

- Right click on “Sources [0]” in the Navigator Window and select “New”
- In the Properties Window, input the data to the right:
- Select the “Source Scenarios” tab (E) and open the “FHA” inventory we created in the previous step.



Source 1 (FHA source)	
▼ General <input type="checkbox"/> Show Disabled	
Name	FHA source
Component Number	1
Description	<none>
Source Scenarios	Invalid Values
Source Term Fraction	1.0 (-)
Iodine Physical Form	User Defined
Aerosol Fraction	0.0 (-)
Elemental Fraction	0.7 (-)
Organic Fraction	0.3 (-)
Compartments	

Step 5: Setting the Source (cont.)

- In the “Edit Inventory Scenarios” box, input the “Accident Parameters” data to the right:
- Also, verify that the other three tabs (Adjusted Inventory, Release Fractions and Timings, Source Term) contain the values shown below:

Accident Parameters Adjusted Inventory Release Fractions and Timings Source Term

Plant Power: 3637.0 MW(t) Units: Ci/MWt

Nuclide	Amount (Ci/MWt)	Inventory (Ci)
Kr-85	0.92916373	3379.3685
Kr-85m	5.988218E-5	0.21779147
I-130	3.947176E-5	0.1435588
I-131	0.13455793	489.38718
I-132	0.10751503	391.03215
I-133	0.024226788	88.112826
I-135	9.310104E-5	0.33860847
Xe-131m	0.29289637	1065.2641
Xe-133	44.585907	1.621589E3
Xe-133m	3.03771E-3	11.048151
Xe-135	0.44319171	1611.8882
Xe-135m	3.03771E-3	11.048151

☒ Display zero values

Accident Parameters Adjusted Inventory Release Fractions and Timings Source Term

Nuclide	Gap (Ci)	Early (Ci)
Kr-85	3379.3685	0.0
Kr-85m	0.21779147	0.0
I-130	0.1435588	0.0
I-131	489.38718	0.0
I-132	391.03215	0.0
I-133	88.112826	0.0
I-135	0.33860847	0.0
Xe-131m	1065.2641	0.0
Xe-133	1.621589E3	0.0
Xe-133m	11.048151	0.0
Xe-135	1611.8882	0.0
Xe-135m	11.048151	0.0

☒ Display zero values

Accident Parameters Adjusted Inventory Release Fractions and Timings Source Term

☒ Use accident release fractions and timings

Import Export

RFT File Header Lines

Fuel Handling Accident release fractions

Duration (h):

Release Durations (hrs)

Gap: 2.0

Early: 0.0

Release Fractions

Group	Gap	Early
Noble Gases	1.0	0.0
Halogens	1.0	0.0
Alkali Metals	1.0	0.0
Tellurium	0.0	0.0
Alkaline Earth Metals	0.0	0.0
Noble Metals	0.0	0.0
Cerium	0.0	0.0
Lanthanides	0.0	0.0
Others	0.0	0.0
Non-radioactive Aerosols	0.0	0.0

Scenario Name: FHA

Accident Parameters Adjusted Inventory Release Fractions and Timings Source Term

Total Inventory: FHA

Accident Type: FHA

Plant Parameters

Number of rods or assemblies in core: 193.0 (-) ?

Number of rods or assemblies damaged: 1.2 (-) ?

Fraction of rods or assemblies damaged: 6.0E-3 (-) ?

Radial peaking factor: 1.65 (-) ?

Pool Iodine DF: 200.0 (-) ?

Decay period (hrs): 0.0 (-) ?

Insert Gap Fraction

RG 1.25

RG 1.183

Gap Fractions

I-131: 0.12 (-) ?

Kr-85: 0.3 (-) ?

Other NG: 0.1 (-) ?

Other Iodine: 0.1 (-) ?

Alkali Metals: 0.0 (-) ?

Step 5: Setting the Source (cont.)

- Also, verify that the other three tabs (Adjusted Inventory, Release Fractions and Timings, Source Term) contain the values shown:

<div> <div>Accident Parameters</div> <div>Adjusted Inventory</div> <div>Release Fractions and Timings</div> <div>Source Term</div> </div>			
Nuclide	Gap (Ci)	Early (Ci)	
Kr-85	3379.3685	0.0	
Kr-85m	0.21779147	0.0	
I-130	0.1435588	0.0	
I-131	489.38718	0.0	
I-132	391.03215	0.0	
I-133	88.112826	0.0	
I-135	0.33860847	0.0	
Xe-131m	1065.2641	0.0	
Xe-133	1.621589E5	0.0	
Xe-133m	11.048151	0.0	
Xe-135	1611.8882	0.0	
Xe-135m	11.048151	0.0	
<input checked="" type="checkbox"/> Display zero values			

Accident Parameters

Adjusted Inventory

Release Fractions and Timings

Source Term

☒ Use accident release fractions and timings

Import

Export

RFT File Header Lines

Fuel Handling Accident release fractions

Duration (h):

Release Durations (hrs)

Gap

2.0

Early

0.0

Release Fractions

Group	Gap	Early
Noble Gases	1.0	0.0
Halogens	1.0	0.0
Alkali Metals	1.0	0.0
Tellurium	0.0	0.0
Alkaline Earth Metals	0.0	0.0
Noble Metals	0.0	0.0
Cerium	0.0	0.0
Lanthanides	0.0	0.0
Others	0.0	0.0
Non-radioactive Aerosols	0.0	0.0

<div> <div>Accident Parameters</div> <div>Adjusted Inventory</div> <div>Release Fractions and Timings</div> <div>Source Term</div> </div>			
Plant Power	3637.0	MW(t)	Units <div>Ci/MWt</div>
Nuclide	Amount (Ci/MWt)	Inventory (Ci)	
Kr-85	0.92916373	3379.3685	
Kr-85m	5.988218E-5	0.21779147	
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Xe-135	0.44319171	1611.8882	
Xe-135m	3.03771E-3	11.048151	
<input checked="" type="checkbox"/> Display zero values			

Step 6: Containment & Environment

- Right click on “Compartments [1]” in the Navigator Window and select “New”. Note that there is already a compartment created for the environment.
- Set the “Containment” and “Environment” compartment as shown to the right:
- Create a new pathway in the Navigator Window in the same way you created a new compartment.
- Initialize the pathway as shown below, and set the inputs for the pathway as shown:

Compartment 1 (Environment)	
▼ General <input type="checkbox"/> Show Disabled	
Name	Environment
Component Number	1
Description	<none>
Type	Environment
Output Detail Level	No Additional Detail
Dose Locations	2 Dose Location connections

Compartment 2 (Containment)	
▼ General <input type="checkbox"/> Show Disabled	
Name	Containment
Component Number	2
Description	<none>
Type	Normal
Output Detail Level	Full Edit at Time Steps
Volume	2.5E6 (m ³)
Deposition	<none>
Filter	<none>
Spray	<none>

set leakage rates

Initialize Pathway	
From Compartment	Compartment 2 (Containment)
To Compartment	Compartment 1 (Environment)
Pathway Type	Air Leakage
<input type="button" value="OK"/> <input type="button" value="Cancel"/>	

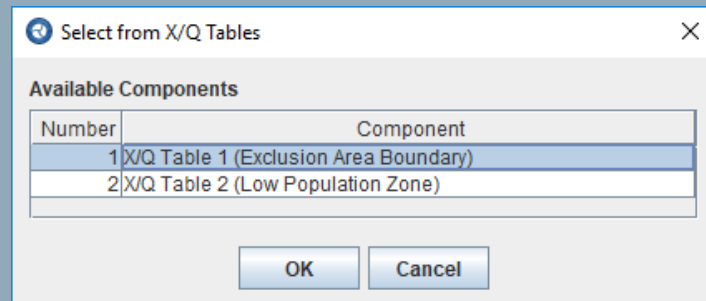
Pathway 1 (Leak to Environment)	
▼ General <input type="checkbox"/> Show Disabled	
Name	Leak to Environment
Component Number	1
Description	<none>
From Compartment	Compartment 2 (Containment)
To Compartment	Compartment 1 (Environment)
Pathway Type	Air Leakage
Printout detail level	None
Leakage Rate	Rows: 0 []

Editing Leakage Rate	
Time h	Leak Rate %/day
0.0	1.0E12
720.0	1.0E12
<input type="button" value="Sort"/> <input type="button" value="Add"/> <input type="button" value="Remove"/>	
<input type="button" value="OK"/> <input type="button" value="Cancel"/>	

Step 7: Dose Locations

- Under “Dose Locations” in the Navigator Window, verify the breathing rates for the EAB and the LPZ to the right:
- Also, verify that each dose location points to the correct corresponding X/Q table.

Time h	Breathing Rates ft ³ /min
0.0	0.741608
8.0	0.3813984
24.0	0.4873424



- The X/Q tables must be populated. Select these in the Navigator Window and set the following inputs:

EAB

LPZ

Editing X/Q Table

Time h	X/Q s/m ³
0.0	1.4E-4
720.0	1.4E-4

Sort Add Remove

OK Cancel

Editing X/Q Table

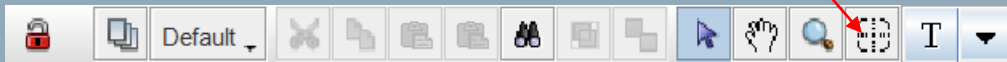
Time h	X/Q s/m ³
0.0	4.5E-5
2.0	2.39E-5
8.0	1.29E-5
24.0	5.49E-6
96.0	1.61E-6
720.0	1.61E-6

Sort Add Remove

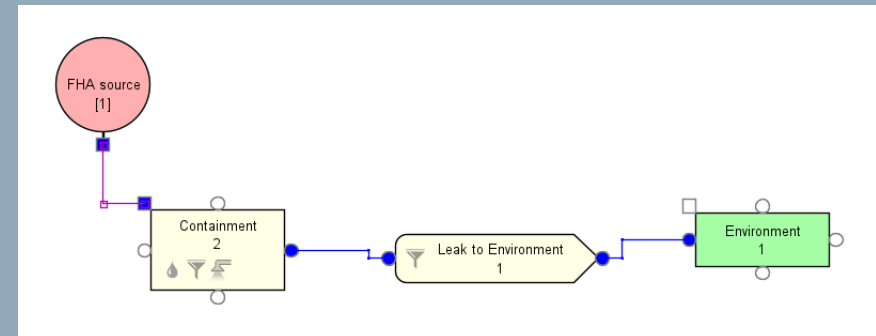
OK Cancel

Step 8: Populating the View Window

- So far, you have not been able to see your components in the View Window
- In the Navigator Window, right click on each of the components you created and click “Add to View” → “Default View”
- In the View Window, click and drag these components to your liking
- You will notice that the source is not connected to the containment. Connect these two components using the connection tool

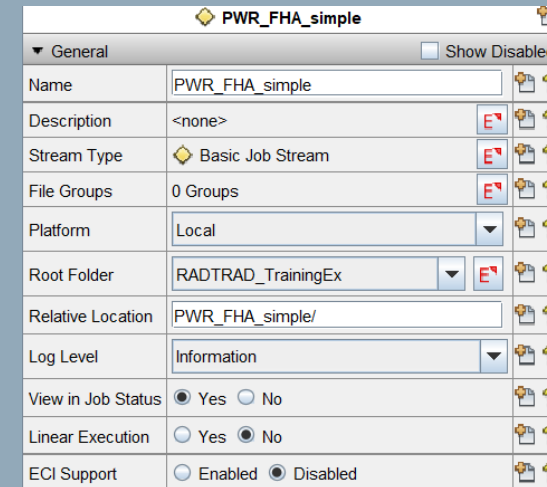


- Left click the connection tool, and then left click on each square port – first the source and then the containment.
- Finally, your View Window should look as follows:



Step 9: Setting the Job Stream

- In the Navigator Window, under “Job Streams [1]”, select the “Simple_Stream”
- In the Properties Window, rename the “Simple_Stream” to “PWR_FHA_simple”
- Define the root and relative location on your machine, where the output files will be stored
 - Set the “Root Folder” to an accessible directory on your machine
 - The “Relative Location” will be a directory within the root directory
- The Properties Window for your job stream should look something like the image on the right:
- Run a model check by clicking the red check mark at the top of the model editor

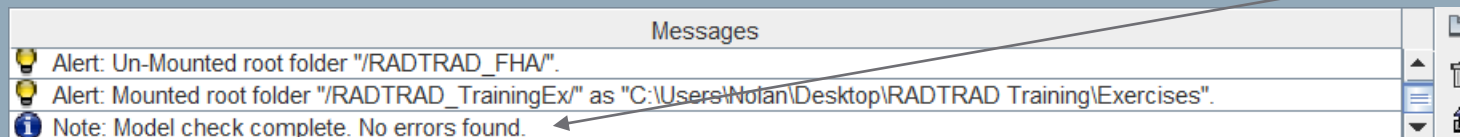


The screenshot shows the 'PWR_FHA_simple' Properties Window. The 'General' tab is selected. The fields are as follows:

Field	Value
Name	PWR_FHA_simple
Description	<none>
Stream Type	Basic Job Stream
File Groups	0 Groups
Platform	Local
Root Folder	RADTRAD_TrainingEx
Relative Location	PWR_FHA_simple/
Log Level	Information
View in Job Status	Yes (selected)
Linear Execution	No (selected)
ECI Support	Disabled (selected)




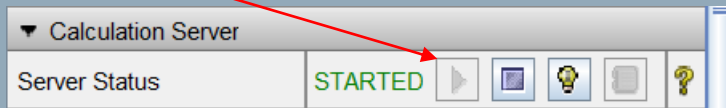
- If there are errors, a window will open listing deficiencies



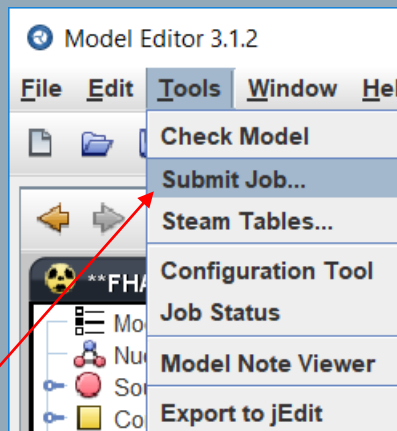
no errors found

Step 10: Running the Simulation

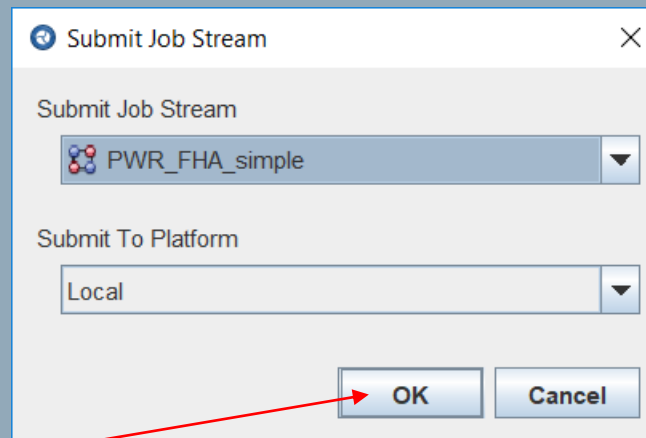
- Prior to running the exercise, be sure that the SNAP Configuration Tool is running
- Open the Configuration Tool: 
- Click the play button on the “Server Status” tab and then close the Configuration Tool.



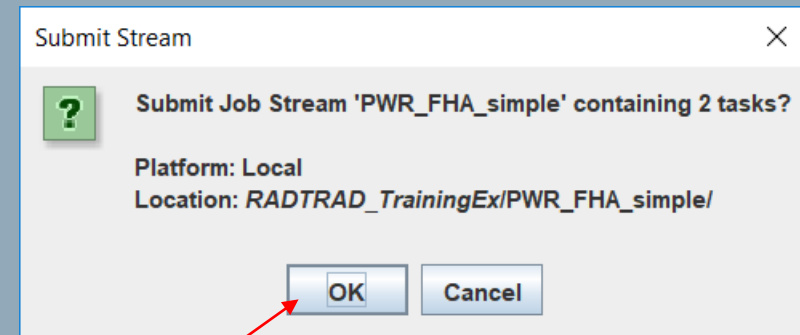
- In the Model Editor, submit the job by following the images below. A SNAP Job Status window will appear – wait and allow the case to complete.



submit job under “Tools”



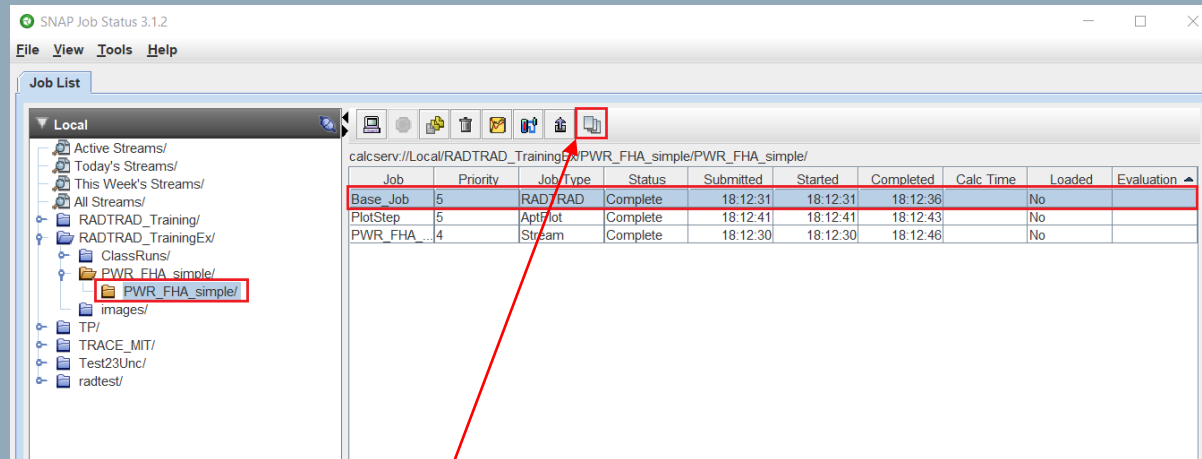
click okay



click okay

Step 11: Checking Results

- Check the results in the job status window



click to open
radrad.out text file

