

SNAP MELCOR Input Examples



PRESENTED BY

Larry Humphries llhumph@sandia.gov



Provide a review of the SNAP GUI for editing model input

- Discuss layout of input
- Provide comparisons with text input

Unique Considerations for SNAP Input

- Working with tabular input
- Making Connections
- Working with Database Variables
- Sensitivity Coefficients
- Comments and Notes

SNAP

**RN Classes should be defined
before Decay Elements**

Decay Heat

Shutdown Flag ☒ [0] Constant

Shutdown Time (s)

Operating Power ☒ (W)

Whole Core Decay ☒ [2] ANS

Operating Time ☐ (s)

Fissions/Atom ☐ (F/A)

Decay Elements [7] Defined Elements

RN Classes [23] RN Classes

Normalization Flag ☐ < Inactive >

ASCII

```

DCH_CL 'CS'   DEFAULT
DCH_CL 'BA'   DEFAULT
DCH_CL 'I2'   DEFAULT
DCH_CL 'TE'   DEFAULT
DCH_CL 'RU'   DEFAULT
DCH_CL 'MO'   DEFAULT
DCH_CL 'CE'   DEFAULT
DCH_CL 'LA'   DEFAULT
DCH_CL 'UO2'  DEFAULT
DCH_CL 'CD'   DEFAULT
DCH_CL 'AG'   DEFAULT
DCH_CL 'BO2'  DEFAULT
DCH_CL 'H2O'  DEFAULT
DCH_CL 'CON'  DEFAULT
DCH_CL 'CSI'  DEFAULT
DCH_CL 'H3B3O6' USER 1 1n cselm
                        1
                        'B2'
DCH_CL 'HBO2'  USER 1 1n cselm
                        1
                        'B3'
DCH_CL 'BH3'   USER 1 1n cselm
                        1
                        'B4'
DCH_CL 'B2H6'  USER 1 1n cselm
                        1
                        'B5'
DCH_CL 'BOH'   USER 1 1n cselm
                        1
                        'B6'
DCH_CL 'B(S)'  USER 1 1n cselm
                        1
                        'B7'
DCH_CL 'C(S)'  USER 1 1n cselm
                        1
                        'B8'
DCH_EL 'B2'    0.0 1 1n time dcheat
                        1
                        0.0 0.0
DCH_EL 'B3'    0.0 1 1n time dcheat
                        1
                        0.0 0.0
DCH_EL 'B4'    0.0 1 1n time dcheat
                        1
                        0.0 0.0
DCH_EL 'B5'    0.0 1 1n time dcheat
                        1
                        0.0 0.0
DCH_EL 'B6'    0.0 1 1n time dcheat

```

Element	Mass (kg)	Heat Data
B2	0.0	Rows: 1 [0.0,0.0]
B3	0.0	[1] Decay Row
B4	0.0	[1] Decay Row
B5	0.0	[1] Decay Row
B6	0.0	[1] Decay Row
B7	0.0	[1] Decay Row
B8	0.0	[1] Decay Row

Add Remove

OK Cancel

Number	Class Name	Custom	Class Elements
1	XE	☐	<none>
2	CS	☐	<none>
3	BA	☐	<none>
4	I2	☐	<none>
5	TE	☐	<none>
6	RU	☐	<none>
7	MO	☐	<none>
8	CE	☐	<none>
9	LA	☐	<none>
10	UO2	☐	<none>
11	CD	☐	<none>
12	AG	☐	<none>
13	BO2	☐	<none>
14	H2O	☐	<none>
15	CON	☐	<none>
16	CSI	☐	<none>
17	H3B3O6	☒	B2
18	HBO2	☒	B3
19	BH3	☒	B4
20	B2H6	☒	B5
21	BOH	☒	B6
22	B(S)	☒	B7
23	C(S)	☒	B8

Add Remove

OK Cancel

RN1 and RN2 Input Combined in SNAP and ASCII

4

SNAP

ASCII

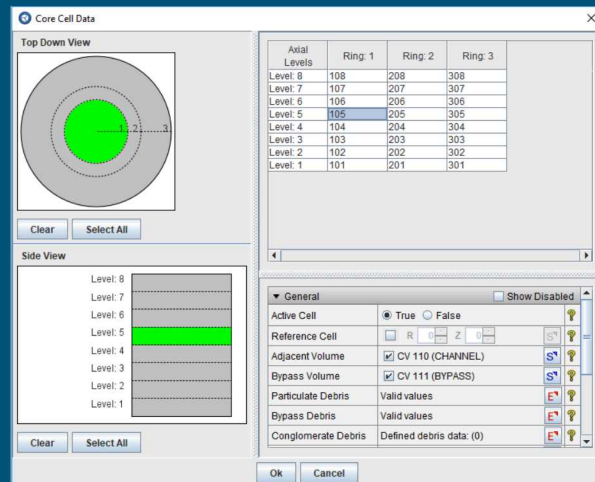
Radionuclide	
General ☐ Show Dis	
Enabled	☒ True ☐ False
Description	<none> E
Default Scheme	☒ 1.8.6 Standards v
Hygroscopic Model	v E
Convection Option	v E
Core Map	Core Mappings (0) E
Vahe's Enter	Valid values E
Vahe's Release	Valid values E
Fuel/Cavity Invent.	Specified Inventories (8) E
Cladding Inventory	Specified Inventories (12) E
Transport/Deposition Scaling	[0] Rows E
Define Booth Classes	☐ True ☒ False
Absorption Length	Valid values E
Cool Split	RN Split Data (0) E
HS Split	Heatstructure split data E
Pool Scrubbing	RN scrub data (2) E
Filters	RN Filters (2) E
Iodine Class	v E
Spray Partitions	Valid values E
Reactions	Reaction Sets (0) E
Transfers	Transfer Sets (0) E
Chem. Enabled	☒ [0] Off v
Iodine Pool	Inactive E
Visualization Output	None S
Dose Input	Dose Input Data (0) E
Cable Mass	Valid values E
Surface Coatings	Valid values E
Aqueous Species	Valid values E
Flashing-Jet Model	Valid values E
Film Entrainment	Valid values E
Pool Concentrate	[0] Ratios Defined E
▼ [RN1_DIM] Dimension Record	
Enable	☒ True ☐ False
Aerosol Sections	10 - v
Aerosol Cmpts.	2 - v

Release Model	
Release Model v	
Gap Release	Gap Release Cells (8) E
Release Comb.	Class combinations (1) E
▼ [RN1_ASP] Aerosol Sectional Parameters	
Enable	☒ True ☐ False
Lwr. Aerosol Diam.	☒ 1.0E-7 (m) v
Upr. Aerosol Diam.	☒ 5.0E-5 (m) v
Aerosols Density	☒ 1000.0 (kg/m³) v
▼ Aerosol Coefficients	
Aero. Coeff. Opt.	☒ [1] Calculate and ... v
Aerosol Coefficient	(-) [0] E
Use Aerosol Component Map	☐ True ☒ False
Surface Deposition	Defined surfaces (1) E
Intervolume Trans.	Defined flows (5) E
Aerosol Sources	Defined aerosol source ... E
Resuspension	Resuspension data set ... E
▼ [RN1_PT] Conditions for Aerosol Coefficients	
Enable	☐ True ☒ False
▼ [RNCFDS] Generated values	
Enable	☐ True ☒ False
▼ [RNCFTI] Generated values	
Enable	☐ True ☒ False
▼ [RN1_MS00] Misc. Aerosol Dynamics Constants	
Enable	☒ True ☐ False
Dyn. Shape Factor	☒ 1.0 (-) v
Agglomeration Fac.	☒ 1.0 (-) v
Particle Slip	☒ 1.257 (-) v
Particle Stick	☒ 1.0 (-) v
Turb. Dissipation	☒ 1.0E-3 (m²/s²) v
Conductivity Ratio	☒ 0.05 (-) v
Accommodation	☒ 2.25 (-) v
Diffusion Thickness	☒ 1.0E-5 (m) v
▼ Condensation Evaporation	

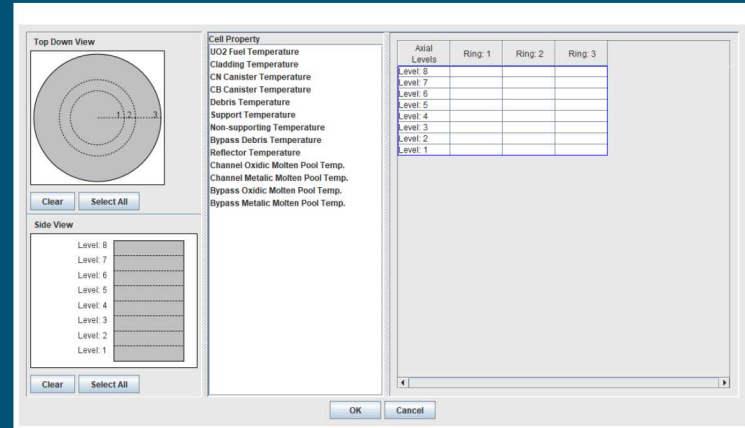
RN1 INPUT				
RN1_DFT	1.86			
!	numsec	numcmp	numcls	numca
RN1_DIM	10	2	23	6
!	iclnrm			
RN1_DCHNORM	NONE			
+	RN1_FPN	8 !()	n ir ia ninp irref iarref rinpl rinp2	
+	RN1_GAP	12 !()	n ir ia ninp irref iarref rinpl rinp2	
+	RN1_GAPOO	8 !()	n ir ia clfail	
+	RN1_CLS	'CsI' 'CSI'	2 !()	n nclsd xmrat
!	dmin	dmax	rhonm	
RN1_ASP	1.0E-7	5.0E-5	1000.0	
!	icoeff			
RN1_ACOEF CALANDWR				
!	chi	gamma	fslip	stick
RN1_MS00	1.0	1.0	1.257	1.0
!	chi	gamma	fslip	stick
RN1_MS01	1.0E-3	0.05	2.25	1.0E-5
+	RN1_DS	1 !()	n ids isde ityp	
+	RN1_SET	5 !()	n ivolf ivolt elev are	
!	icaon			
RN1_CAF	OFF			
RN2 INPUT				
+	RN2_PLS	2 !()	n fpcav name avent mvent nvent ntyp	
!	fltnam	flttfp	ctype	ikay gdf xmasg icvtyp
RN2_FLT	FIL1-CONTVENT	'CONT VENT'	AEROSOL VALUE 1000.0	-1.0 'FILTERS'
RN2_FLT	FIL2-CONTVENT	'CONT VENT'	FPVAPOR VALUE 1000.0	-1.0 'FILTERS'
+	RN2_FCL	1 !()	n iclss ikay dfc xmas	
!	age	xmbedi	dhrels	specht
RN2_FVC	0.0	827.35	1.0	711.78

COR Package Utilizes Similar Interface for Cell Data

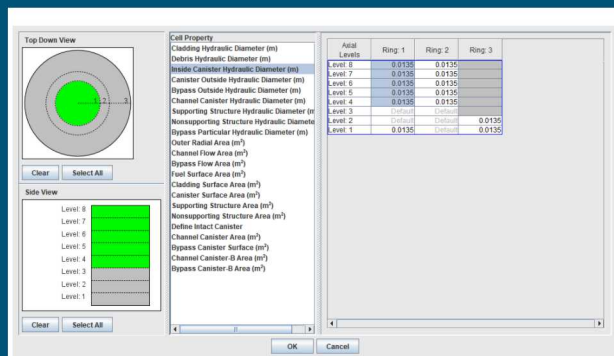
Cell Properties



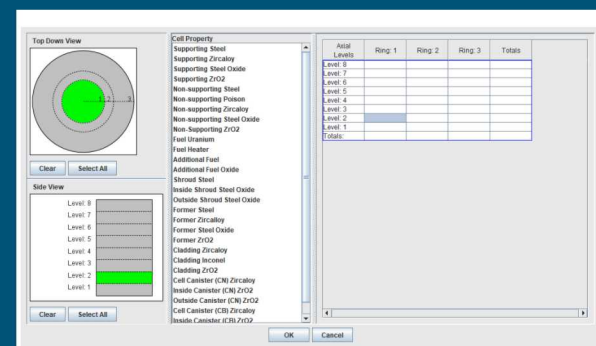
Initial Temperatures



Areas/Hydraulic Diameter



Material Masses



Implemented as Table

- Tabular Function
- COR Axial Elevations
- COR Radial Rings
- Most COR Cell data
 - Examples
 - Component Material Masses, Surface Areas, Temperatures, hydraulic diameters, flow areas, Cell Radial Ring areas
 - Gap Release Temperatures
 - Exceptions
 - volumes associated with COR cells
 - PD material masses in channel and bypass
 - Core Blockage Cells
 - Additional Heat sources
 - Cladding/Canister/Fuel/Blade Collapse control functions
- CVH Volume Altitude tables
- DCH Elements
- RN Classes
- HS nodalizations
- Concrete Composition
- CAV geometry points

Not Implemented as Table

- RN Gap Inventories
- RN Fuel Cavity Inventories
- NCGs
- Material Properties
 - However, MPs can receive data from Tabular Functions defined in the database
- Object information is implemented for each object. Does not allow editing a table of objects like CVs or HSs
 - CV initial conditions
 - HS Boundary volumes and conditions

HS 11104 (SHROUD LEVEL 4)	
Enable	☒ True ☐ False
Left Emissivity	0.9 (-)
Left Radiation Model	Gray Gas
Left Radiation Path	0.1 (m)
▼ Right (Outside) Boundary Surface Data	
Right Boundary Type	Convective Condition
Right Boundary Mass	☒ True ☐ False
Rt. Boundary Vol.	CV 150 (DC+UP+SD)
Right Boundary Flow	[1] External Flow
Right Minimum Pool	0.5 (-)

7 Use of MS EXCEL

Though SNAP utilizes tables, it is not a spreadsheet. Depending on the table, SNAP has only the most basic functional capabilities of a spreadsheet.

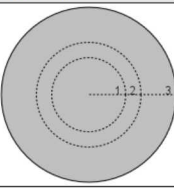
However, as an alternative, companion EXCEL spreadsheets can be used to create workbooks for calculating and documenting table entries.

Many, but not all of SNAP's tables can utilize cut-and-paste data from an EXCEL spreadsheet.

Component	Mass	Area				
Fuel Rods		6640				
UO ₂ fuel	192000					
Clad		7840				
Zr clad	40960					
Canister						
CN (Zr)	11840	880				
CB (Zr)	11840	880				
Control Blades		800				
Steel	10000					
B4C	1000					
Core Plate		20				
Steel	5000					
CRGT		1200				
Steel	80000					

NRINGS	3					
NAXL	8	10	8	24007.25	23992.75	0
RVLH	4	9	7	24007.25	23992.75	0
ZLHT	5	8	6	24007.25	23992.75	0
		7	5	24007.25	23992.75	0
Show Volume		6	4	0	0	0
		5.9	3	0	0	0
		5	2	0	0	0
		2.95	1	0	0	0

Top Down View



Clear Select All

Side View

Level: 8	
Level: 7	
Level: 6	
Level: 5	
Level: 4	
Level: 3	
Level: 2	
Level: 1	

Clear Select All

Cell Property

- Supporting Steel
- Supporting Zircaloy
- Supporting Steel Oxide
- Supporting ZrO₂
- Non-supporting Steel
- Non-supporting Poison
- Non-supporting Zircaloy
- Non-supporting Steel Oxide
- Non-supporting ZrO₂
- Fuel Uranium
- Fuel Heater
- Additional Fuel
- Additional Fuel Oxide
- Shroud Steel
- Inside Shroud Steel Oxide
- Outside Shroud Steel Oxide
- Former Steel
- Former Zircaloy
- Former Steel Oxide
- Former ZrO₂
- Cladding Zircaloy
- Cladding Inconel
- Cladding ZrO₂
- Cell Canister (CN) Zircaloy
- Inside Canister (CN) ZrO₂
- Outside Canister (CN) ZrO₂
- Cell Canister (CB) Zircaloy
- Inside Canister (CB) ZrO₂

Axial Levels	Ring: 1	Ring: 2	Ring: 3	Totals
Level: 8	24007.250...	23992.749...		48000.0
Level: 7	24007.250...	23992.749...		48000.0
Level: 6	24007.250...	23992.749...		48000.0
Level: 5	24007.250...	23992.749...		48000.0
Level: 4	Default	Default		0.0
Level: 3	Default	Default		0.0
Level: 2	Default	Default	0.0	0.0
Level: 1	Default	Default	0.0	0.0
Totals:	96029.000...	95970.999...	0.0	1.92E5

OK

Cancel

8 Making Connections

Connections are made graphically from objects on a view window using the connection tool

- Cannot be made from Connections dropdown (right)
- Can be made from flow path, spray or control function menus

Connection types

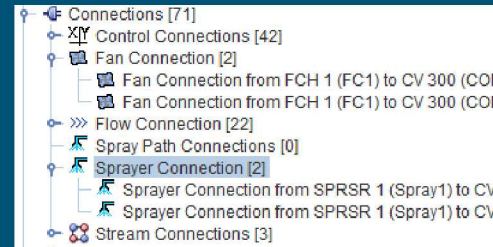
- Flow Paths
 - Connects control volumes
- Fan Connections
 - Connects inlet and outlet control volumes to fan cooler
- Spray Connections
 - Connects source pool and target CV for spray
- Spray Path Connections
 - Connects multiple spray paths
- Control Functions
 - Connections to other control functions or control function arguments

Graphical Connections

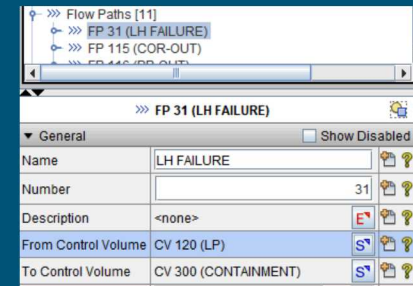
- User first drags associated connected objects (control volumes) and connections (Flow paths, sprays, Fan connections, spray paths) into view
- Click on connection tool and cursor changes to cross-hair
 - Blue dot appears on connection 'cross-hairs' when node is detected and connection can be made
- User assigns node connections.
 - Connection node indicates input/output
 - Selection of object node is generally not important
 - SNAP adjusts connection node to correspond to elevations specified through other input.



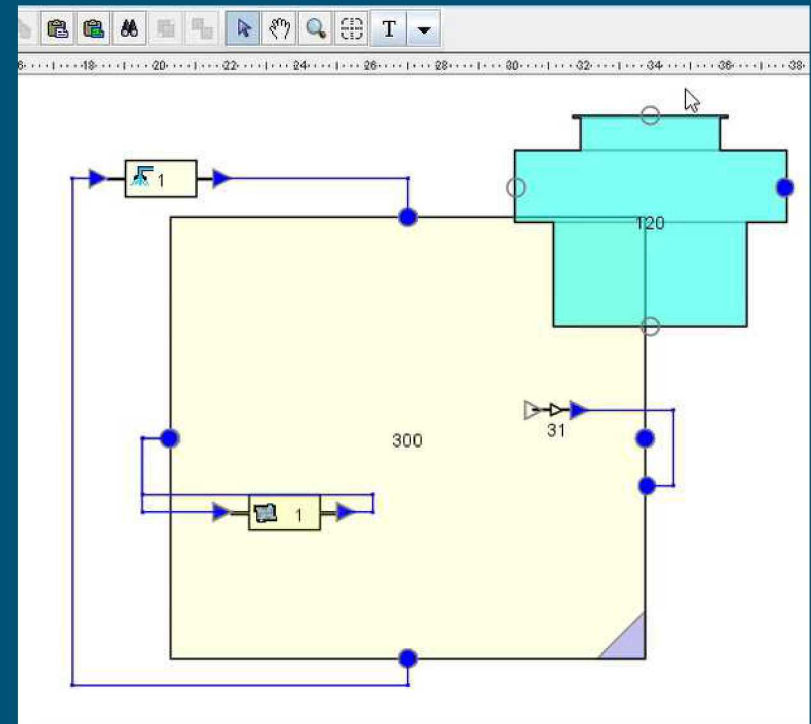
Connection cannot be made from Connections Menu



Connection can be made from Flow Paths, Sprays, and Fan Cooler Menu



Connection can be made graphically



9 Database Variables

Control Function arguments must be added to Database Variables before they can be used for input.

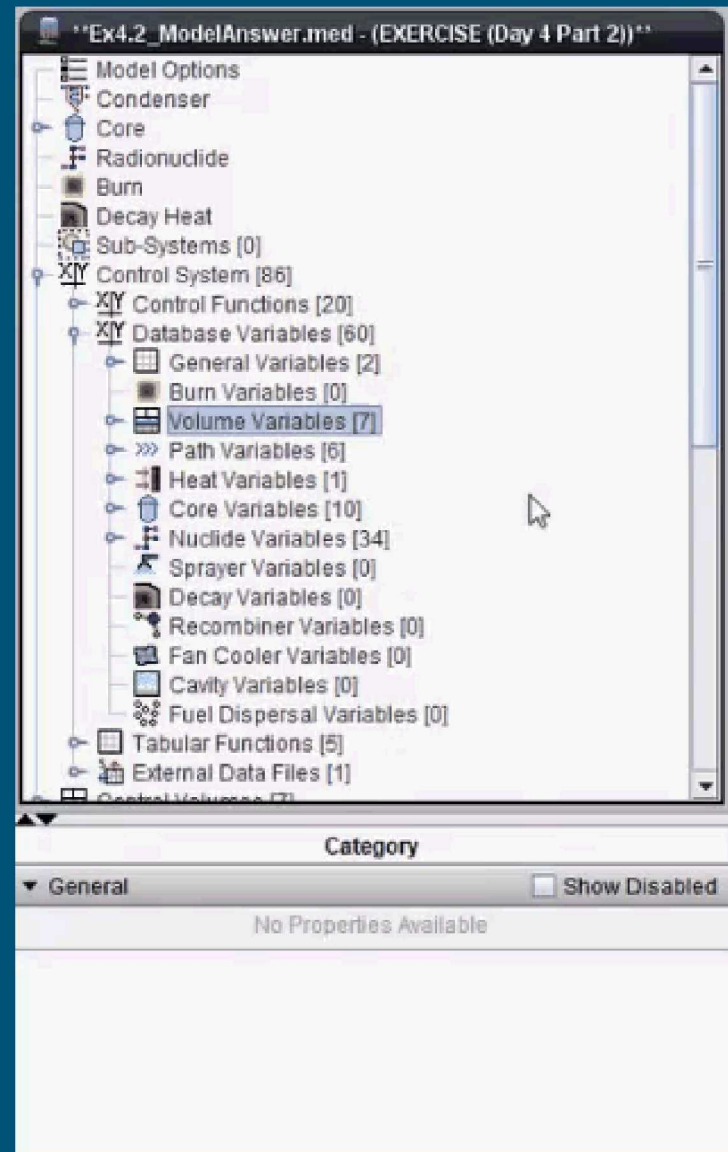
Used as input to control functions

Control Function arguments are organized by package

- General Variables (EXEC)
- Burn Variables (BUR)
- Path Variables (FL)
- Heat Variables (HS)
- Core Variables (COR)
- Nuclide Variable (RN)
- Sprayer Variables (SPR)
- Decay Variables (DCH)
- Recombiner Variables (PAR)
- Fan Cooler Variables (FCL)
- Cavity Variables (CAV)
- Fuel Dispersal Variables (FDI)

Adding a CF argument to the database

- Right Click Package category and select 'New'
- New variable appears in list
- Make selection to MELCOR CF arguments

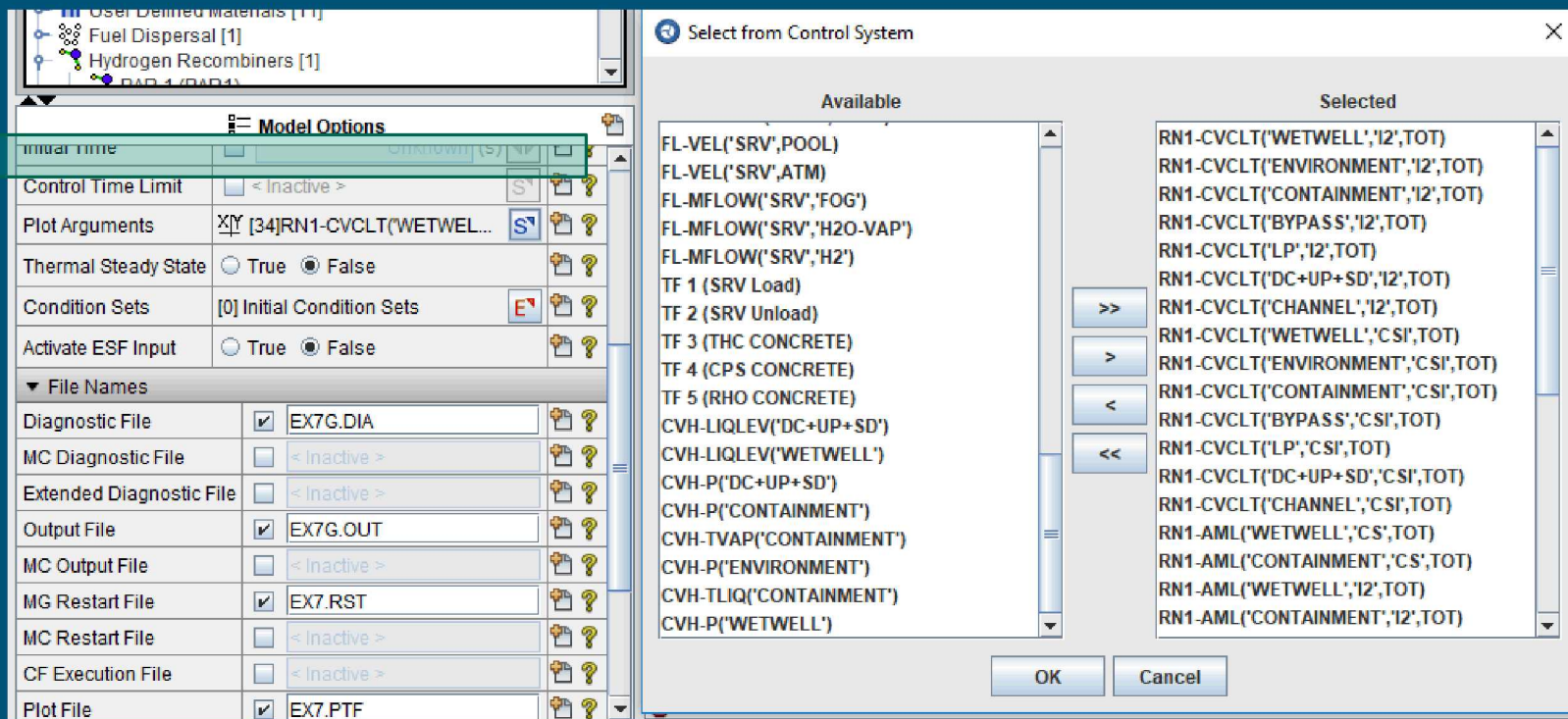


Example: Add swollen liquid level for wetwell to database.

MELCOR ASCII Input:

***** PLOT *****

- 1 (2007-H0000) ('(2007-H0000)', FE)
- 2 (2007-H0000) ('(2007-H0000)', R1)
- 3 (2007-H0000) ('(2007-H0000)', R1)
- 4 (2007-H0000) ('(2007-H0000)', R1)



Note that a CF argument must be added to Control System Database before it can be assigned to a plot variable

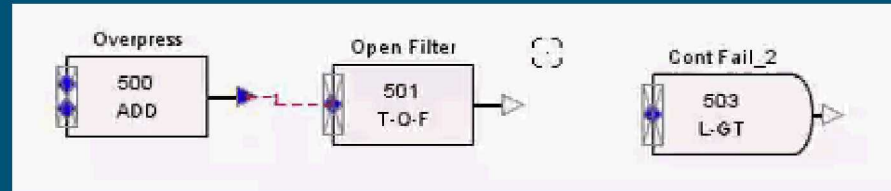
11 Control Function connections

Connecting output from one CF to input of another CF

Graphically

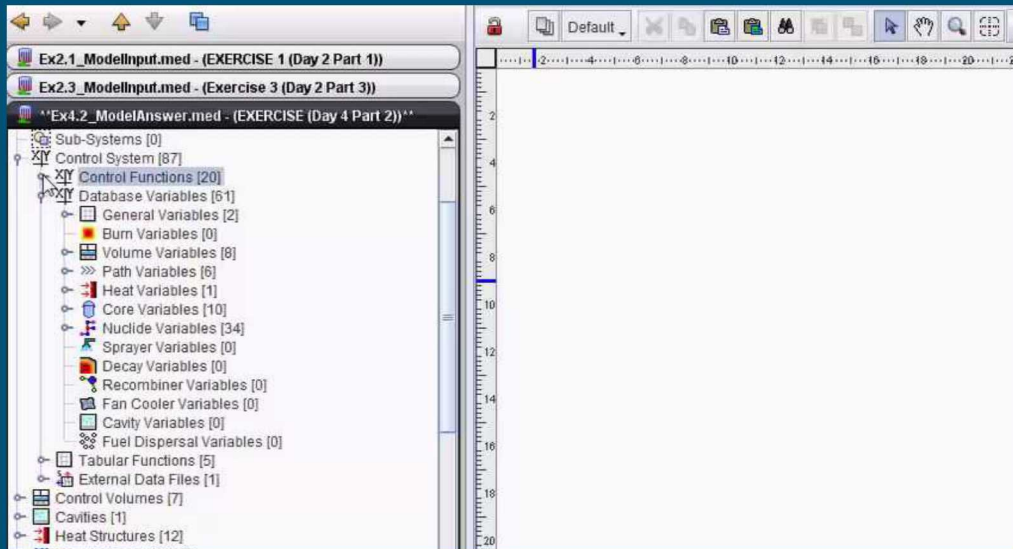
Drag both CF objects to the view and use connection tool

Cannot make connection from property window



Connecting control function arguments to the input of a control function

- Drag control function object and all Database variables to view
- Make adjustments to multipliers later from properties window
- Cannot make connection from property window



Example: Activate Sprays when containment pressure exceeds $1.2E5$ Pa.

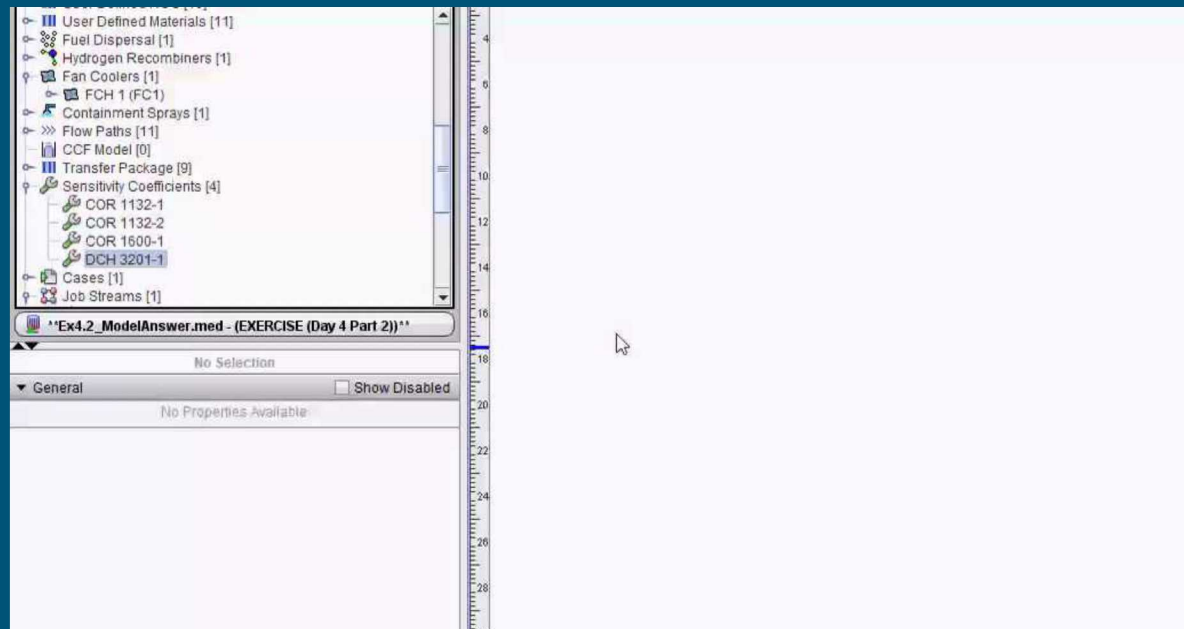
MELCOR ASCII

```

1027 CV_PAS SEPARATE OnlyAtm SATURATED !IPORA, VaporState
1028 CV_PTD TAIM 4.3800000E+02
1029 CVH SC 1 !SCnumber Value Index
1030 1 4414 5.0000000E-01 1
1031 !
1032 FL_INPUT ! FL package start record
1033 !
1034 !-----
1035 ! Test section flowpaths
1036 !-----

```

SNAP

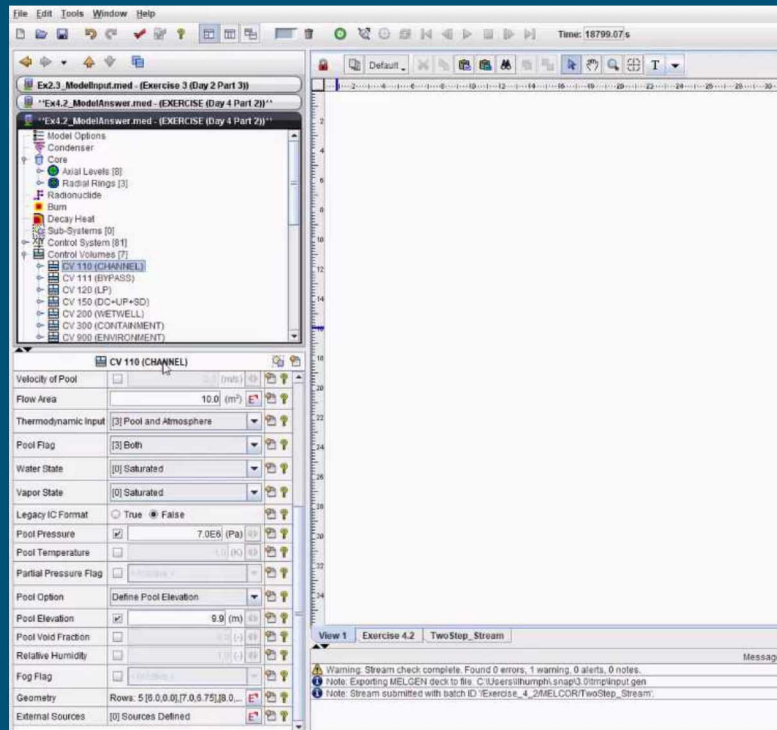


MELCOR ASCII

```
!Nodalization from SANDXXXX Page 4-89
! https://svn-melcor.sandia.gov/svn/melcor-II/documentation/trunk/Assessments/ABCOVE/Assesment
HS_ND 9 ! NXVALU NI XVALUE TEMPIN MATNAM
1 1 0.17907000E+01 0.56233000E+03 'SS-3161'
2 2 0.17970500E+01 0.56233000E+03 'SS-3161'
3 3 0.18034000E+01 0.56233000E+03 'SS-3161'
4 4 0.18097500E+01 0.56233000E+03 'SS-3161'
5 5 0.18161000E+01 0.56233000E+03 'SS-3161'
6 6 0.18224500E+01 0.56233000E+03 'SS-3161'
7 7 0.18288000E+01 0.56233000E+03 'SS-3161'
8 8 0.18351500E+01 0.56233000E+03 'SS-3161' !Modified to use SS-3161 1/12/2007 by LLH
9 9 0.18415000E+01 0.56233000E+03
```

- Greater granularity
 - Notes can be attached to single lines in a table
- Active HTML links in some editors

SNAP



- Less granularity
- A single note can be linked to multiple components
- Notes can include pictures
- HTML links are not active
- Notes cannot be printed with ASCII
- Notes Manager