OLI SYSTEMS, INC.

A Guide to Using the OLI Engine in Aspen Plus

Featuring Aspen Plus V14.5

Jim Berthold
Diana Miller
9/16/2025

How to use the OLI Engine in Aspen PLUS.

2 Gatehall Dr.
Suite 100
Parsippany, NJ 07054
973-539-4996
(Fax) 973-539-5922
https://support.olisystems.com
www.olisystems.com

Disclaimer:

This manual was produced using the **OLI Engine 12.5.23 in Aspen Plus (version 14.5)**. As time progresses, new data and refinements to existing data sets can result in values that you obtain being slightly different than what is presented in this manual. This is a natural progress and cannot be avoided. When large systematic changes to the software occur, this manual will be updated.

Aspen Plus is a registered trademark of Aspen Technologies, Inc. Cambridge, MA.

Contents

Chapter 1 An Overview of the Aspen-OLI Interface

Advantages of Aspen-OLI

- The user interface is familiar to Aspen Plus users
- Learn one flow sheeting system
- Multiple Property Options in same flowsheet
- Well-established non-electrolyte capability
- Sizing
- Costing
- Two Software Vendors, can get answers more quickly

Disadvantages of Aspen-OLI

- No Corrosion
- No Ion-exchange
- No Surface Complexation
- No Scaling Tendencies
- Two Software Vendors (who answers the question?)

Aspen-OLI Interface Layout

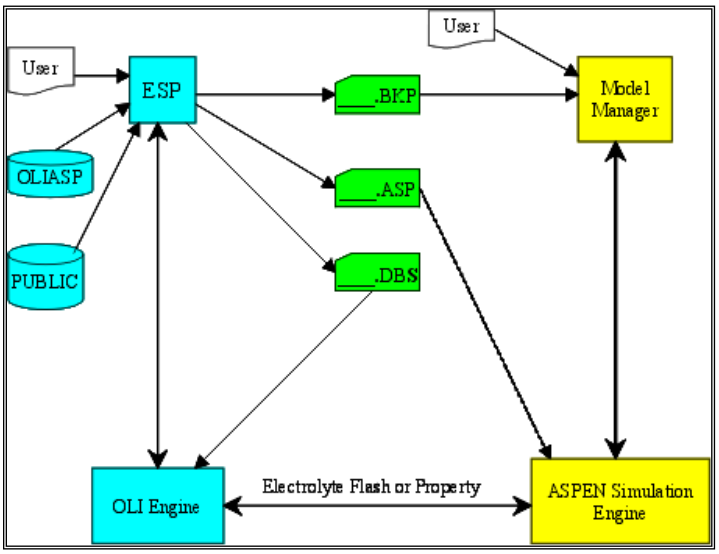


Figure 1-1 The layout of the Aspen OLI Interface

Aspen OLI Unit Operations

- MIXERS
- FSPLIT
- SEP
- SEP2
- HEATER
- FLASH2
- FLASH3
- HEATX
- MHEATX
- RADFRAC
- RSTOIC
- RYIELD
- RCSTR
- RPLUG
- PUMP
- COMPR

Aspen Property Set

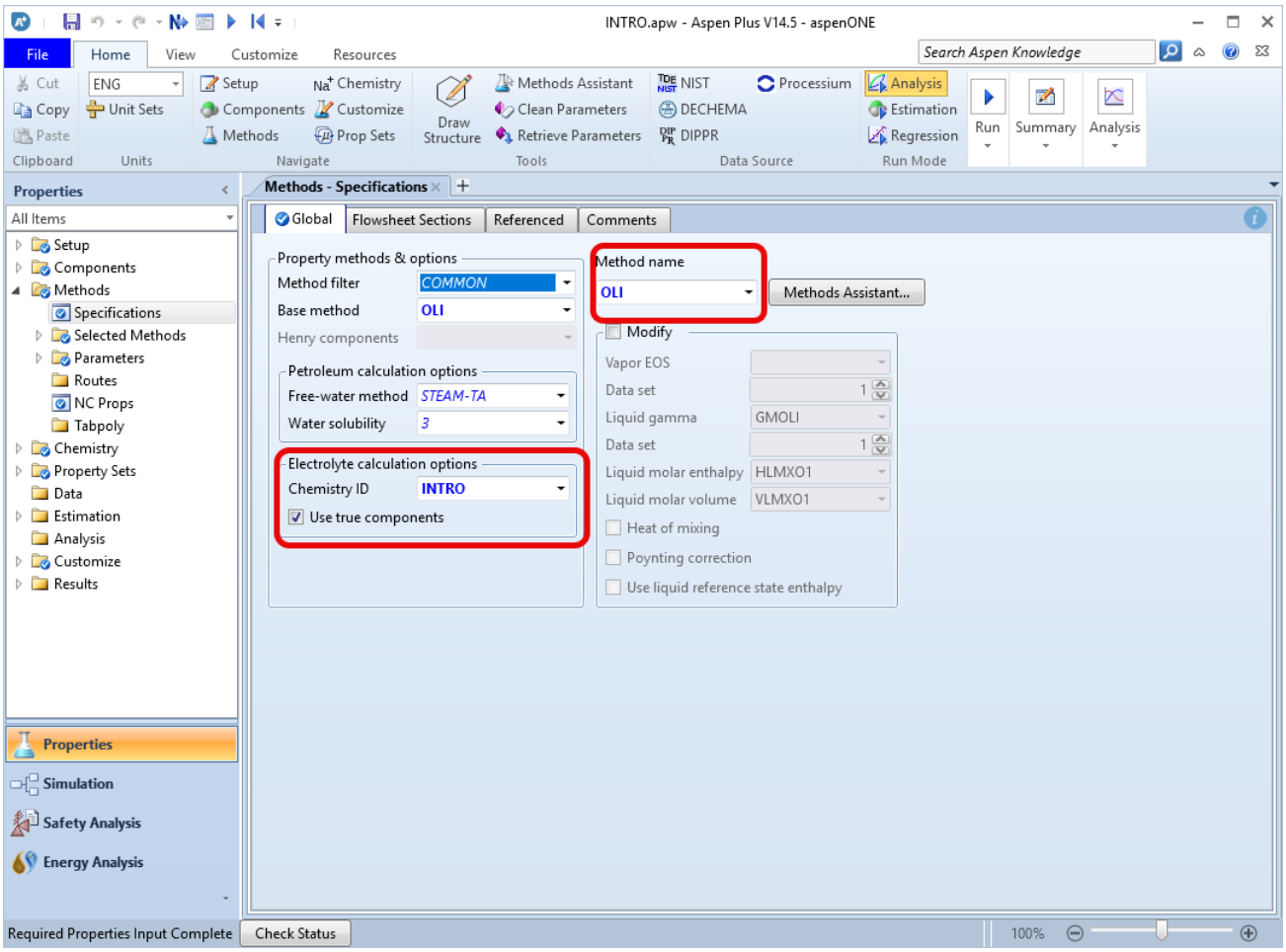


Figure 1-2 OLI Property Set, the boxed areas show that OLI is enabled.

Property	Route ID
PHIVMX	PHIVMXO1
PHILMX	PHILMXO1
HVMX	HVMXO1
HLMX	HLMXO1
GVMX	GVMXO1
GLMX	GLMXO1
SVMX	SVMXO1
SLMX	SLMXO1
VVMX	VVMXO1
VLMX	VLMXO1
MUVMX	MUVMX01
MULMX	MULMX01
KVMX	KVMX01
KLMX	KLMX01
DVMX	DVMX01
DLMX	DLMX02
SIGLMX	SIGLMX01
PHIV	PHIV00
PHIL	PHILO1
HV	HV00
HL	HL00
GV	GV00
GL	GL00
SV	SV00
SL	SL00
VV	VV00
VL	VL01
MUV	MUV01
MUL	MUL01
KV	KV01
KL	KL01
DV	DV01
DL	DL01
SIGL	SIGL01
HSMX	HSMXO1
PHIL	PHIL00

Property	Route ID
MUVMXL	MUVMXLP1
MUVLP	MUVLP01
KVMXLP	KVMXLP01
KVLP	KVLP01
DHV	DHV00
DHL	DHL00
DHLPC	DHLPC00
DGV	DGV00
DGL	DGL00
PHILPC	PHILPC00
DSV	DSV00
KVPC	KVPC01

Property Model	Set OpCodes			Affected Properties
PHIVMX	PHVMXOLI	1		PHIVMX
PHILMX	PHLMXOLI	1		PHILMX
HVMX	HVMXOLI	1		HVMX
HLMX	HLMXOLI	1		HLMX
GVMX	GVMXOLI	1		GVMX
GLMX	GLMXOLI	1		GLMX
SVMX	SVMXOLI	1		SVMX
SLMX	SLMXOLI	1		SLMX
VVMX	VVMXOLI	1		VVMX
VLMX	VLMXOLI	1		VLMX
MUVMXL	MUV2WILK	1		MUVMX
MUVLP	MUV0CEB	1		MUVMX KVMX MUV KV
MULMX	MUL2ANDR	1		MULMX
KVMXLP	KV2WMSM	1		KVMX
KVLP	KV0STLP	1		KVMX KV
KLMX	KL2SRVR	1		KLMX
DVMX	DV1CEWL	1		DVMX
DLMX	DL1WCA	1		DLMX
SIGLMX	SIG2HSS	1	1	SIGLMX
PHIV	ESIG0	1		PHIV GL SL
PHIL	PHILOLI	1		PHIL
DHV	ESIG0	1		HV HL SL
PL	PL0XANT	1		HL GL SL
DHVL	DHVLWTSN	1		HL SL
DHLPC	DHLPC00	1		HL SL
DGV	ESIG0	1		GV
PHILPC	PHILPC00	1		GL SL
DSV	ESIG0	1		SV
VV	ESIG0	1		VV
VL	VL0RKT	1		VL
MUL	MUL0ANDR	1		MUL
KVPC	KV0STPC	1		KV
VV	ESRK0	1		KV
KL	KL0SR	1		KL
DV	DV0CEWL	1		DV
DL	DL0WCA	1		DL
SIGL	SIG0HSS	1		SIGL
HSMX	HSMXOLI	1		HSMX

Using the Aspen OLI Interface

New property option in ASPEN named OLI:

PROPERTIES OLI CHEMISTRY=xxxxx TRUE-COMPS=YES

The following ASPEN paragraphs are created when the chemistry model is generated:

DATABANKS	PROP-DATA
COMPONENTS	PROPERTIES
CHEMISTRY	PROP-SET pH

ASPEN user is then required to add the additional paragraphs to run the simulation such as:

FLOWSHEET

STREAMS

BLOCKS

ESP-NAME	DB	8-CHAR	ASP-ALIAS	ASP-NAME
AR	P	AR	AR	ARGON
BCL3	V	BCL3	BCL3	BORON-TRICHLORIDE
BF3	V	BF3	BF3	BORON-TRIFLUORIDE
BR2	V	BR2	BR2	BROMINE
CLNO	V	CLNO	CLNO	NITROSYL-CHLORIDE
CL2	P	CL2	CL2	CHLORINE
PCL3	V	PCL3	CL3P	PHOSPHORUS-TRICHLORIDE
SICL4	V	SICL4	CL4SI	SILICON-TETRACHLORIDE
D2	V	D2	D2	DEUTERIUM
D2O	V	D2O	D2O	DEUTERIUM-OXIDE
F2	V	F2	F2	FLUORINE
NF3	V	NF3	F3N	NITROGEN-TRIFLUORIDE
SIF4	V	SIF4	F4SI	SILICON-TETRAFLUORIDE
SF6	V	SF6	F6S	SULFUR-HEXAFLUORIDE
HBR	V	HBR	HBR	HYDROGEN-BROMIDE
HCL	P	HCL	HCL	HYDROGEN-CHLORIDE
HF	P	HF	HF	HYDROGEN-FLUORIDE
AGION	P	AG+	AG+	AG+
AGCL2ION	P	AGCL2-	AGCL2-2	AGCL2--
AGSO4ION	P	AGSO4-	AGSO4-	AGSO4-
ALION	P	AL+3	AL+3	AL+++
ALFION	P	ALF+2	ALF+2	ALF++
ALF2ION	P	ALF2+	ALF2+	ALF2+

Potential Problems

Mixing property options in the same flowsheet The user can mix property options in the same flowsheet, using OLI in one block and an Aspen sysopt such as SYSOP3 in another block. However, the user must be aware of the potential problem of enthalpy mis-matches in switching property options. Even though the base enthalpy for both Aspen and OLI is the heat of formation of the pure component at 25 C, a mis-match will occur due to differences in heat capacity and excess enthalpy calculations. If an isothermal calculation is made at the point of property option change, the effect will be to have an artificial duty on the block. An adiabatic calculation could cause major problems in convergence and result in erroneous results.

Chemistry model location (xxxx.DBS file) By default, ASPEN looks for the .DBS file in the directory where the BKP file has been created.

8 Character Component Names at chemistry model generation, an 8-character name will be created for each species and cross referenced to both OLI component names and Aspen component names. This cross referencing is made based on a table (OLIASP.XRF) supplied with the installation. **Do Not** change the names after the chemistry model is created. It is okay to add additional names to the components paragraph providing these components will have zero flow rates for any block using the OLI property option.

Chemistry ParagraphThe chemistry paragraph created and placed in the Aspen input file is only used by the RADFRAC block. All other blocks chemistry is defined by the information in the xxx.DBS file

Added Unit Blocks (OLI)

Four phase flash block (EFLASH)

OLI Distillation program (FraChem[1])

New run command (RUNASP)

Reads xxxx.ASP file and converts keyword input to positional input and outputs xxxx.INP. Executes the standard Aspen run command to run the simulation.

[1] This is also known as EFRACH

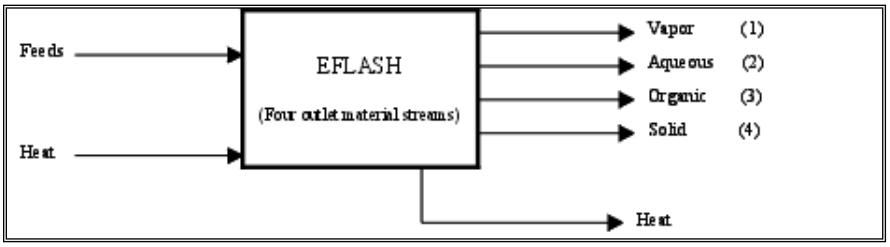


Figure 1-3 EFLASH unit operation

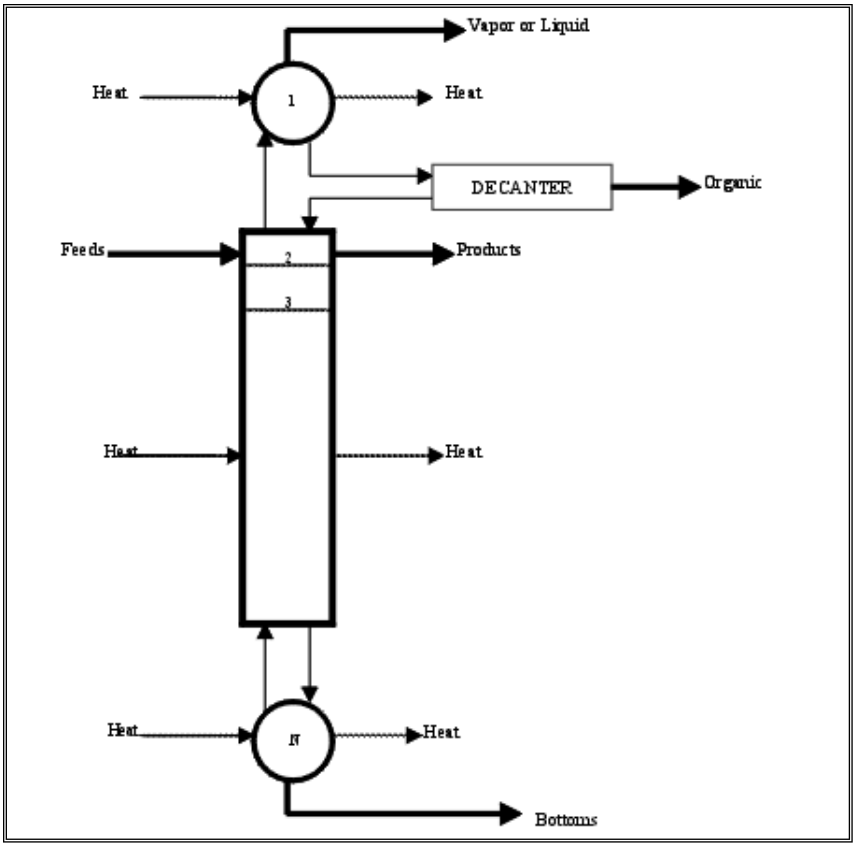


Figure 1-4 EFRACH Block

Chapter 2 ASPEN Neutralization Flowsheet

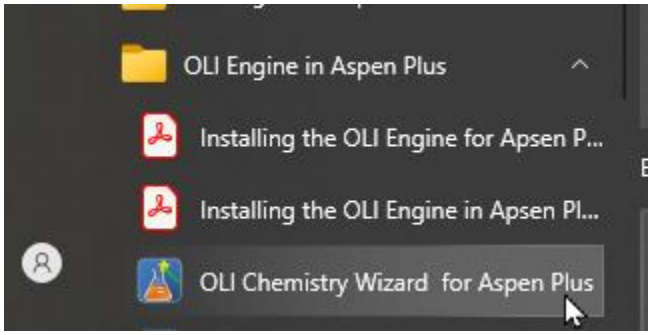
A Tour of the OLI-ASPEN Interface

The following example is flowsheet simulation of an acid-base neutralization process. An acid stream and a base stream are mixed together and then caustic is added to raise the pH to 9. Solid NACL is added to precipitate out Na2SO4. The resulting stream is split, removing 75% and recycling 25%.

Generating Chemistry Model

There are two methods to create an OLI chemistry model to be used with Aspen PLUS. These are the Chemistry Wizard and the OLI Engine[2]. We will concentrate on the OLI Chemistry Wizard.

Use the Start Button and locate the ***OLI Chemistry Wizard for Aspen Plus***. Typical installation paths will put the program here:



The Chemistry Wizard information dialog is now displayed. You can enter the name of the model and change the location where the model files will be located. Here we will enter the name ***Neutral1***for the model name and change the location of the files.

[2] The OLI Engine chemistry generator is supplied with the OLI Engine for Aspen PLUS and is very similar to the chemistry generator used for ESP. This will be shown in Chapter 6.

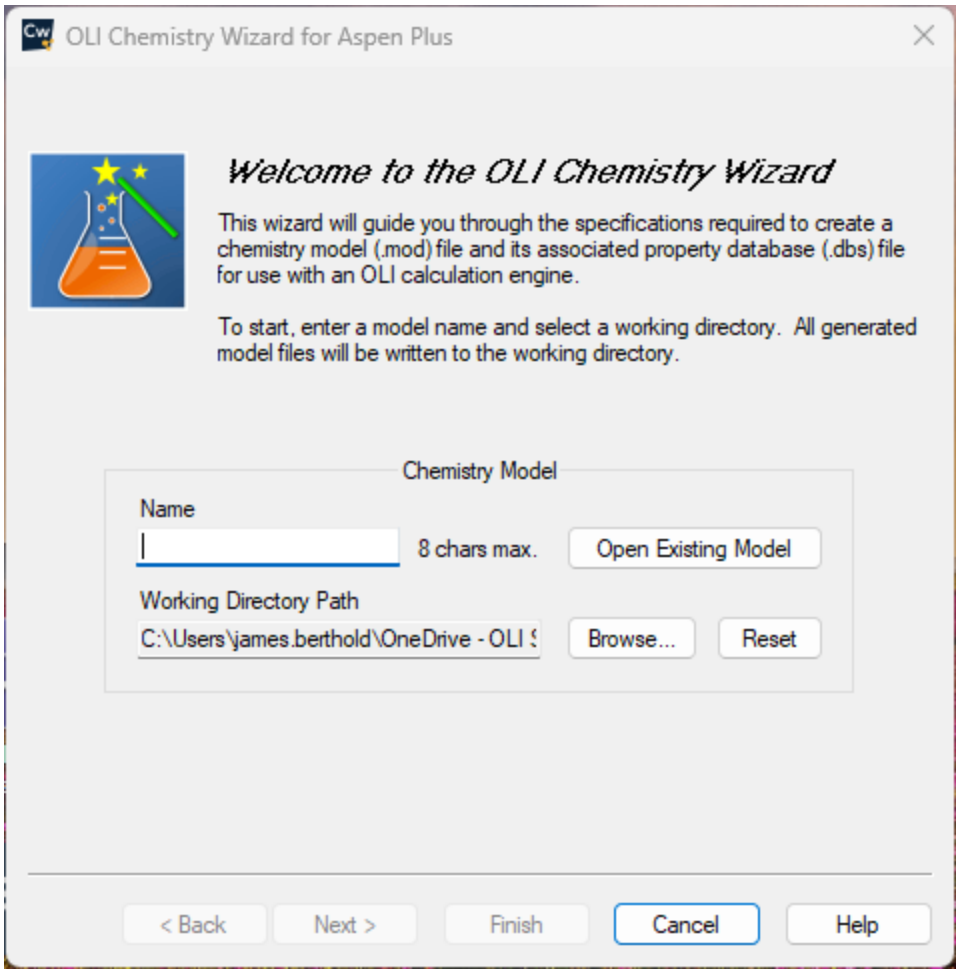
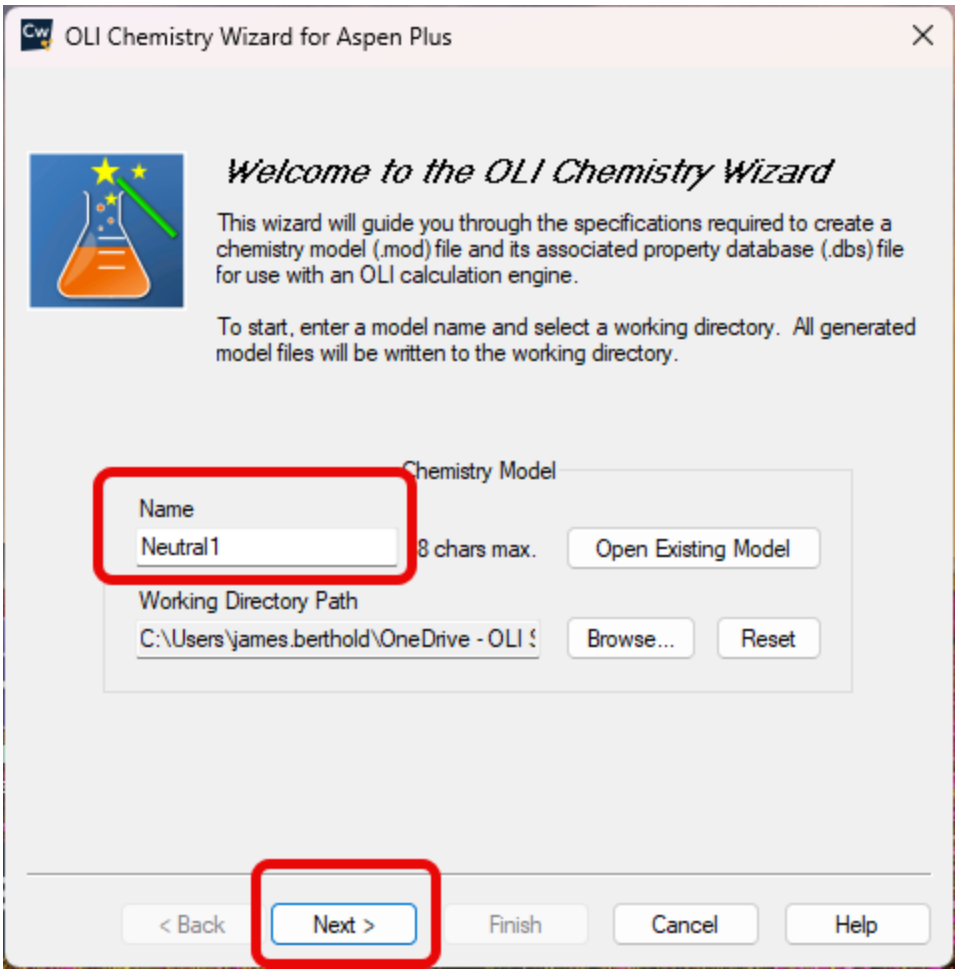
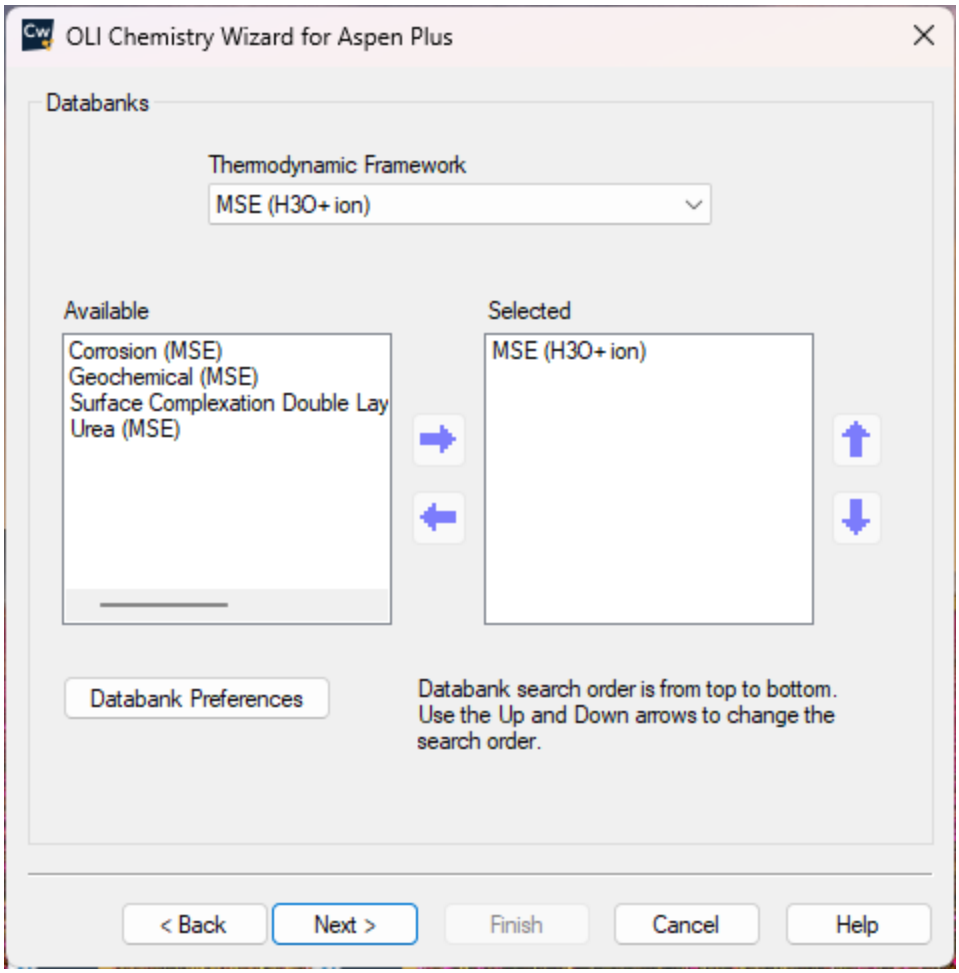


Figure 2-1 Specifying the model name and location



Click the ***Next>*** button to continue



Here we can select the thermodynamic framework. The default is MSE. There are two offered by OLI: the traditional aqueous model and the mixed-solvent electrolyte framework. This latter framework is also known as the H3O+ (hydronium ion) framework.

We can also select databases in addition to the PUBLIC database. These databases listed contain data that are limited to a more specific region of thermodynamic space than the PUBLIC database or contains data that is missing from the public database. For this example, we will only use the PUBLIC database.

Click the ***Next>*** button to continue

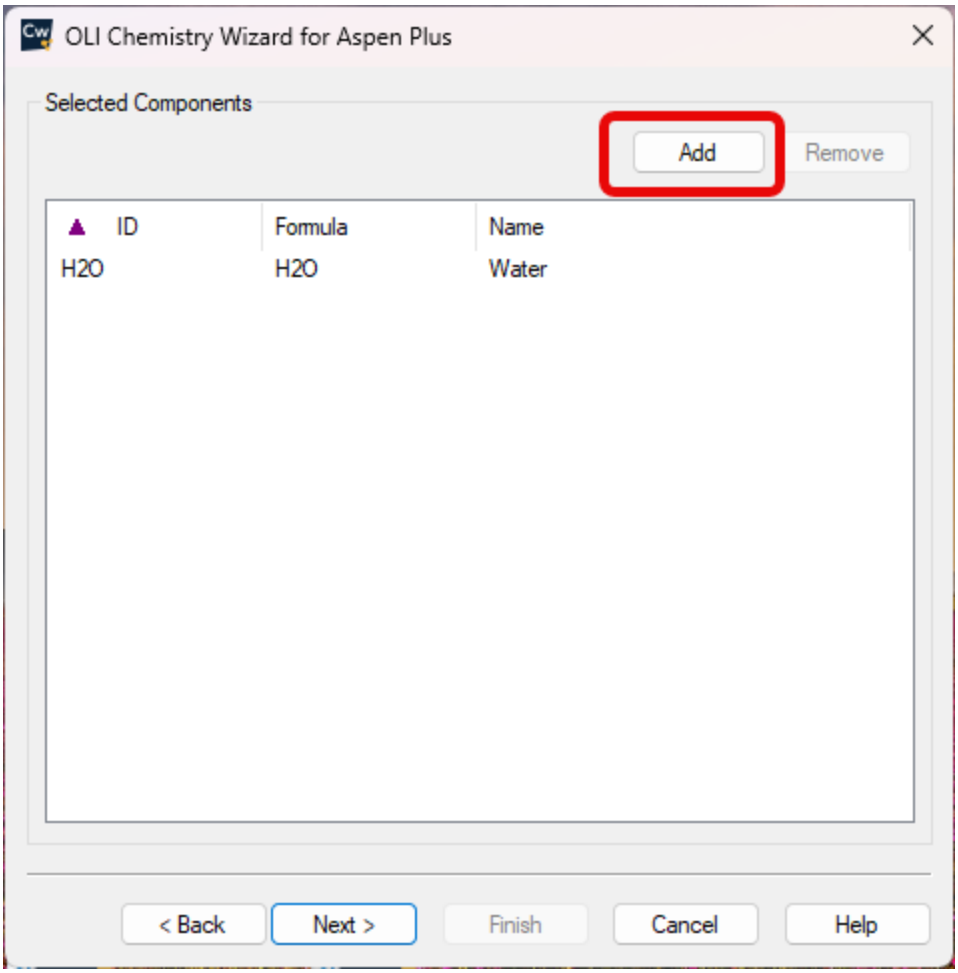


Figure 2-2 Adding components

We are now ready to add the components for this example. Click the ***Add*** button.

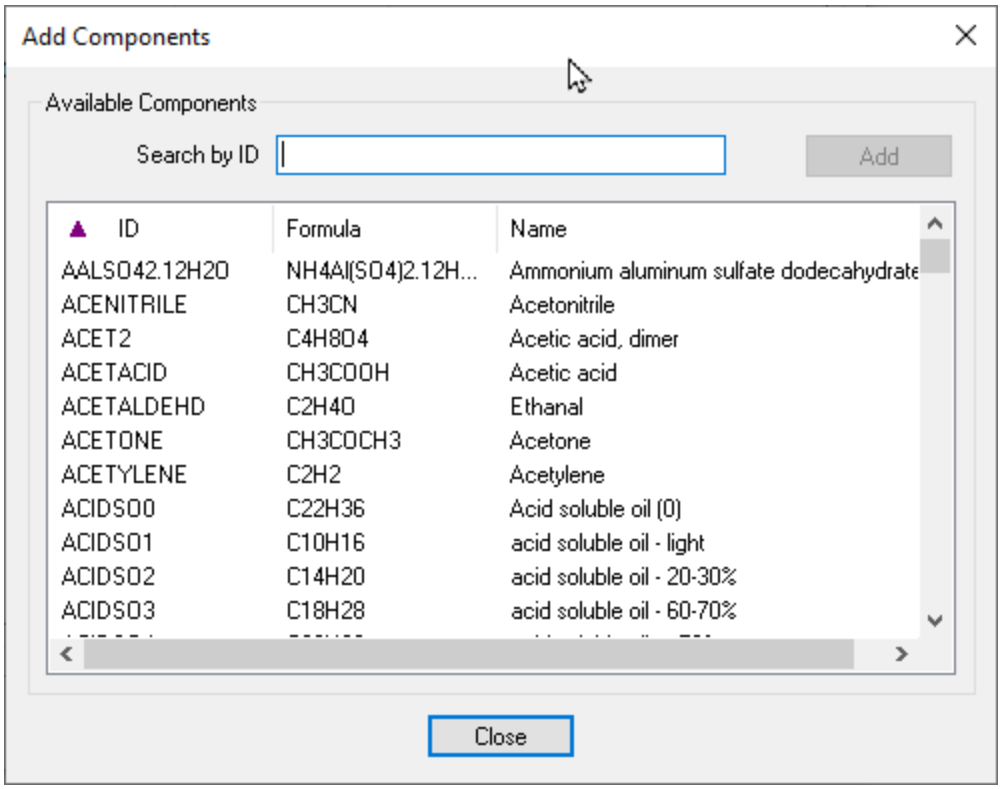


Figure 2-3 Select Components

We now need to add our components of ammonia (NH3), carbon dioxide (CO2), sulfur dioxide (SO2), hydrochloric acid (HCL), sulfuric acid (H2SO4) and sodium hydroxide (NAOH).

We can scroll through the list or enter the component ID and let the software find the component. We will try the latter technique, enter the component ID NH3

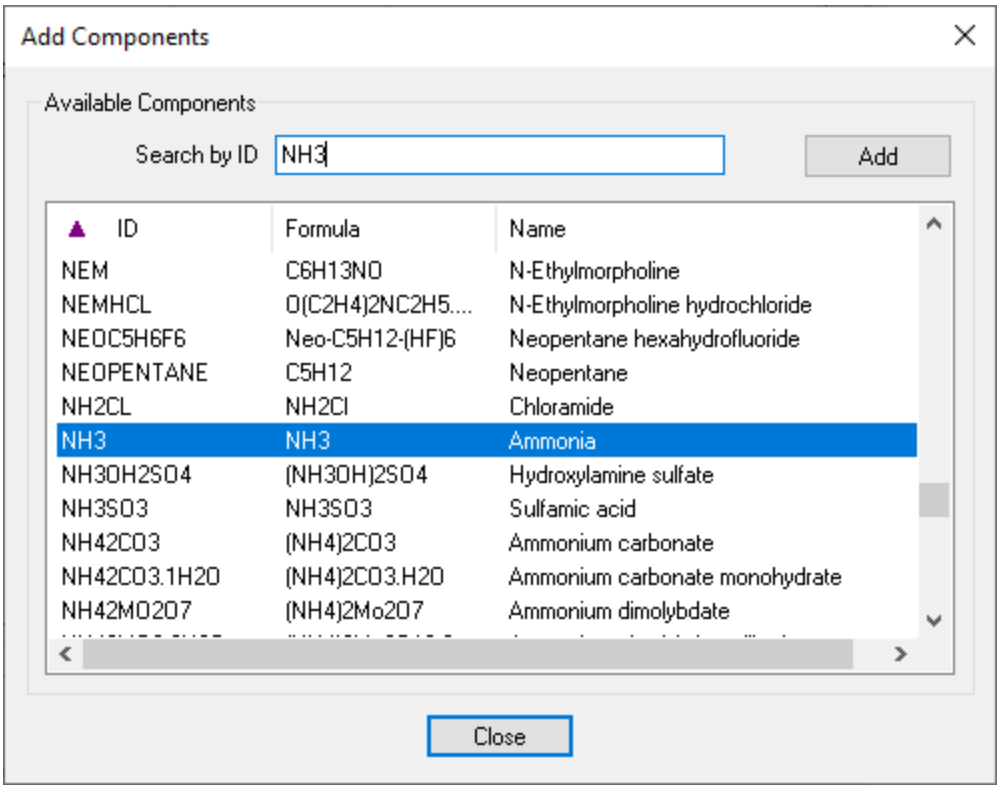


Figure 2-4 Adding NH3, ammonia

You can see that the screen automatically scrolled as you entered letters. The current component NH3 is highlighted. Click the ***Add*** button. Repeat this action for the remaining components. Click the ***Close*** button when done.

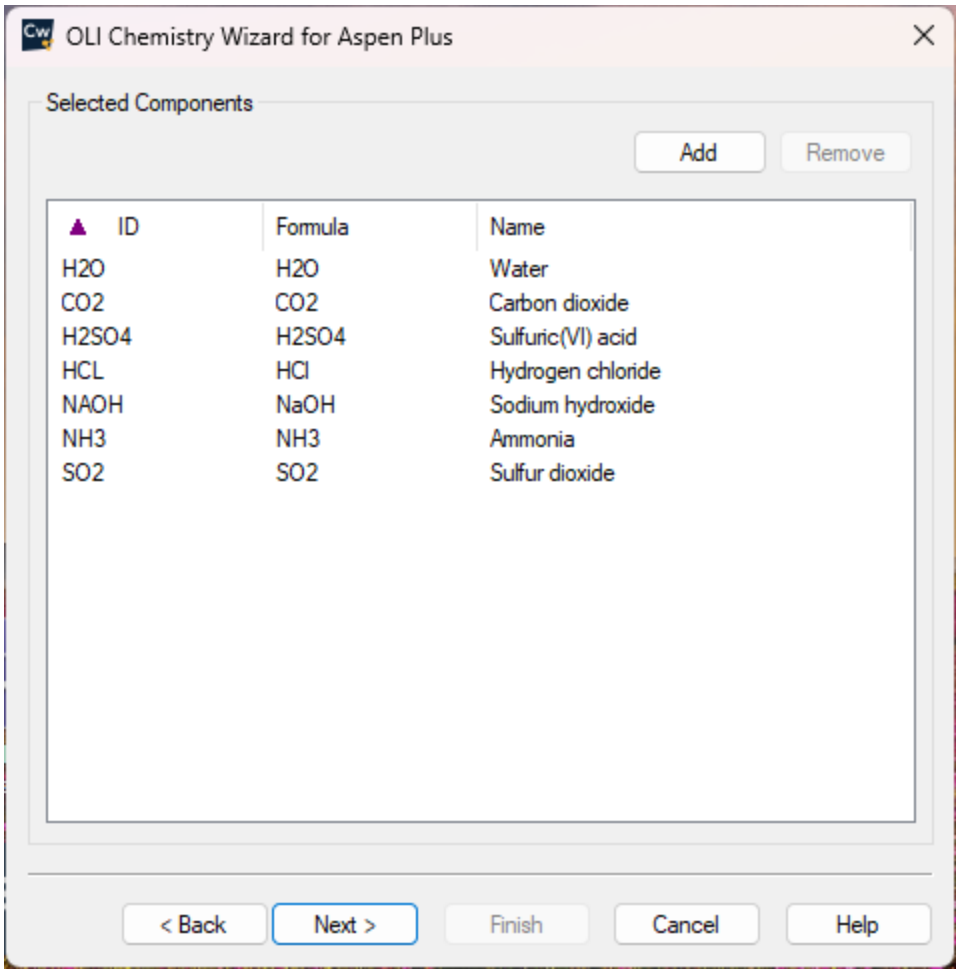


Figure 2-5 the added components

Click the ***Next>*** button.

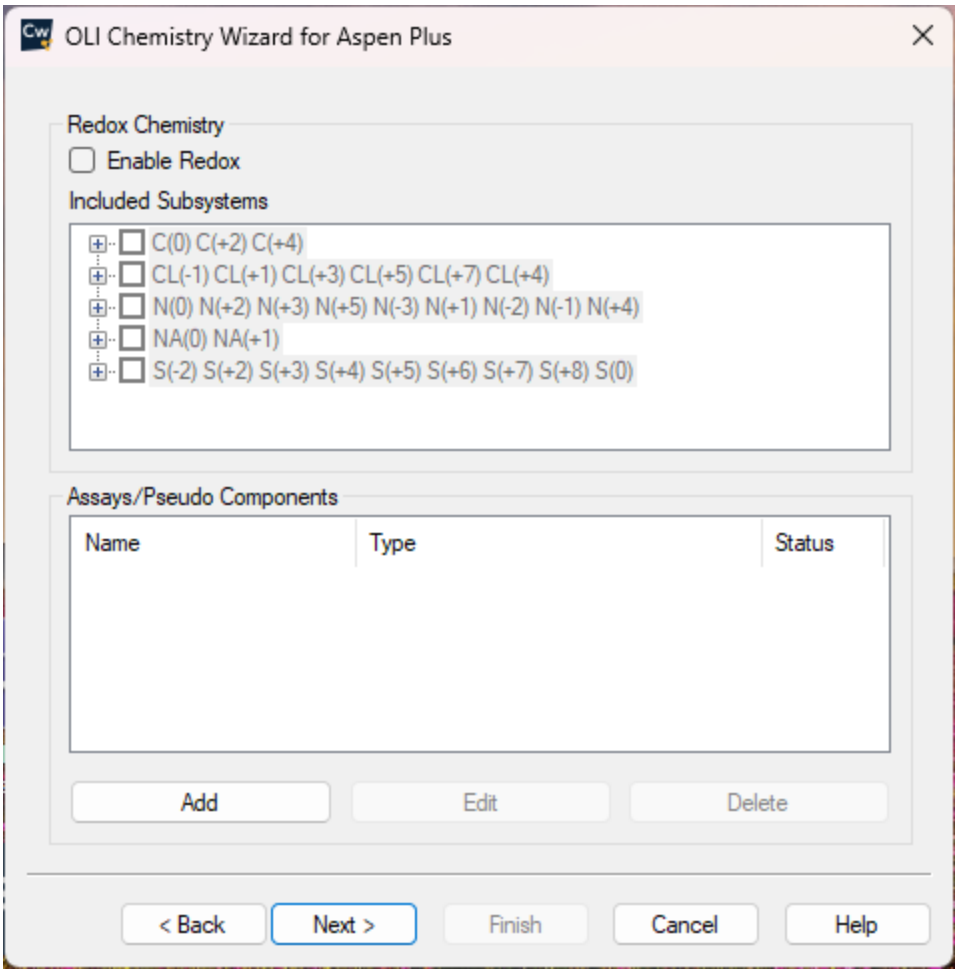


Figure 2-6 adding redox

On this screen we can add oxidation and reduction to the chemistry. We will not do so for this example. Click the ***Next>*** button.

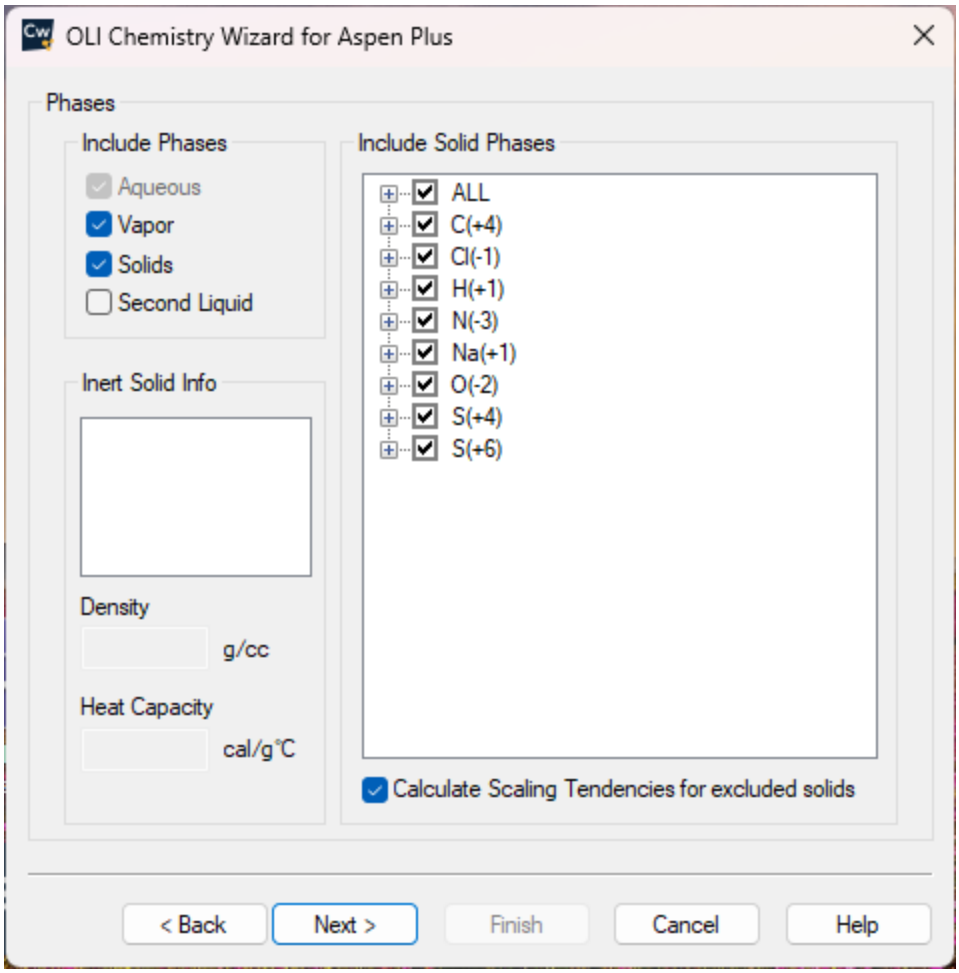


Figure 2-7 Selecting phases, including solids

On this screen we can enable vapor and second liquid (non-aqueous) phases.

By default, the vapor phase is enabled, and the second liquid phase is disabled. We can also turn off all potential solid phases or select individual solids to exclude. Occasionally the user will have prior knowledge of which solid phases will be present.

Eliminating solids that are not possible can dramatically reduce the execution time of the program.

Click ***Next>*** to continue.

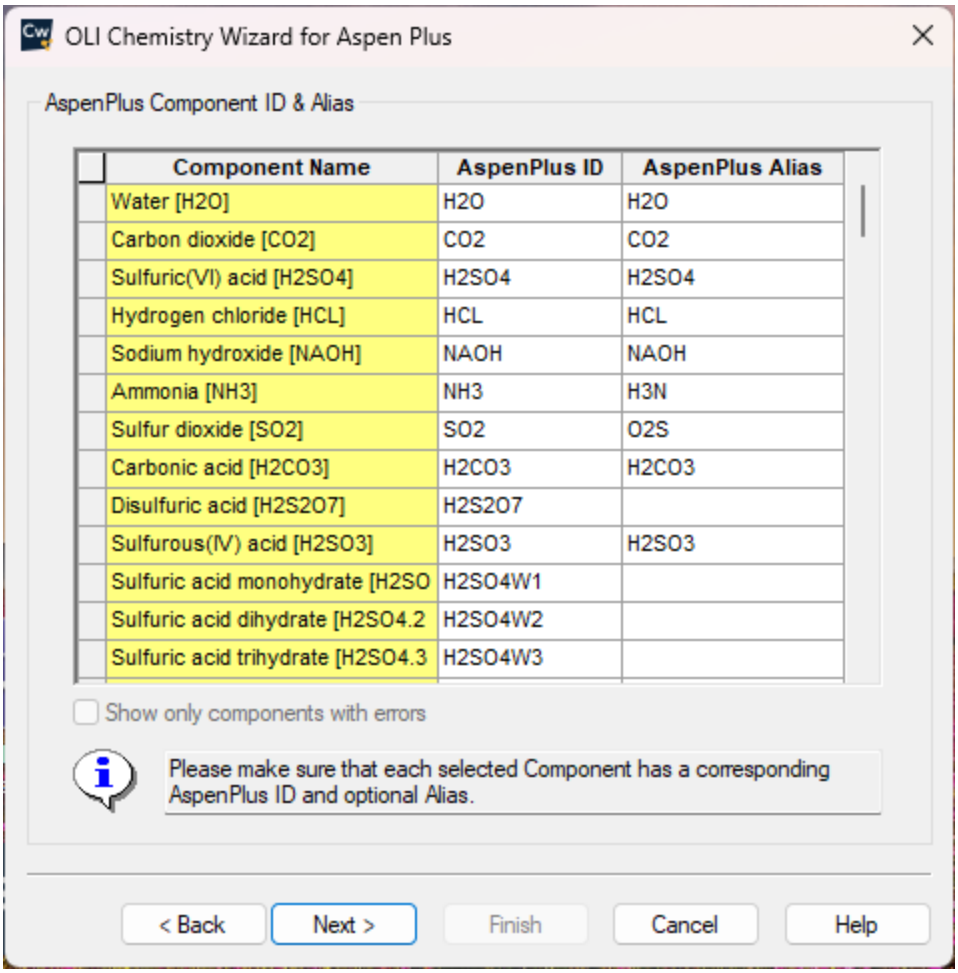


Figure 2-8 Aspen Alias names

Many times, OLI will have a component that Aspen PLUS will not. For those cases an alias name has to be provided to allow the two programs to properly communicate.

Click the ***Next>*** button.

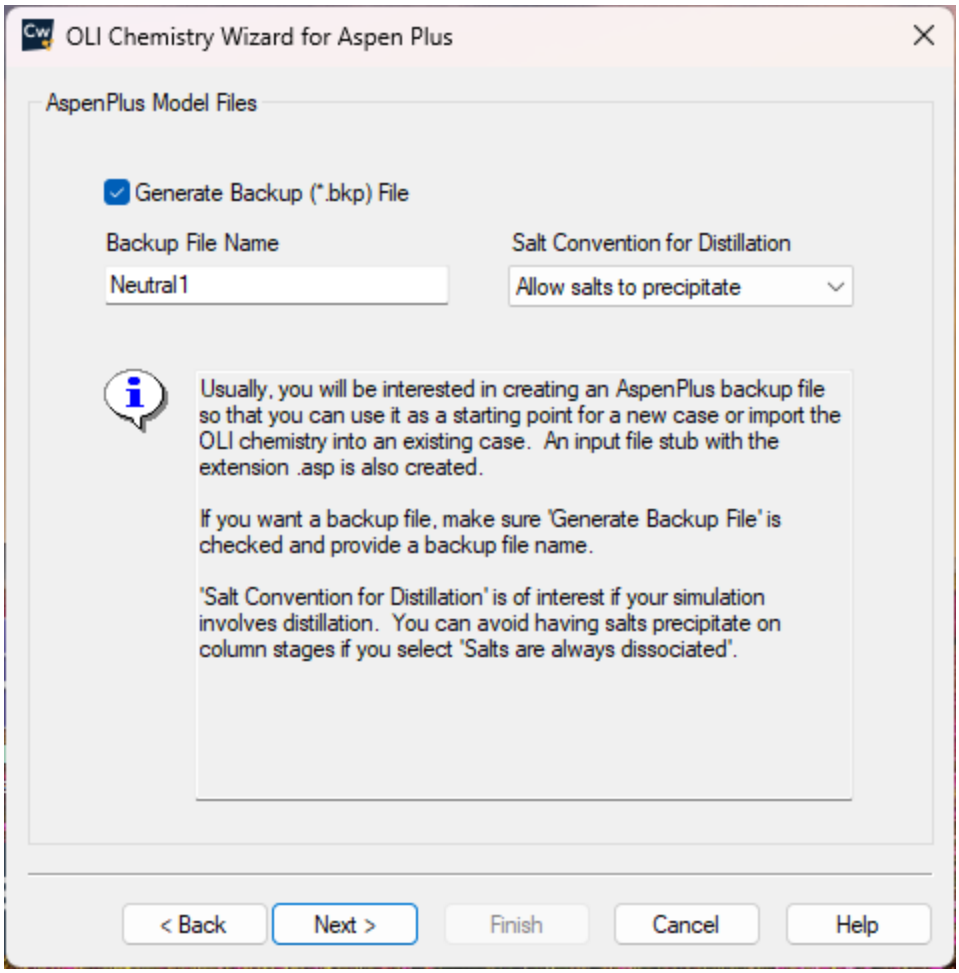


Figure 2-9 BKP file options

OLI initially communicates to Aspen PLUS via the BKP file. We will shortly create a flowsheet without any unit operations. The BKP file will initially have the same name as the chemistry model, but you may change the name if you wish.

A second option is to allow the solid salts to precipitate. This is the default option. Alternatively, you can dramatically increase the speed of execution by setting the salts to be dissociated. It is recommended for OLI models that you accept the default choices.

Click the ***Next>*** button.

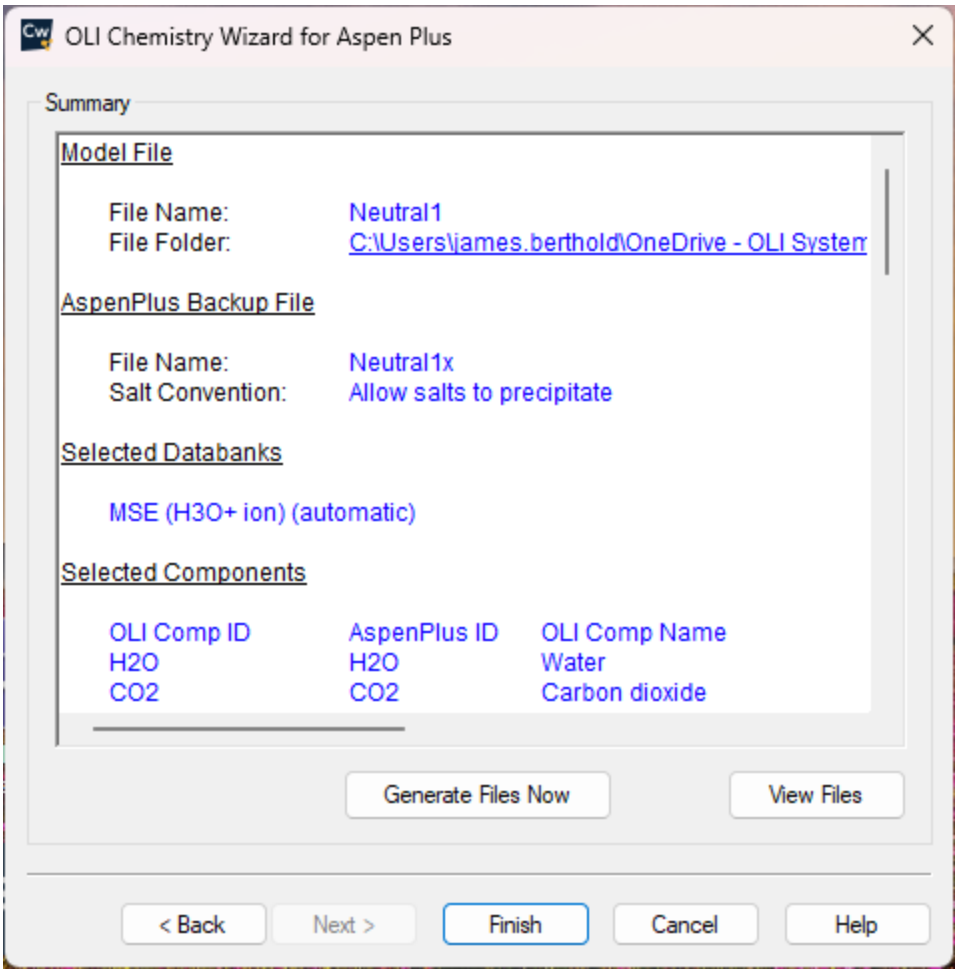


Figure 2-10 Almost done

We are almost done with the chemistry model generation. This is the summary screen of what we have selected. Please review it to make sure you have made the choices you require. Click the ***Generate Files Now*** button.

If the model was successfully generated, you will receive this message (you will have a different set of folders):

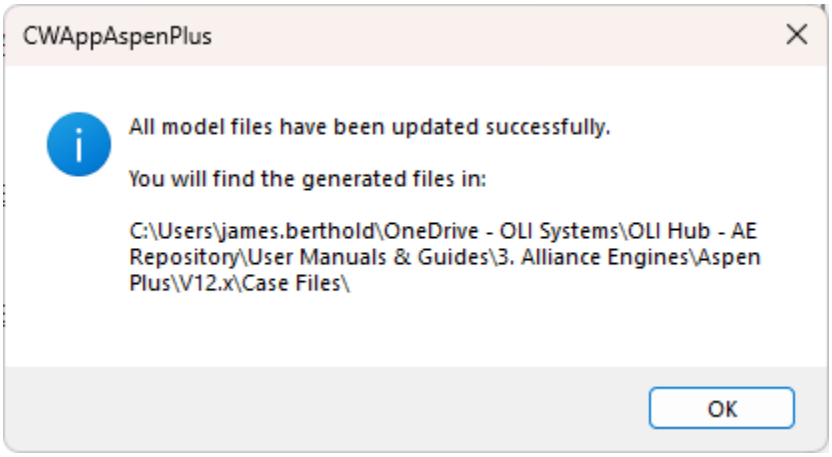


Figure 2-11 completed

Click the ***OK*** button.

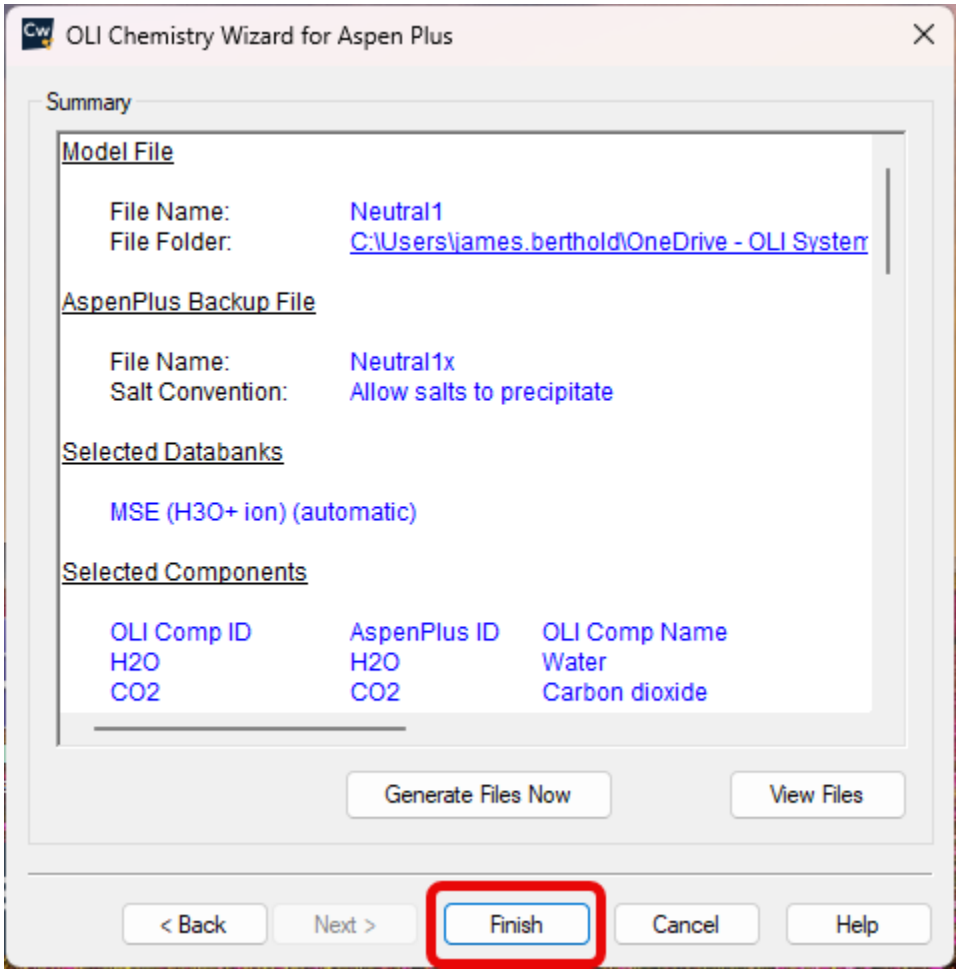


Figure 2-12 Done

We are now done with the chemistry model generation. Notice that the ***Generate Files Now*** button and the ***Next>*** button are gray. Click the ***Finish*** button.

We create a BKP file and an ASP file. We will use the BKP file in a moment. The ASP file is the old Aspen INP file. We have renamed the file from INP to ASP since OLI also uses a file with extension INP.[3] Here is the contents of the file. It can be renamed to INP to be used with the Aspen PLUS Simulation Engine.

Creating the Aspen Flowsheet

It is beyond the scope of this manual to instruct the user in how to run Aspen PLUS. We will just concentrate on the issues unique to OLI. Start Aspen PLUS in the normal manner.

We first need to load the BKP file we just created. Use the standard file/open dialogs to open the NEUTRAL1.BKP file.

Accept whatever local or network settings you must in which to activate the Aspen PLUS program. You may see the following warning:

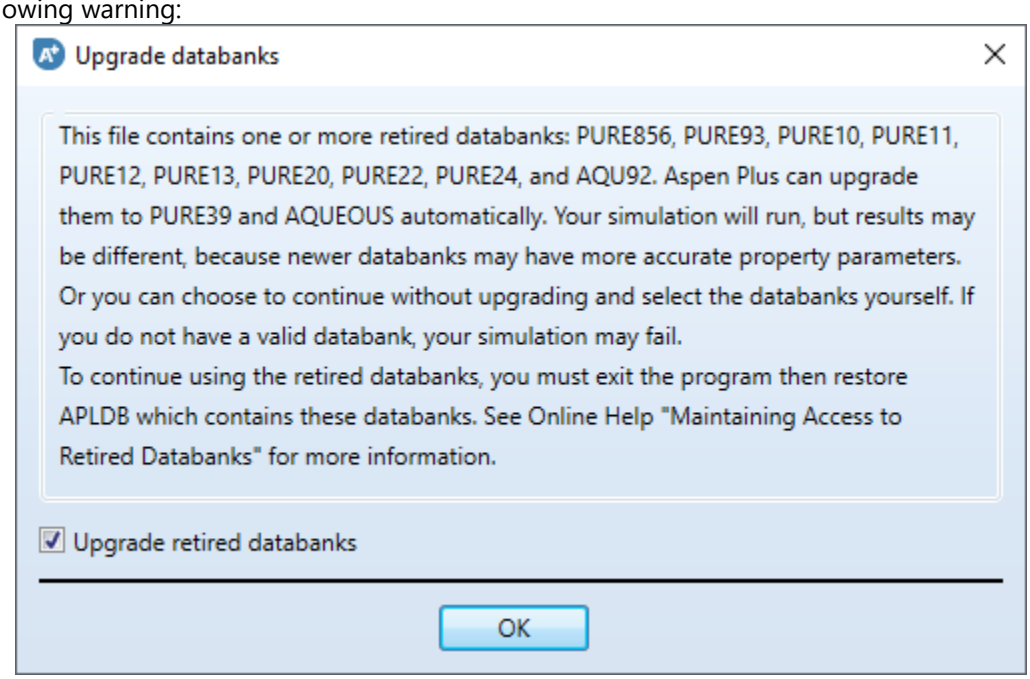


Figure 2-13 Compatibility warning

The BKP file generated by OLI is a very simple format file without any of the features available in latter versions Aspen PLUS. Keep the ***Upgrade retired databanks*** check box selected.

Click the ***OK*** button.

[3] The INP file is used with OLI's ProChem software.

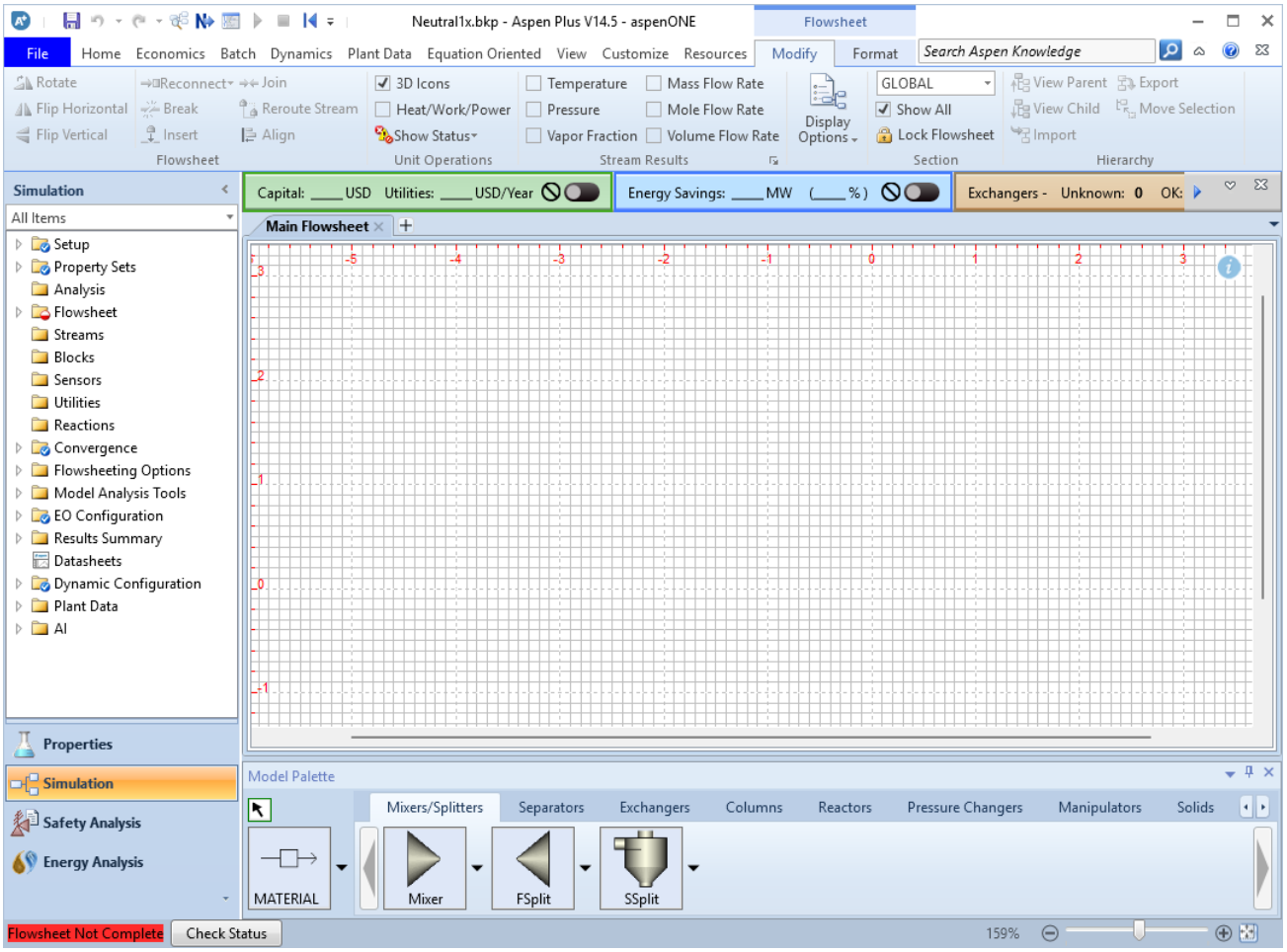


Figure 2-14 A blank flowsheet

You should already be familiar with Aspen Plus. Here we will remove the PFD grid lines to make the image more readable.

We will create the following process:

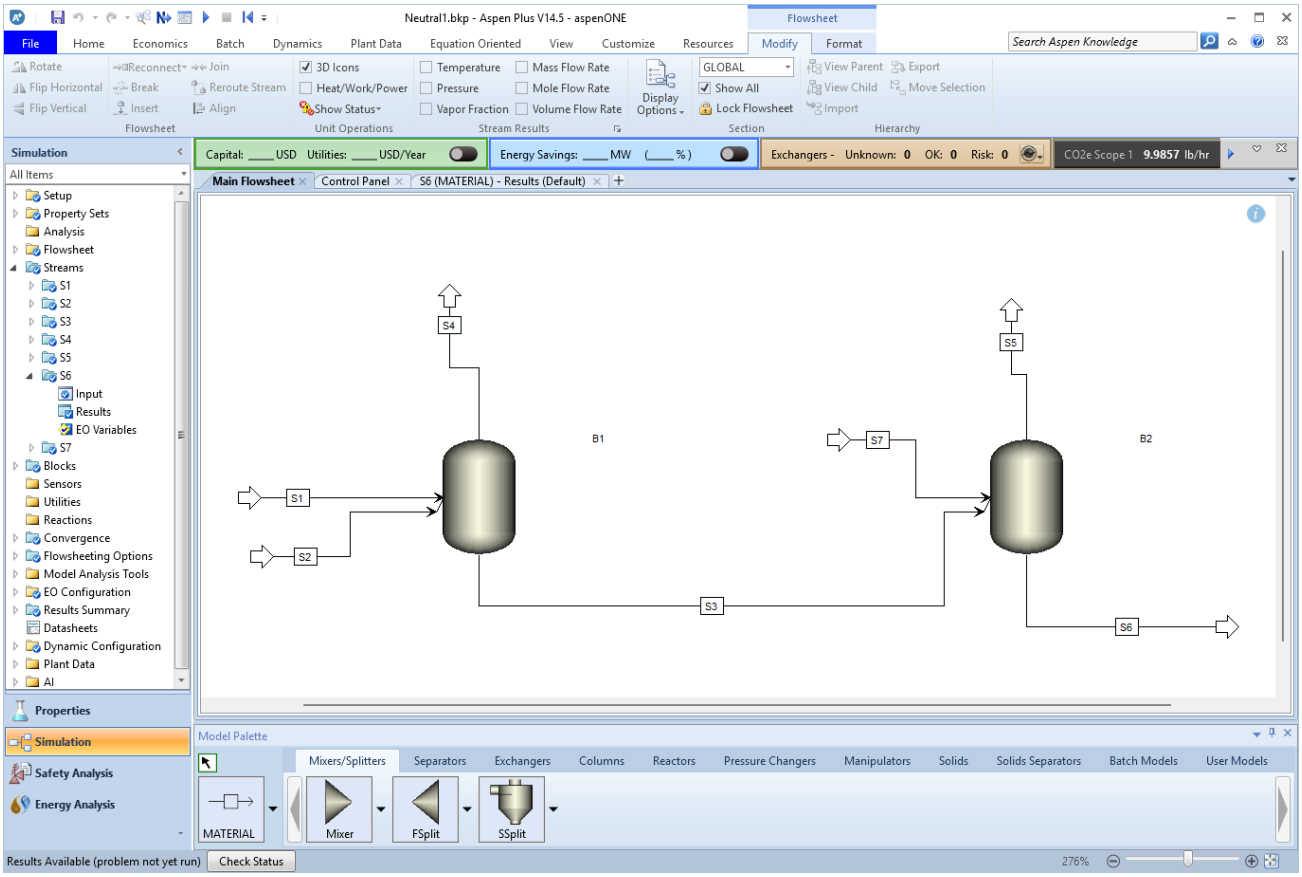


Figure 2-15 Neutral 1 Process

This process mixes a basic stream (S1) with an acidic stream (S2) adiabatically in block B1. The resultant vapor stream (S3) is drawn off and the mixed liquid (S4) is neutralized with a sodium hydroxide stream (S5) adiabatically in block B2. A design specification is that stream 7 is to be held to a pH of 9.0 within 0.01 pH units. The following tables contain the Stream conditions:

Table 2-1 Stream Definitions

Stream	S1	S2	S7
Temperature (°C)	40	25	30
Pressure (atm)	1	1	1
Total flow (lbmole/hr)	200	150	100
H2O (lbmole/hr)	55.5	55.5	55.5
NH3	1	0	0
CO2	0.1	0	0
SO2	0.1	0	0
HCL	0	0.1	0
H2SO4	0	1.0	0
NAOH	0	0	1

Table 2-2 Block Definition

Block	B1	B2
Duty (Btu/hr)	**0**	**0**
Pressure (atm)	**1**	**1**

Table 2-3 Design Specifications[4]

Design Specification	DS-1
Variable Name	**PH**
Variable Type	**Stream-Prop**
Variable Target	**S6**
Prop-Set	**PH**
Variable Target Value	**9.0**
Tolerance	**0.01**
Vary	**S5**
Vary Option	**Type: Stream-Var** **Substream: Mixed** **Variable: Mole-Flow** **Lower Bound: 50** **Upper Bound: 400**

After entering the parameters, run the case as you would normally.

Below are the stream results from this case.

[4] In the OLI terminology, these are controllers

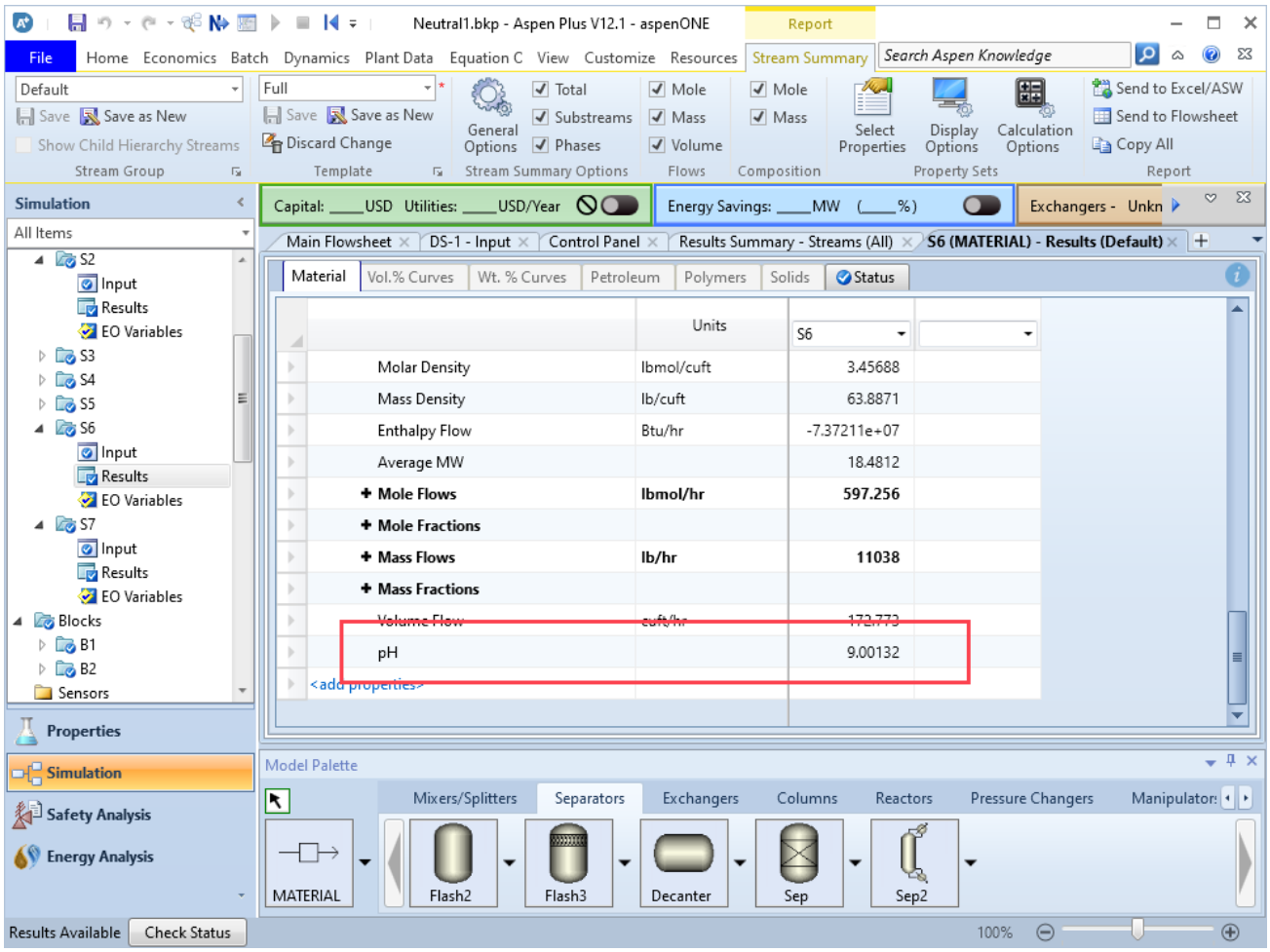
Table 2-4 Stream Results[5]

Material								
Stream Name	**Units**	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**
Description								
From				B1	B1	B2	B2	
To		B1	B1	B2				B2
Stream Class		CONVEN	CONVEN	CONVEN	CONVEN	CONVEN	CONVEN	CONVEN
Maximum Relative Error								
Cost Flow	$/hr							
MIXED Substream								
Phase		Liquid Phase	Liquid Phase	Liquid Phase	Vapor Phase		Liquid Phase	Liquid Phase
Temperature	F	104	77	101.9425509	101.9425509		103.4933075	86
Pressure	psia	14.69594878	14.69594878	14.69594878	14.69594878		14.69594878	14.69594878
Molar Vapor Fraction		0	0	0	1		0	0
Molar Liquid Fraction		1	1	1	0		1	1
Molar Solid Fraction		0	0	0	0		0	0
Mass Vapor Fraction		0	0	0	1		0	0
Mass Liquid Fraction		1	1	1	0		1	1
Mass Solid Fraction		0	0	0	0		0	0
Molar Enthalpy	Btu/lbmol	-122696.8402	-127456.7837	-123875.6391	-162299.5724		-123432.8376	-122057.3314
Mass Enthalpy	Btu/lb	-6686.769197	-6548.86252	-6630.212564	-3741.61784		-6678.842426	-6749.366956
Molar Entropy	Btu/lbmol-R	17.6639649	16.51379181	17.46261958	51.5282997		17.36737312	16.31316405
Mass Entropy	Btu/lb-R	0.962656057	0.848495852	0.934654146	1.187921833		0.939733305	0.902064048
Molar Density	lbmol/cuft	3.404801353	3.406140669	3.418696925	0.002450691		3.456876839	3.582951805
Mass Density	lb/cuft	62.4753682	66.29177711	63.87325633	0.10630322		63.88713644	64.79504504
Enthalpy Flow	Btu/hr	-24239504.37	-19118517.56	-43315959.51	-42062.42507		-73721052.44	-30405092.91
Average MW		18.34919624	19.46243081	18.68350946	43.37684373		18.48117229	18.08426364
Mole Flows	lbmol/hr	197.5560603	150	349.6729446	0.259165347	0	597.2564019	249.1050112
H2O	lbmol/hr	193.4635711	143.7410383	342.1455427	0.017617916	0	586.0373248	240.4404912
CO2	lbmol/hr	7.66061E-05	0	0.125840463	0.226891287	0	8.33514E-05	0
H2SO4	lbmol/hr	0	3.61682E-06	3.07301E-07	6.24244E-21	0	2.16611E-22	0
HCL	lbmol/hr	0	5.13859E-09	1.3437E-09	8.71308E-10	0	1.89949E-17	0
NH3	lbmol/hr	0.512364133	0	1.06816E-08	6.22188E-11	0	0.323057445	0
SO2	lbmol/hr	2.69133E-11	0	0.270189477	0.014656143	0	7.68539E-11	0
SO3	lbmol/hr	0	4.285E-20	1.76611E-20	1.72293E-27	0	0	0
NA3HSO4	lbmol/hr	0	0	0	0	0	1.96287E-11	0
NH4OH	lbmol/hr	1.738548888	0	3.7603E-08	0	0	1.12560953	0

[5] Many zero rows have been eliminated from this report.

NA3OHSO4	lbmol/hr	0	0	0	0	0	2.12271E-09	0
NAOH	lbmol/hr	0	0	0	0	0	2.44234E-10	2.18245E-06
OH-	lbmol/hr	0.000312961	3.29618E-14	4.30429E-12	0	0	0.000533753	4.332258921
CO3-2	lbmol/hr	0.078199932	0	1.20386E-14	0	0	0.024175316	0
H3O+	lbmol/hr	2.32562E-09	3.343767367	0.621144698	0	0	1.8625E-08	1.13406E-13
HCO3-	lbmol/hr	0.133829287	0	1.9365E-06	0	0	0.081414867	0
HSO3-	lbmol/hr	0.00084127	0	0.067499883	0	0	0.00123196	0
HSO4-	lbmol/hr	0	2.221596419	1.48477922	0	0	6.35528E-08	0
NA+	lbmol/hr	0	0	0	0	0	4.332261083	4.332258921
NAOHCO-2	lbmol/hr	0	0	0	0	0	1.29627E-08	0
NH2CO2-	lbmol/hr	0.140627861	0	2.64846E-14	0	0	0.020168852	0
NH4+	lbmol/hr	1.135795979	0	3.527336812	0	0	2.058501034	0
CL-	lbmol/hr	0	0.265017663	0.265017666	0	0	0.265017667	0
S2O5-2	lbmol/hr	4.68072E-08	0	0.000193931	0	0	3.71615E-08	0
SO3-2	lbmol/hr	0.351892323	0	3.20464E-07	0	0	0.336845509	0
SO4-2	lbmol/hr	0	0.428576642	1.165397151	0	0	2.650176613	0

pH is not a standard Aspen Plus stream variable you must add the property to the report. Here we have added pH to the S6 stream report.



As you can see, the pH of stream S6 is 9.0 within the tolerance we defined.

Chapter 3 ASPEN Emergency Chlorine Scrubber Flowsheet

A Tour of the OLI-ASPEN Interface (RADFRAC example)

The following example is a simulation of a Chlorine scrubber. Caustic is used to remove chlorine from a gas stream. The caustic feed rate to the column is adjusted to reduce the chlorine in the column overhead gas to 0.5 moles/hr.

Generating Chemistry Model

Using the OLI Chemistry Wizard, create a chemistry model with the following components. We recommend the name of the model to be CHLORINE. Turn off all solids in this model.

H2O, CO2, CL2, N2, NAOH

Creating the Aspen Flowsheet

Start Aspen normally and open the Chlorine.bkp file just created.

Create the following flowsheet

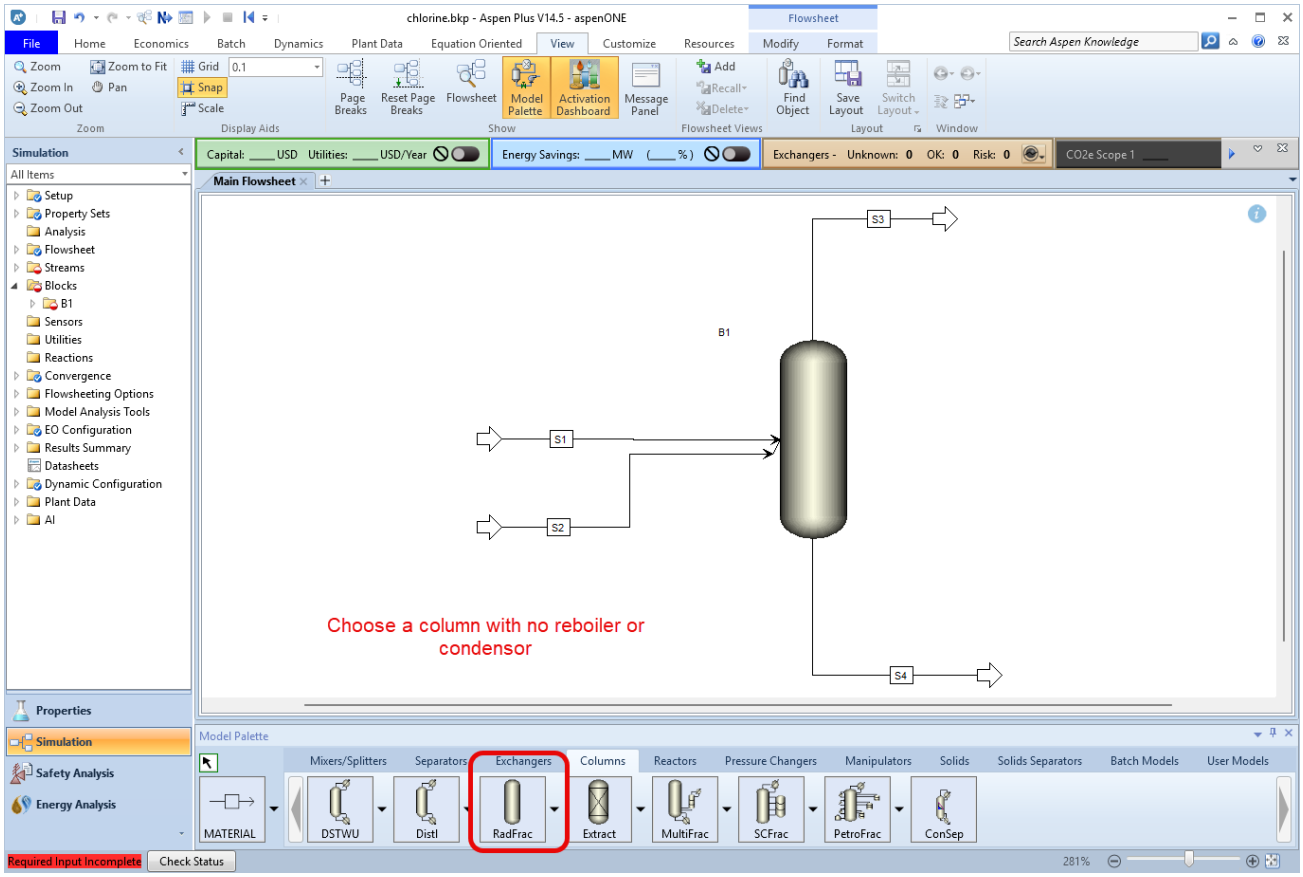
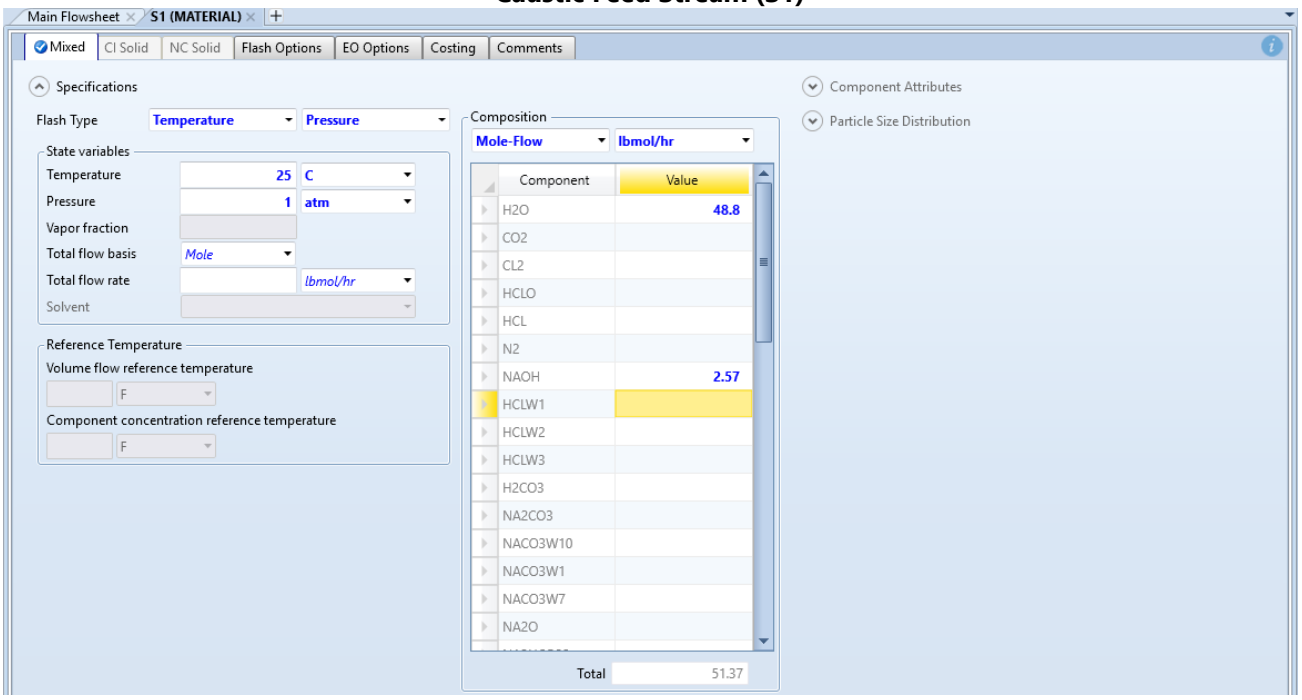
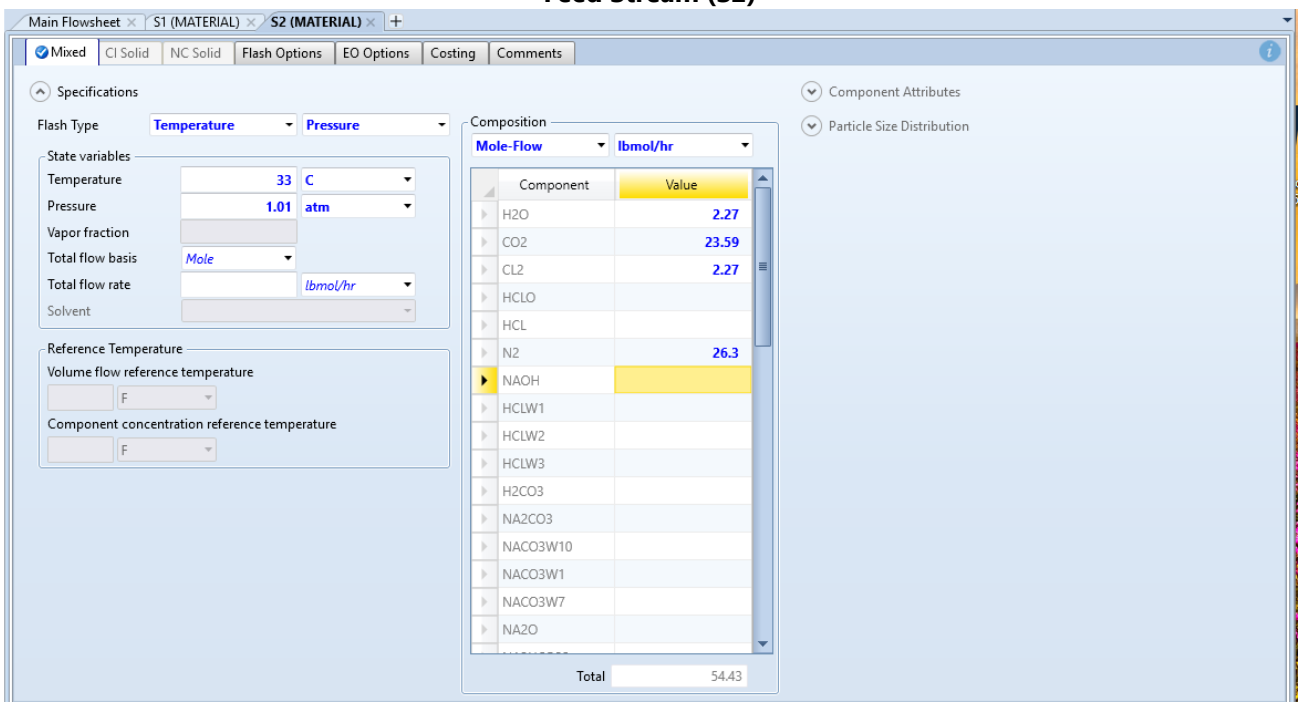

chlorine.bkp - Aspen Plus V14.5 - aspenONE
Flowsheet
File
Home
Economics
Batch
Dynamics
Plant Data
Equation Oriented
View
Customize
Resources
Modify
Format
Search Aspen Knowledge
Zoom
Zoom to Fit
Zoom In
Pan
Zoom Out
Grid
0.1
Snap
Scale
Page Breaks
Reset Page Breaks
Flowsheet
Model Palette
Activation Dashboard
Message Panel
Add
Recall
Delete
Find Object
Save Layout
Switch Layout
Simulation
All Items
Setup
Property Sets
Analysis
Flowsheet
Streams
Blocks
B1
Sensors
Utilities
Reactions
Convergence
Flowsheeting Options
Model Analysis Tools
EO Configuration
Results Summary
Datasheets
Dynamic Configuration
Plant Data
AI
Capital: ____ USD Utilities: ____ USD/Year
Energy Savings: ____ MW (____ %)
Exchangers - Unknown: 0 OK: 0 Risk: 0
CO2e Scope 1
Main Flowsheet
B1
S1
S2
S3
S4
Choose a column with no reboiler or condensor
Properties
Simulation
Safety Analysis
Energy Analysis
Model Palette
Mixers/Splitters
Separators
Exchangers
Columns
Reactors
Pressure Changers
Manipulators
Solids
Solids Separators
Batch Models
User Models
MATERIAL
DSTWU
Distl
RadFrac
Extract
MultiFrac
SCFrac
PetroFrac
ConSep
Required Input Incomplete
Check Status
281%

Figure 3-1

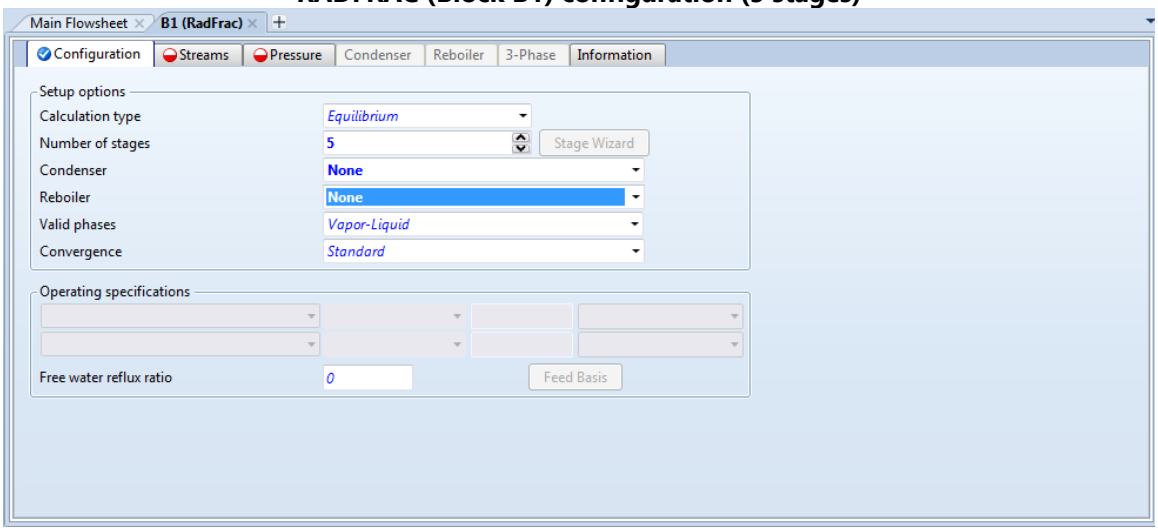
Caustic Feed Stream (S1)



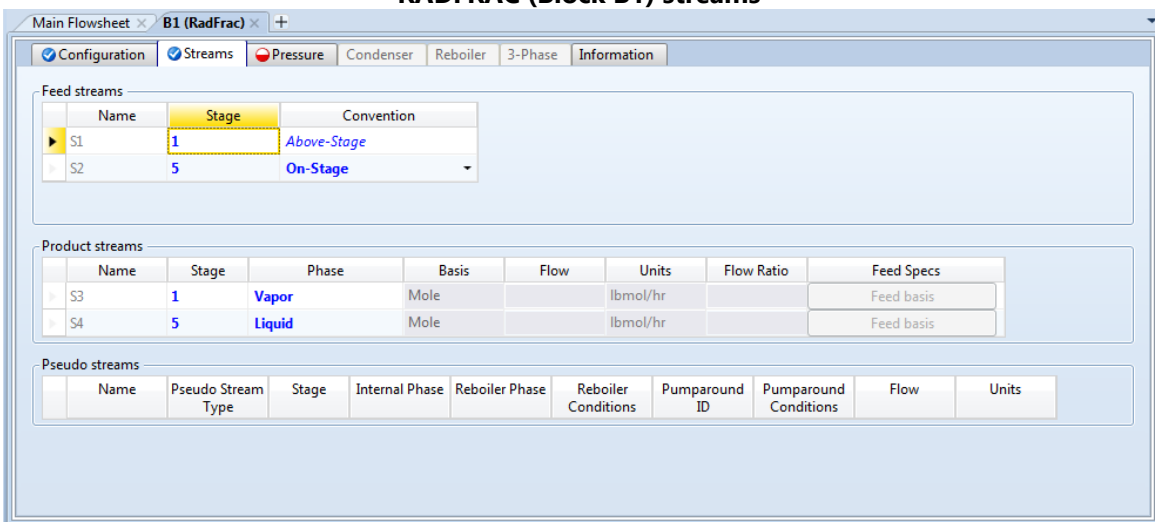
Feed Stream (S2)



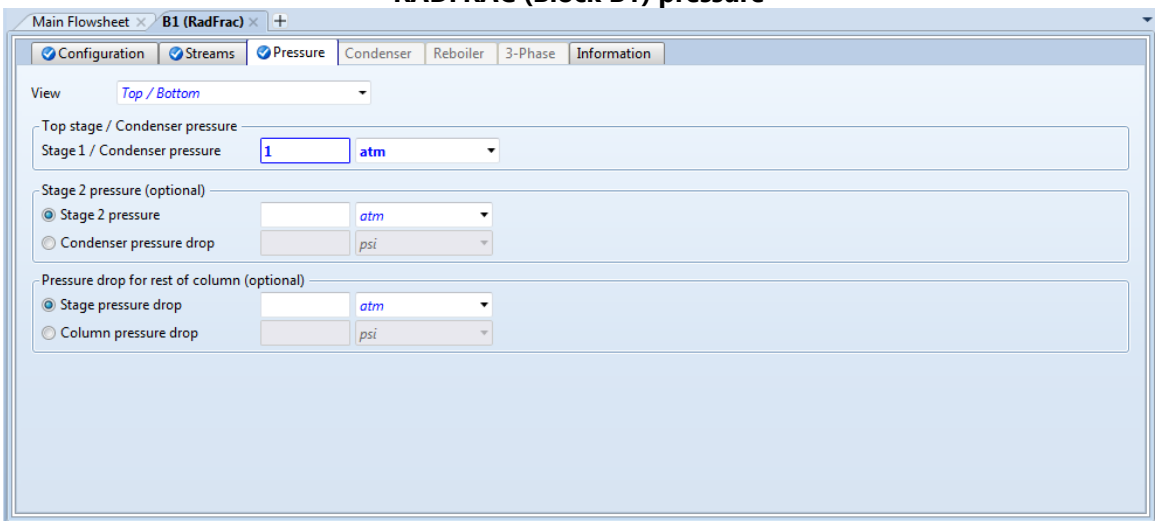
RADFRAC (Block B1) configuration (5 stages)



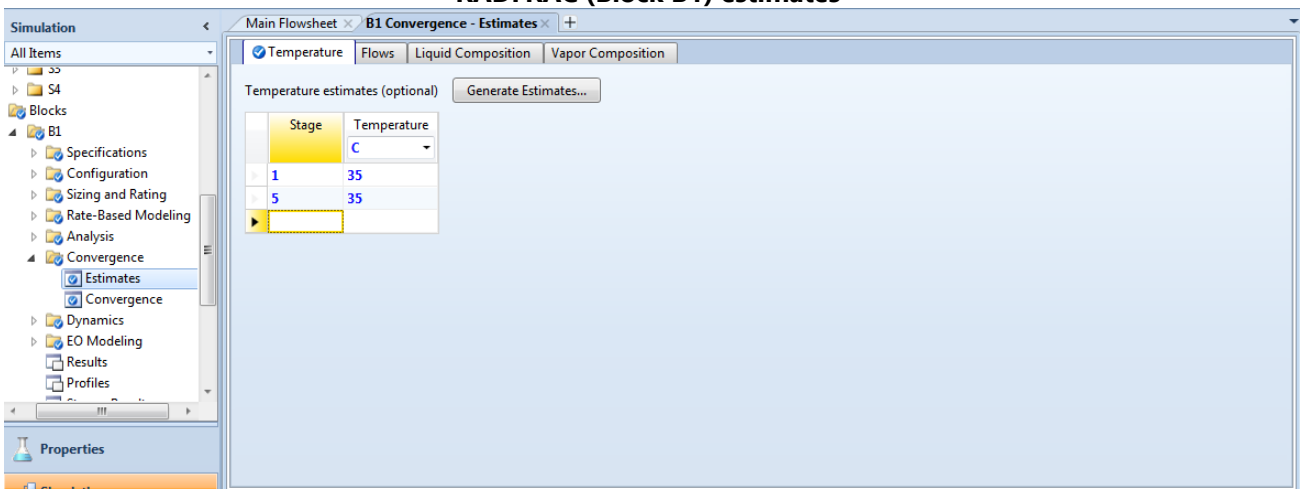
RADFRAC (Block B1) streams



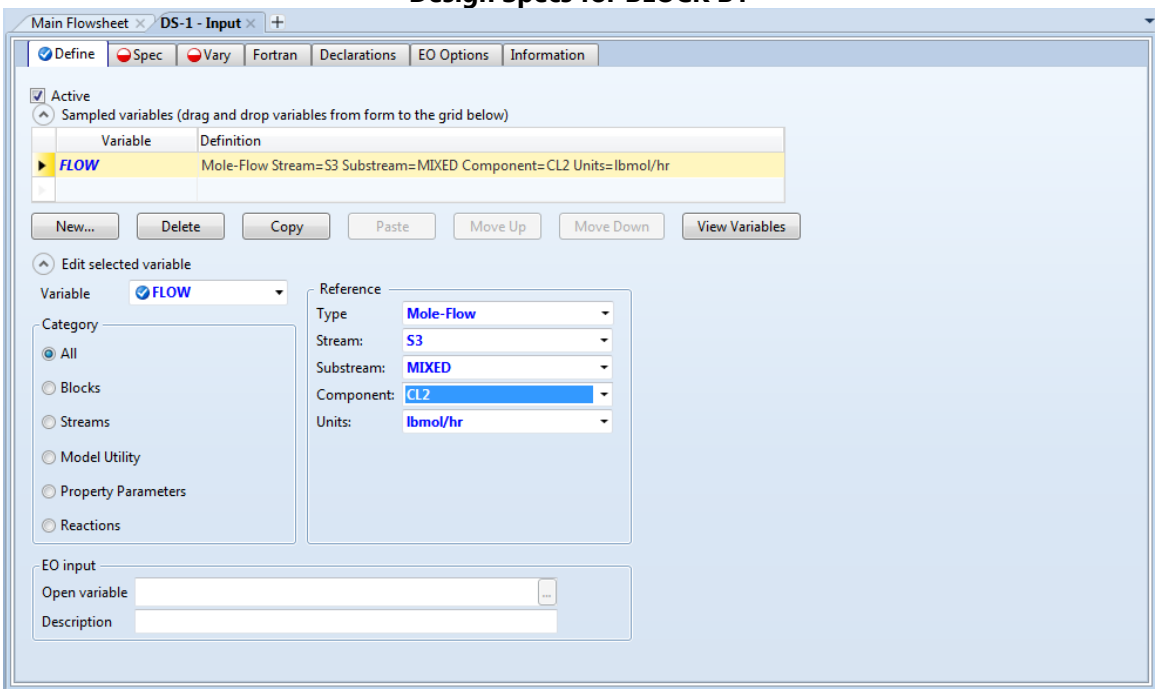
RADFRAC (Block B1) pressure

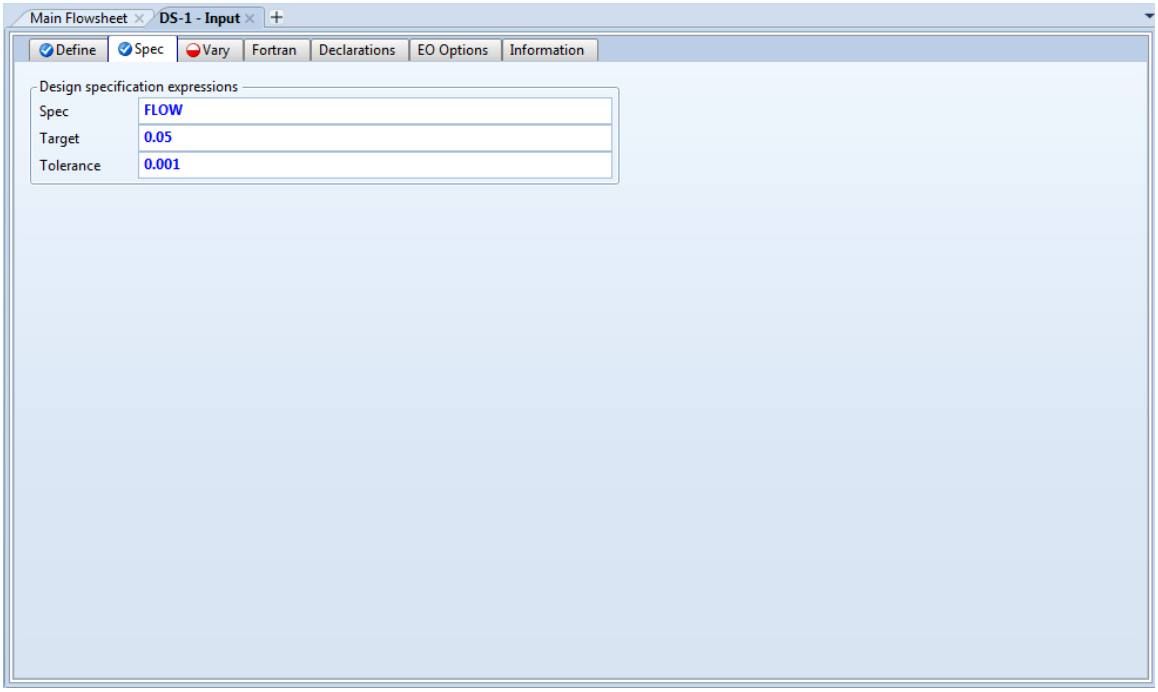


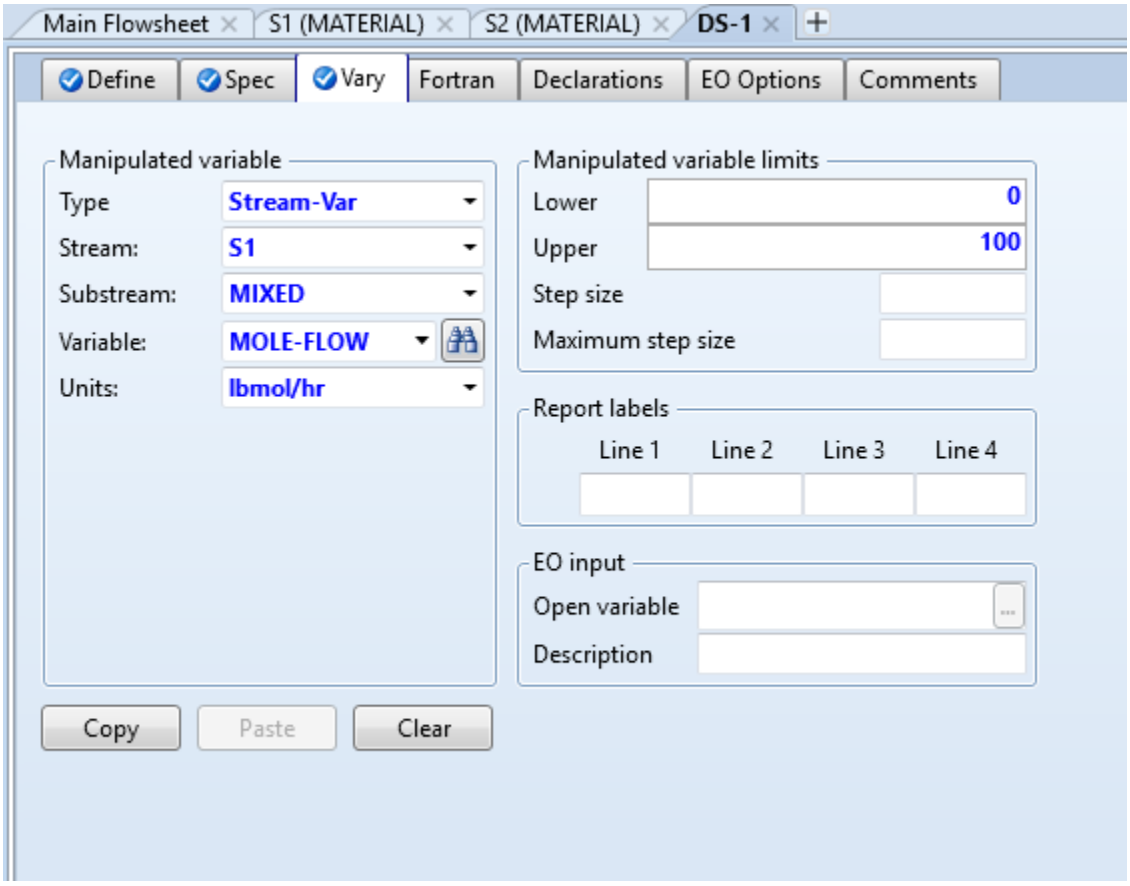
RADFRAC (Block B1) estimates



Design Specs for BLOCK B1







Now select the Vary Object

Now run the case

Stream Results

	Units	S1	S2	S3	S4
Description					
From				B1	B1
To		B1	B1		
Stream Class		CONVEN	CONVEN	CONVEN	CONVEN
Maximum Relative Error					
Cost Flow	$/hr				
MIXED Substream					
Phase		Liquid Phase	Vapor Phase	Vapor Phase	Liquid Phase
Temperature	F	77	91.4	110.9184062	89.51948356
Pressure	psia	14.69594878	14.84290826	14.69594878	14.69594878
Molar Vapor Fraction		0	1	1	0
Molar Liquid Fraction		1	0	0	1
Molar Solid Fraction		0	0	0	0
Mass Vapor Fraction		0	1	1	0
Mass Liquid Fraction		1	0	0	1
Mass Solid Fraction		0	0	0	0
Molar Enthalpy	Btu/lbmol	-120910.6071	-77606.16654	-81473.38825	-116925.4843
Mass Enthalpy	Btu/lb	-6641.881885	-2136.843859	-2379.848615	-5733.410093
Molar Entropy	Btu/lbmol-R	14.85892015	48.53681558	48.52375771	16.33121535
Mass Entropy	Btu/lb-R	0.816232711	1.336434989	1.417385481	0.80079681
Molar Density	lbmol/cuft	3.811204487	0.002516816	0.002405863	3.389175157
Mass Density	lb/cuft	69.3801932	0.091406058	0.08236397	69.11784441
Enthalpy Flow	Btu/hr	-6375009.552	-4224103.645	-4426577.285	-6172535.916
Average MW		18.20426939	36.31812694	34.23469364	20.39370679
Mole Flows	lbmol/hr	52.72498174	54.43	54.33157231	52.79033866
H2O	lbmol/hr	47.70076477	2.269997668	4.330893326	45.8998837
CO2	lbmol/hr	0	23.59	23.54990646	0.007019855
CL2	lbmol/hr	0	2.269997668	0.04915845	0.001817761
HCLO	lbmol/hr	0	2.33E-06	0.101818683	1.857252763
HCL	lbmol/hr	0	2.33E-06	5.60E-12	3.00E-14
N2	lbmol/hr	0	26.3	26.2997954	0.000204605
NAOH	lbmol/hr	2.92E-06	0	3.95E-42	2.14E-13
H2CO3	lbmol/hr	0	0	0	0
NA2CO3	lbmol/hr	0	0	0	0
NA2O	lbmol/hr	0	0	0	0

NA3HCO32	lbmol/hr	0	0	0	0
NA5H3C34	lbmol/hr	0	0	0	0
NACL	lbmol/hr	0	0	0	0
NACLO	lbmol/hr	0	0	0	0
NAHCO3	lbmol/hr	0	0	0	0
OH-	lbmol/hr	2.512107027	0	0	9.22E-08
CLO-	lbmol/hr	0	0	0	0.259952344
CO3-2	lbmol/hr	0	0	0	6.01E-05
H3O+	lbmol/hr	2.53E-15	0	0	1.15E-07
HCO3-	lbmol/hr	0	0	0	0.033013538
NA+	lbmol/hr	2.512107027	0	0	2.512109948
NAOHCO-2	lbmol/hr	0	0	0	1.55E-13
CL-	lbmol/hr	0	0	0	2.219023789
Mole Fractions					
Mass Flows	lb/hr	959.8197714	1976.79565	1860.024733	1076.590688
Mass Fractions					
Volume Flow	cuft/hr	13.83420436	21626.52768	22582.99023	15.57616122
Vapor Phase					
Liquid Phase					
Molar Enthalpy	Btu/lbmol	-120910.6071			-116925.4843
Mass Enthalpy	Btu/lb	-6641.881885			-5733.410093
Molar Entropy	Btu/lbmol-R	14.85892015			16.33121535
Mass Entropy	Btu/lb-R	0.816232711			0.80079681
Molar Density	lbmol/cuft	3.811204487			3.389175157
Mass Density	lb/cuft	69.3801932			69.11784441
Enthalpy Flow	Btu/hr	-6375009.552			-6172535.916
Average MW		18.20426939			20.39370679
Mole Flows	lbmol/hr	52.72498174			52.79033866
Mole Fractions					
Mass Flows	lb/hr	959.8197714			1076.590688
Mass Fractions					
Volume Flow	cuft/hr	13.83420436			15.57616122
pH		14.35814337			6.571125775

The flowrate of the caustic stream (S1) was adjusted and the specified flowrate of chlorine in the vapor stream S3 was achieved.