1 Modeling Coal Drying

In this simulation you will simulate a coal drying process.

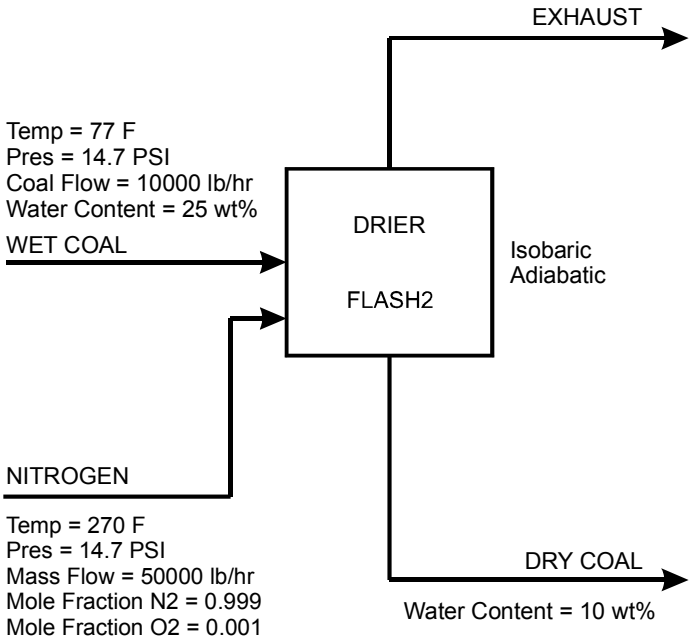
You will:

- Define nonconventional solid components.
- Specify physical properties for nonconventional solid components.
- Change the global stream class.
- Specify streams with nonconventional solid components.
- Modify component attributes in a unit operation block.
- Analyze the results.

Allow about 30 minutes to complete this simulation.

Coal Drying Flowsheet

The process flow diagram and operating conditions for this simulation are shown in the following figure. A wet coal stream and a nitrogen stream are fed to a drier. There are two products from the drier: a stream of dried coal and a stream of moist nitrogen.



To Start Aspen Plus

1 From your desktop, click **Start** and then select **Programs**.

2 Select **AspenTech | Process Modeling <version> | Aspen Plus | Aspen Plus <version>**. The **Start Using Aspen Plus** window appears within the Aspen Plus main window.

On this window, Aspen Plus displays links for commands and cases so that you can quickly enter information or make a selection before proceeding. In this simulation, start a new case using an Aspen Plus template.

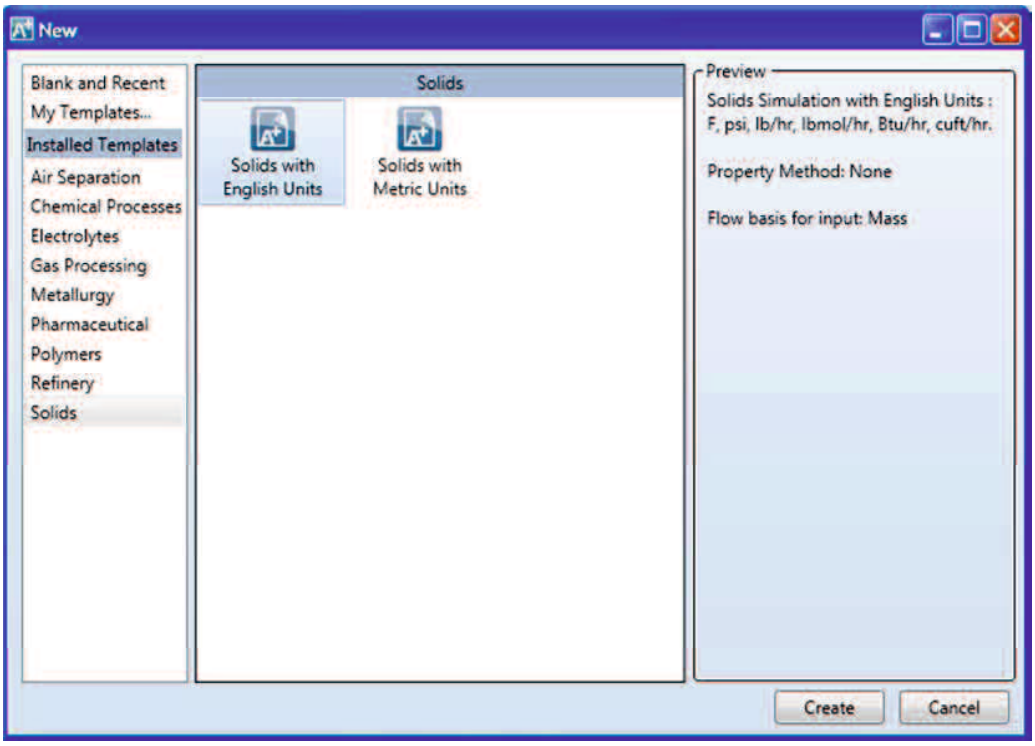
3 Click **New** on the **Start Using Aspen Plus** window.

The **New** dialog box appears. Use this dialog box to specify the template for the new run. With the template, Aspen Plus automatically sets various defaults appropriate to your application.

To Specify the Template for the New Run

1 Under **Installed Templates** in the panel on the left side of the **New** dialog box, click **Solids**, then click the **Solids with English Units** template.

Information for unit sets, property method, etc. that were pre-defined in the template is shown on the right side, in the **Preview** field.



2 Click **Create** to apply this template.

It takes a few seconds for Aspen Plus to apply these options.

Specifying Components

The **Components - Specifications | Selection** sheet is used to enter the components present in the simulation. The components in this simulation are H_2O, N_2, O_2, and coal.

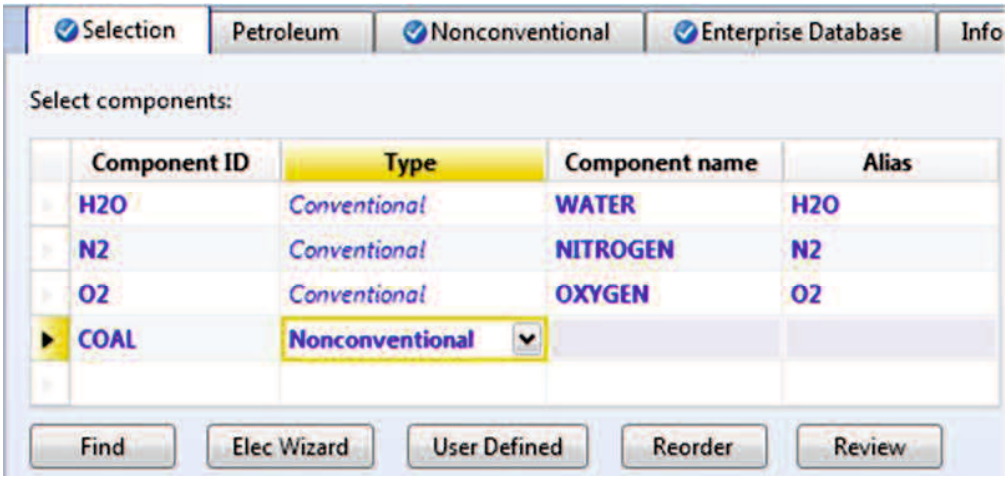
1 In the first four **Component ID** fields, enter **H2O**, **N2**, **O2**, and **COAL**.

Because H2O, N2, and O2 are present in the databanks, WATER, NITROGEN, and OXYGEN appear in the **Component name** field. Aspen Plus does not recognize COAL. Coal is actually a mixture of different compounds, but for this simulation it will be treated as a single component.

By default, Aspen Plus assumes all components are of the type **Conventional**, indicating that they participate in phase equilibrium calculations. However, in this simulation, coal will be modeled as a nonconventional solid.

2 From the COAL **Type** field, click  and select **Nonconventional**.

The **Components - Specifications | Selection** sheet is now complete:



3 From the Navigation Pane, select **Methods | Specifications**.
The **Methods - Specifications | Global** sheet appears.

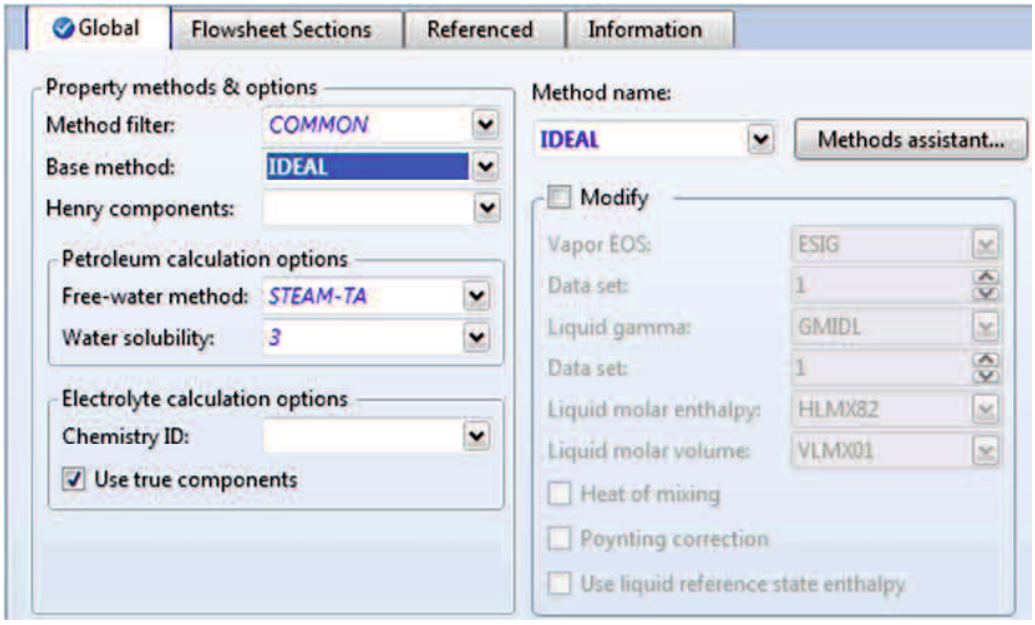
Defining Properties

The **Methods - Specifications | Global** sheet is used to select the thermodynamic methods used to calculate properties such as K-values, enthalpy, and density. Property methods in Aspen Plus are categorized into various process types.

Because the physical property methods for solid components are the same for all property methods, select a property method based on the conventional components in the simulation.

The **IDEAL** property method (Ideal gas and Raoult's Law, as the prompt indicates) is a good choice for this simulation, since the process involves the conventional components H_2O, N_2, and O_2, at low pressure.

1 In the **Base method** field, click  and select **IDEAL**.



2 Click to continue.

The **Methods - NC Props | Property Methods** sheet appears.

Specifying Nonconventional Solid Physical Property Models

The **Methods - NC Props | Property Methods** sheet is used to specify the models used to calculate the nonconventional solid properties. Because nonconventional components are heterogeneous solids that do not participate in chemical or phase equilibrium, the only physical properties that are calculated for nonconventional components are enthalpy and density.

In this simulation, use the **HCOALGEN** and the **DCOALIGT** models to calculate the enthalpy and density of coal.

1 In the **Model name** field for **Enthalpy**, click and select **HCOALGEN**.

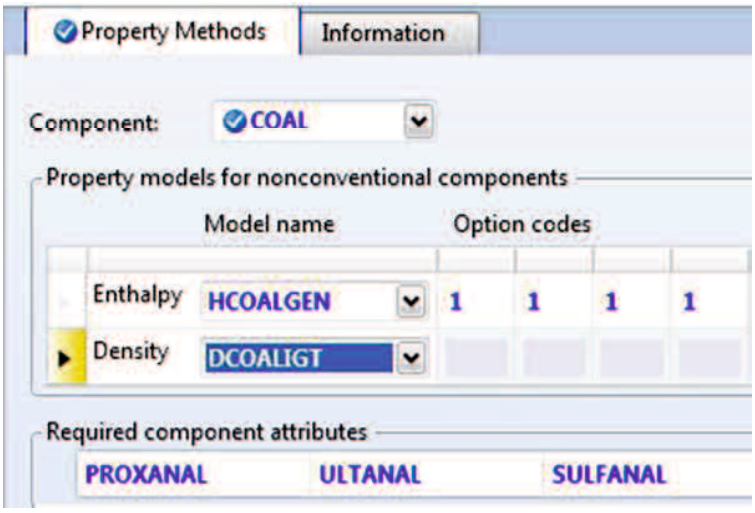
The component attributes **PROXANAL**, **ULTANAL**, and **SULFANAL** are automatically included in the **Required component attributes** field for COAL when you select HCOALGEN. Also, four **Option Codes** fields with values of **1** appear.

Aspen Plus uses component attributes to represent nonconventional components in terms of a set of identifiable constituents needed to calculate physical properties. HCOALGEN uses the proximate analysis, ultimate analysis, and sulfur analysis to calculate the enthalpy of coal.

The Option Codes fields define how the HCOALGEN model calculates the heat of combustion, the standard heat of formation, the heat capacity, and the enthalpy basis for coal.

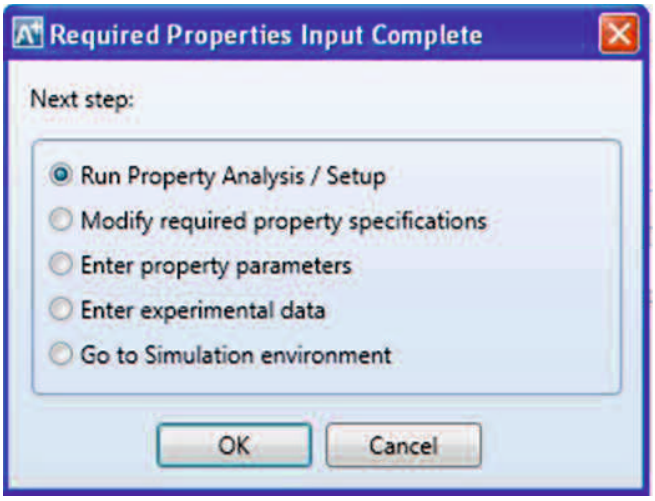
2 In the **Model name** field for **Density**, click and select **DCOALIGT**.

The **Property Methods** sheet is complete:



3 Click  to continue.

The **Required Properties Input Complete** dialog box appears:



Correct representation of physical properties is an essential component of process modeling. For many simulations, the only physical property specification that you must provide is the selection of a property method. The **Required Properties Input Complete** dialog box shows that the Aspen Plus physical property system has many optional capabilities that you can use to increase the accuracy of physical property calculations.

4 Select **Go to Simulation environment** and click **OK** to continue.

Drawing the Graphical Simulation Flowsheet

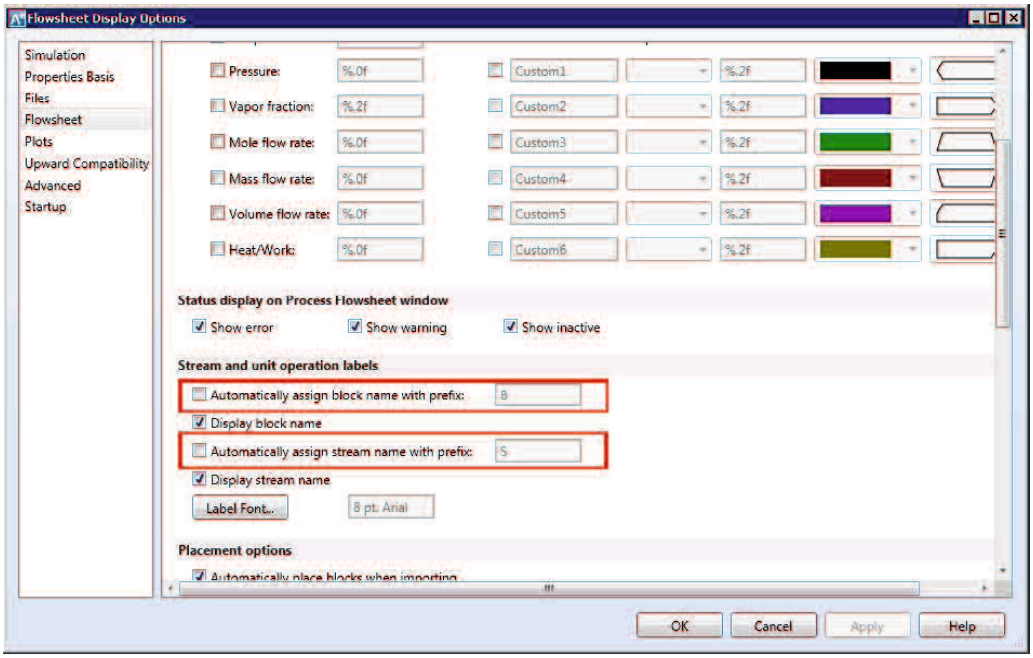
In this simulation, begin building the process flowsheet. Since you will enter your own block and stream IDs, turn off the automatic naming of blocks and streams, which provide these IDs automatically.

1 From the ribbon, click **File**. Click **Options**.

The **Options** dialog box appears.

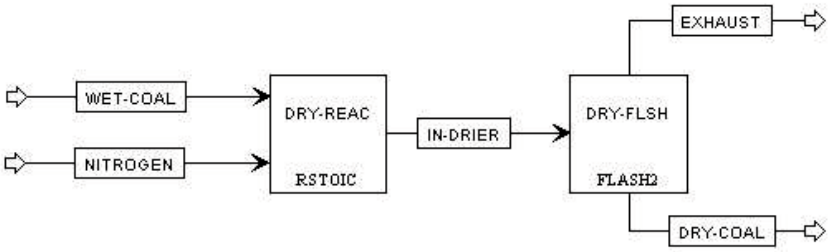
2 Select **Flowsheet** from the panel on the left side of the dialog box.

3 Clear the **Automatically assign block name with prefix** and **Automatically assign stream name with prefix** check boxes under **Stream and unit operation labels**.



4 Click **Apply** and then **OK** to apply the changes and close the dialog box.

The simulation flowsheet shown in the following figure feeds the WET-COAL stream and the NITROGEN stream to an RStoic model. In the RStoic block, a portion of the coal reacts to form water. Because the RStoic model has a single outlet stream, use a Flash2 model to separate the dried coal from the moist nitrogen.



5 Place the flowsheet blocks and streams to create the graphical simulation flowsheet as shown in the figure above. (See *Getting Started Building and Running a Process Model*, Chapter 2, if you need to review how to create a graphical simulation flowsheet.)

6 As you place blocks and streams, Aspen Plus prompts you to enter the IDs. Enter the block IDs and click **OK**.

The simulation flowsheet above appears different from the process diagram in the previous figure because the simulation flowsheet uses two unit operation models to simulate a single piece of equipment. Also, the simulation flowsheet defines an extra stream (IN-DRIER) to connect the two simulation unit operation models. There is no real stream that corresponds to the simulation stream IN-DRIER.

Specifying Title, Stream Properties, and Global Options

1 From the Navigation Pane, go to **Setup | Specifications**.

The **Setup - Specifications** form displays default settings Aspen Plus uses for other sheets. Use this form to give your simulation a title, and to review the stream properties and global options that were set when you selected the Solids with English Units template.

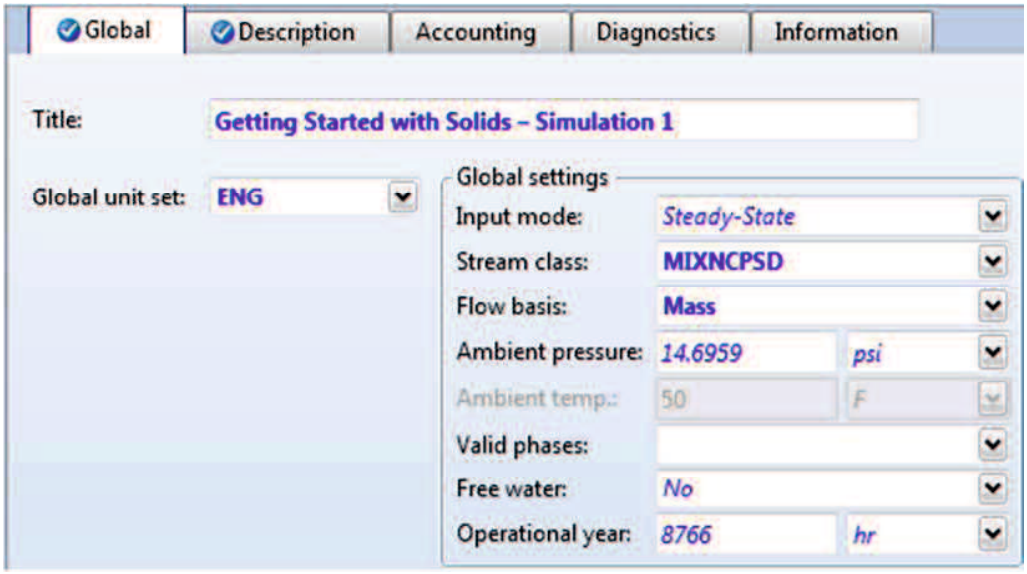
It is always good practice to describe your simulation by entering a title for the simulation.

2 In the **Title** field, enter the title **Getting Started with Solids – Simulation 1**.

In the Solids with English Units template, the following global defaults have been set for solids applications:

- **ENG** units (English Engineering Units)
- **Mass** Flow Basis for all flow inputs
- **MIXCISLD** for the global Stream class

3 In the **Stream class** field, click  and select **MIXNCPSD**.



Stream Classes and Substreams

Stream classes are used to define the structure of simulation streams when inert solids are present.

The default stream class for most simulations is CONVEN. The CONVEN stream class has a single substream: the MIXED substream. By definition, all components in the MIXED substream participate in phase equilibrium whenever flash calculations are performed.

To introduce inert solid components to a simulation, you must include one or more additional substreams. Aspen Plus has two other types of substreams available: the CISOLID substream type and the NC substream type.

The CISOLID substream (Conventional Inert Solid) is used for homogeneous solids that have a defined molecular weight. The NC substream (Nonconventional) is used for heterogeneous solids that have no defined molecular weight. Both the CISOLID substream and the NC substream give you the option of including a Particle Size Distribution (PSD) for the substream.

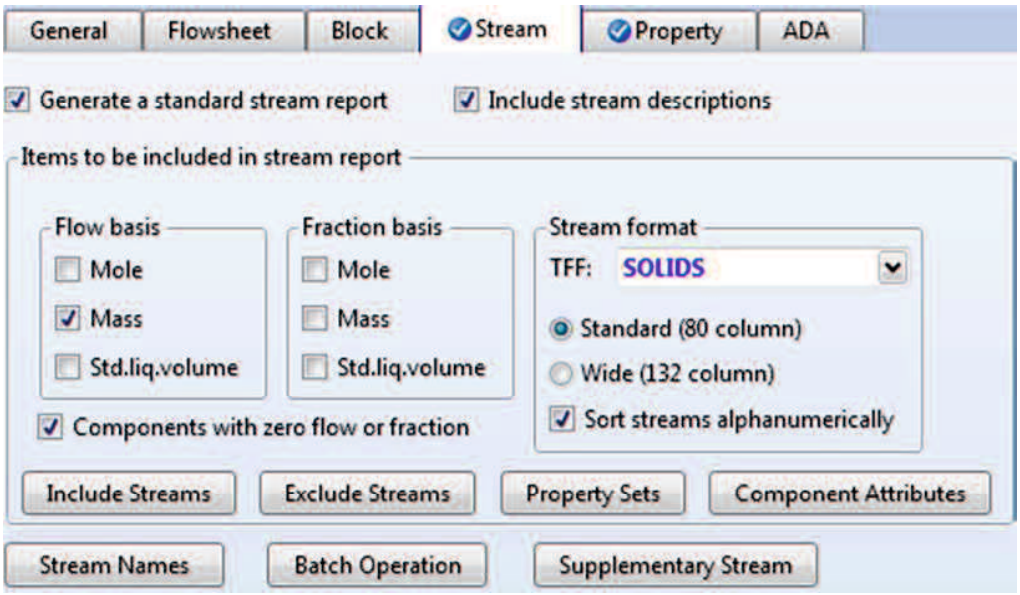
Substreams are combined in different ways to form different stream classes. The MIXNCPSD stream class contains two substreams: MIXED and NCPSD.

The default stream class of the Solids application type, MIXCISLD, is insufficient for this simulation since you will use an NC substream with a particle size distribution for the feed coal. In this simulation, use the MIXNCPSD stream class.

To Review the Report Options Specified in the Selected Template

4 From the Navigation Pane, click the **Setup | Report Options** form.

5 Click the **Stream** tab.



Since you chose the Solids with English Units template when you started this simulation, Aspen Plus has set the following defaults for calculating and reporting stream properties:

- The component mass flow rates will be included in the stream report.
- The stream results will be displayed using the **SOLIDS** stream format.
- Property set **ALL-SUBS** (properties for the entire stream, all substreams combined) will be reported for each stream.

6 Click **Property Sets** to view the selected property sets.

7 Click **Close** to return to the **Stream** sheet.

8 From the Quick Access Toolbar, click to continue.

The **NITROGEN (MATERIAL) - Input | Mixed** sheet appears.

Entering Stream Data

To specify a stream, Aspen Plus requires two thermodynamic specifications, and enough information to calculate the flow rate of each component.

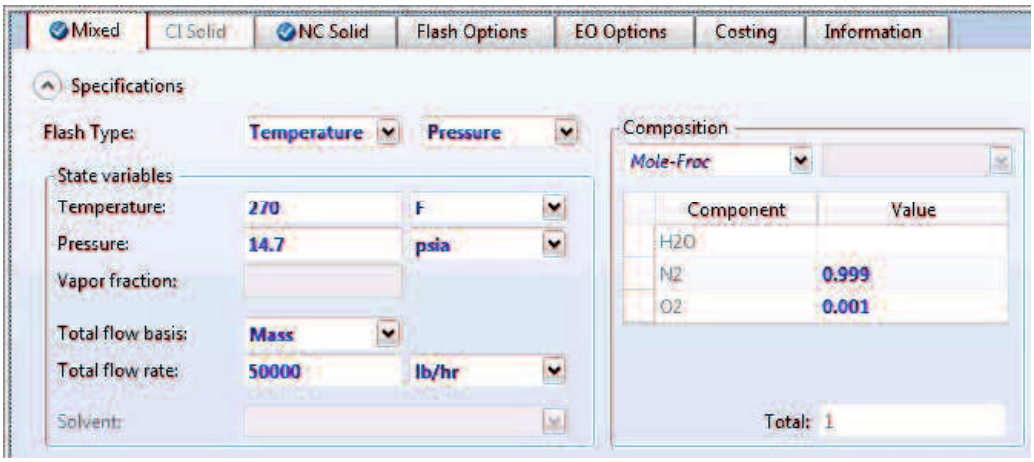
Specifying the Nitrogen Stream

1 On the **NITROGEN (MATERIAL) - Input | Mixed** sheet, enter the following specifications:

Parameter	Value
Temperature	270 F
Pressure	14.7 psia
Total flow	Mass 50000 lb/hr
Composition	Mole-Frac

2 Enter the following mole fractions:

Component	Value
N2	0.999
O2	0.001



3 Click to continue.

Specifying the Wet Coal Feed Stream

The **WET-COAL (MATERIAL) - Input | Mixed** sheet appears. Substream MIXED appears by default. To access the NCPSD substream:

4 Click the tab **NC Solid**. In the **Substream name** field, verify **NCPSD** has been selected.

5 For the NCPSD substream, enter the following specifications:

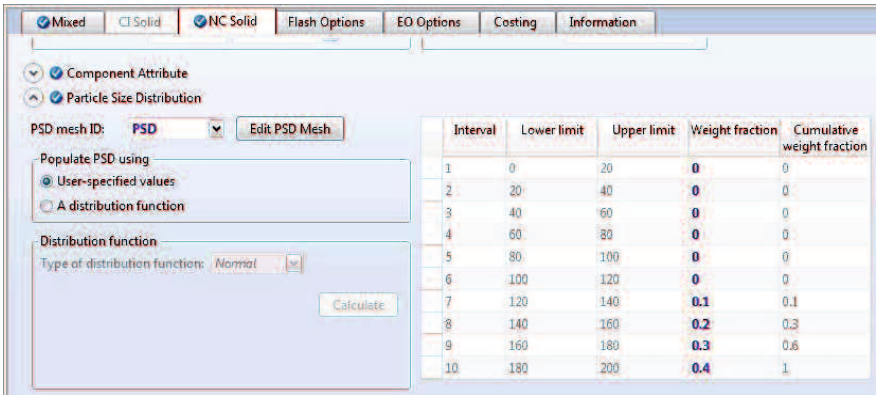
Parameter	Value
Temperature	77 F
Pressure	14.7 psia
COAL Mass flow	10000 lb/hr

6 Click **Particle Size Distribution** to display the PSD parameters.

By default, Aspen Plus uses a particle size distribution of 10 size ranges covering 20 microns each. The default size ranges are appropriate for this simulation. On this sheet, enter the weight fraction of coal in each size range.

7 On the last four **Weight fraction** fields, enter the following values:

Interval	Weight fraction
7	0.1
8	0.2
9	0.3
10	0.4

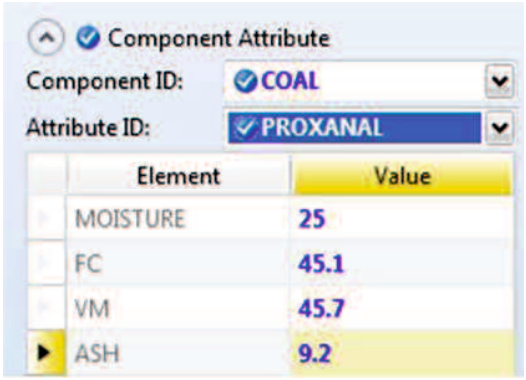


8 Click **Component Attribute**.

In this section, enter the component attributes for the component COAL in the NCPSD substream. The values in PROXANAL, ULTANAL, and SULFANAL are defined as weight % on a dry basis, except for Moisture in PROXANAL.

9 Enter the component attribute values for coal. For the attribute **PROXANAL**, enter these values:

Element	Value
Moisture	25
FC	45.1
VM	45.7
Ash	9.2



10 In the **Attribute ID** field, click  and select **ULTANAL**.

11 For the attribute ULTANAL, enter these values:

Element	Value
Ash	9.2
Carbon	67.1
Hydrogen	4.8
Nitrogen	1.1
Chlorine	0.1
Sulfur	1.3
Oxygen	16.4

12 In the **Attribute ID** field, click and select **SULFANAL**.

13 For the attribute SULFANAL, enter these values:

Element	Value
Pyritic	0.6
Sulfate	0.1
Organic	0.6

The values meet the following consistency requirements:

- SULFANAL values sum to the ULTANAL value for sulfur.
- ULTANAL value for ash equals the PROXANAL value for ash.
- ULTANAL values sum to 100.
- PROXANAL values for FC, VM, and ASH sum to 100.

14 Click to continue.

The **DRY-FLSH (Flash2) - Input | Specifications** sheet appears.

Specifying Blocks

The unit operation models RStoic and Flash2 simulate a single piece of plant equipment for drying coal. Nitrogen provides the heat for coal drying. Both the RStoic and Flash2 models are isobaric and adiabatic.

Specifying the Flash2 Block

On the **DRY-FLSH (Flash2) - Input | Specifications** sheet:

1 In the **Flash Type** fields, where **Temperature** is selected, click and change it to **Duty**.

2 In the **Pressure** field, enter **14.7** psia.

3 In the **Duty** field, enter **0** Btu/hr.

4 Click to continue.

Specifying the RStoic Block

The **DRY-REAC (RStoic) - Setup | Specifications** sheet appears.

1 In the **Pressure** field, enter **14.7** psia.

2 In the **Flash Type** fields, where **Temperature** is selected, click and change it to **Duty**.

3 In the **Heat duty** field, enter **0** Btu/hr.

4 Click to continue.

The **DRY-REAC (RStoic) - Setup | Reactions** sheet appears.

This RStoic block models the drying of coal. Although coal drying is not normally considered a chemical reaction, you are using an RStoic block to convert a portion of the coal to form water. The following equation is the chemical reaction for coal drying:

COAL(wet) $\rightarrow$ 0.0555084 H_2O

Aspen Plus treats all nonconventional components as if they have a molecular weight of 1.0. The reaction indicates that 1 mole (or 1 lb.) of coal reacts to form 0.0555084 mole (or 1 lb.) of water.

To Enter the Reaction Stoichiometry

1 Click **New**.

The **Edit Stoichiometry** dialog box appears. A reaction number of 1 is automatically chosen.

2 In the **Reactants | Component** field, click and select **COAL**.

3 In the **Reactants | Coefficient** field, enter **1**.

Note that the stoichiometric coefficient for reactants is displayed as negative, **-1**.

4 In the **Products | Component** field, click and select **H2O**.

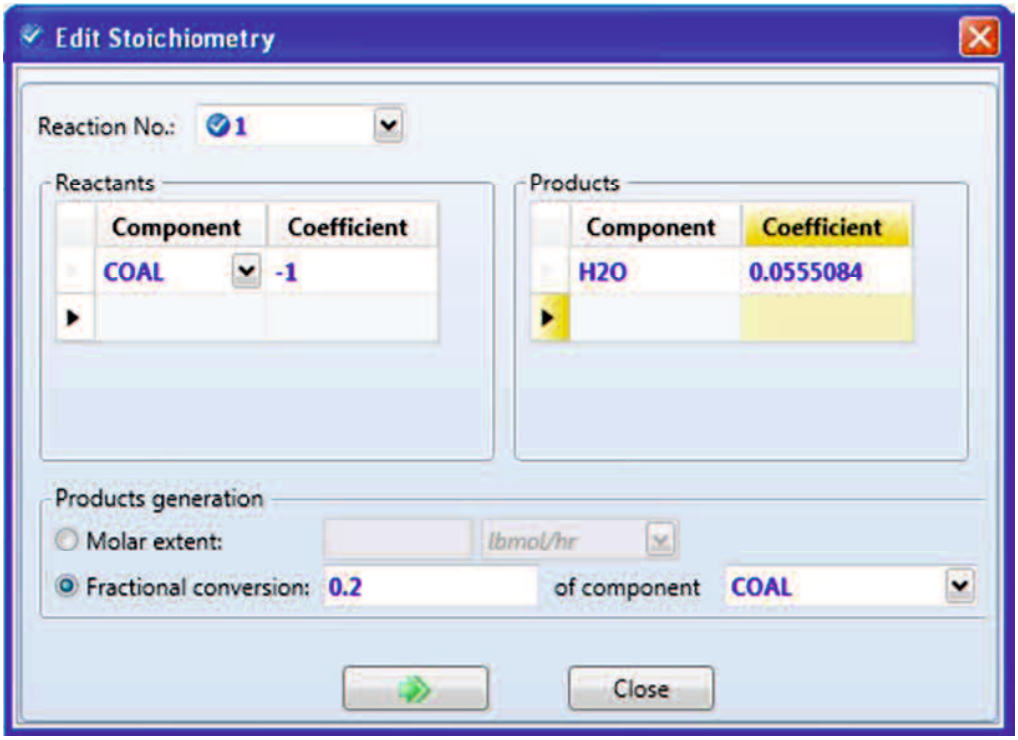
5 In the **Products | Coefficient** field, enter **0.0555084**.

The conversion for this reaction must be set to achieve the proper amount of drying.

6 Select the **Fractional conversion** option.

7 In the **Products generation** section, for the **Fractional conversion** field, enter **0.2**; in the **of component** field, click and select **COAL**.

The fraction conversion of Coal of 0.2 is a temporary value that you will override later with a Calculator block.



8 Click **Close** to return to the **DRY-REAC (RStoic) - Setup | Reactions** sheet.

Updating the Moisture Content

Drying the coal changes its component attribute for moisture in the Proximate Analysis. Since the other elements of PROXANAL, ULTANAL, and SULFANAL are on a dry basis, drying the coal does not change these attributes.

1 Click the **Component Attr.** tab. Click  at the end of the row of tabs, if necessary, to access it.

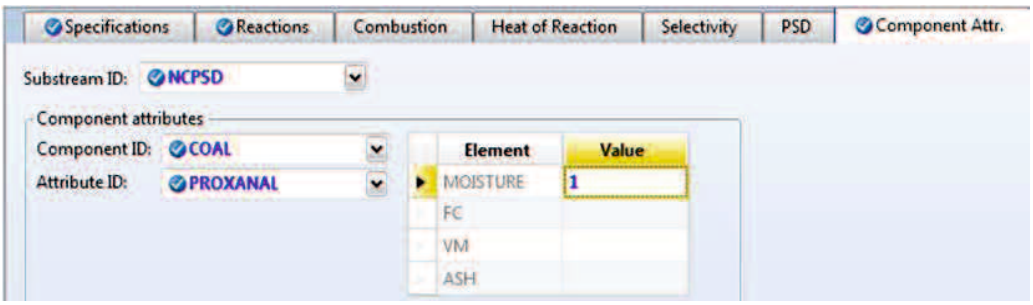
The **DRY-REAC (RStoic) - Setup | Component Attr.** sheet appears. On this sheet, enter the values for component attributes that change in this RStoic block. If you do not enter an attribute value, the attribute does not change.

2 In the **Substream ID** field, click  and select **NCPSD**.

3 In the **Component ID** field, click  and select **COAL**.

4 In the **Attribute ID** field, click  and select **PROXANAL**.

5 In the **Moisture** field, enter a value of **1**. (The moisture content of 1 is a temporary value that you will override later with a Calculator block.)



6 Click  to continue.

The **Required Input Complete** dialog box appears.

Although you could run your simulation now, you have not yet created the Calculator block to control the drying.

7 Click **Cancel**.

Using a Calculator Block to Control Drying

The material balance equations for this process define relations between the following quantities:

- Water content of the feed coal.
- Fractional conversion of coal to water.
- Water content of the dried coal.

$$COALIN \times \frac{H2OIN}{100} = COALOUT \times \frac{H2OOUT}{100} + COALIN \times CONV \quad (1)$$

$$COALIN = COALOUT + COALIN \times CONV \quad (2)$$

Where:

COALIN	=	Mass flow rate of coal in stream WET-COAL
COALOUT	=	Mass flow rate of coal in stream IN-DRIER
H2OIN	=	Percent moisture in the coal in stream WET-COAL
H2ODRY	=	Percent moisture in the coal in stream IN-DRIER
CONV	=	Fractional conversion of coal to H_2O in the block DRY-REAC

Equation 1 is the material balance for water, and equation 2 is the overall material balance. These equations can be combined to yield equation 3:

$$CONV = \frac{(H2OIN - H2OOUT)}{(100 - H2OOUT)} \quad (3)$$

Use equation 3 in a Calculator block to ensure these three specifications are consistent.

The Calculator block specifies the moisture content of the dried coal and calculates the corresponding conversion of coal to water.

Using a Calculator block to set specifications allows you to run different cases easily.

1 From the Navigation Pane, select **Flowsheeting Options | Calculator**.

The **Calculator** object manager appears.

2 Click **New** to create a new Calculator block.

The **Create New ID** dialog box appears, displaying an automatically generated Calculator ID, C-1.

3 Delete the ID **C-1** and enter the ID **WATER** and click **OK**.

The **WATER | Define** sheet appears.

4 Ensure that the **Active** checkbox is checked.

Use this sheet to access the flowsheet variables you want to use in the Calculator block. Define the three Calculator variables from equation 3: H2OIN, H2ODRY, and CONV.

H2OIN is the water content of the feed coal. The H2OIN variable accesses the first element (percent moisture) of the component attribute PROXANAL for component COAL in the NCPSD substream of stream WET-COAL.

Creating the H2OIN Variable

1 Click **New**.

The **Create new variable** dialog box appears.

2 In the **Variable name** field, enter **H2OIN** and click **OK**.

3 Click **H2OIN** in the grid. It appears in the **Edit selected variable** section.

4 In the **Category** frame, click **Streams**.

5 In the **Reference** frame, in the **Type** field, click and select **Compattr-Var** since the variable is a component attribute.

When you are specifying variables, Aspen Plus displays the other fields necessary to complete the variable definition. In this case, the **Stream** field appears.

6 In the **Stream** field, click and select **WET-COAL**.

The **Substream** and **Component** fields appear. In this example, do not modify the default choice of **NCPSD** in the **Substream** field.

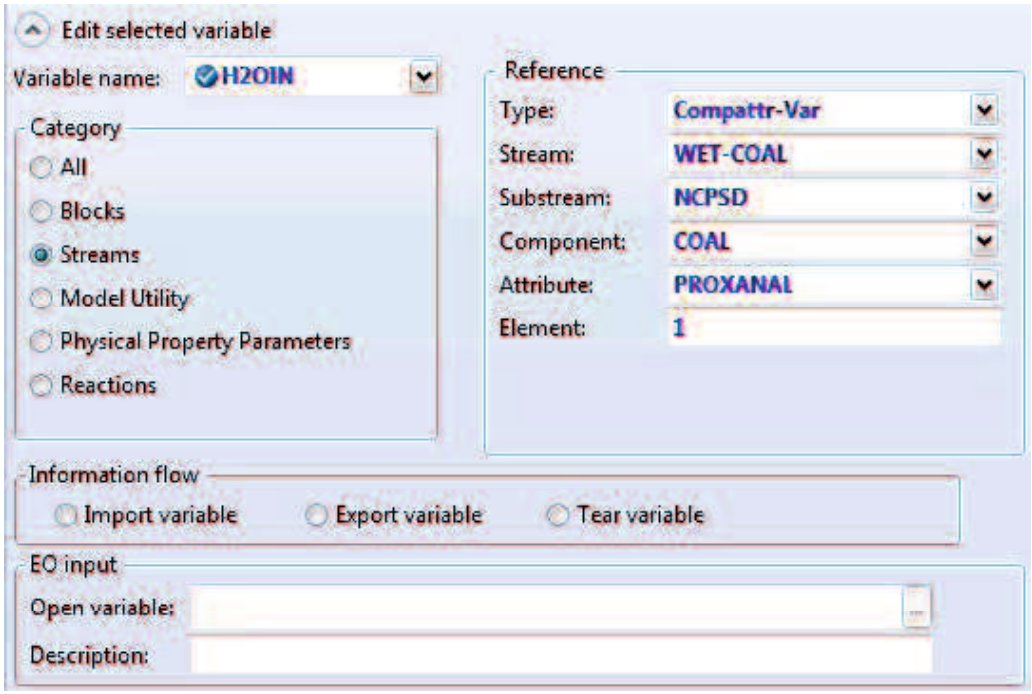
7 In the **Component** field, click and select **COAL**.

The **Attribute** field appears.

8 In the **Attribute** field, click and select **PROXANAL**.

9 In the **Element** field, enter **1**. Press **Enter**.

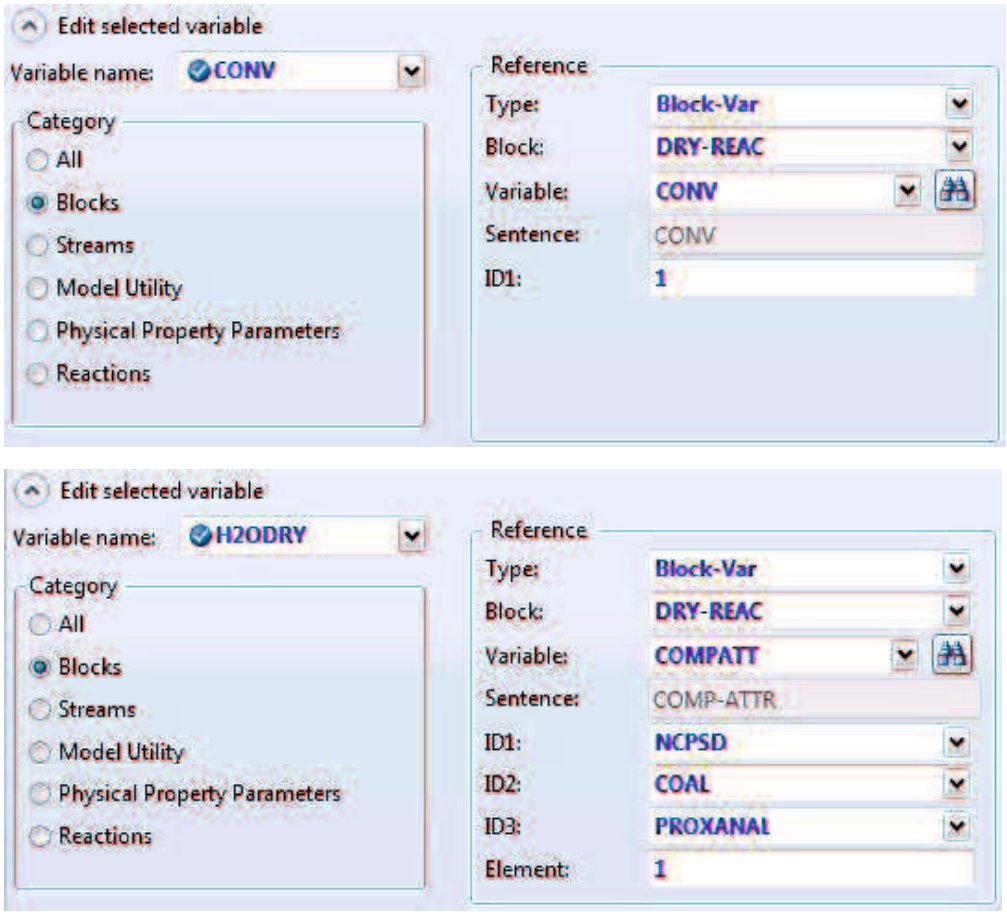
The blue check mark next to H2OIN in the **Variable name** field indicates that the definition of variable H2OIN is complete:



Creating the Other Variables

CONV and H2ODRY are block variables in the DRY-REAC block. CONV is the fractional conversion of the first (and only) reaction. H2ODRY is the moisture content of the coal leaving the RStoic block.

1 Click **New** to create another variable, **CONV**. Create the new **CONV** and **H2ODRY** variables as shown:



2 Click to continue.

Calculating the Conversion Variable

The **WATER | Calculate** sheet appears. Use this sheet to enter the Fortran statements you want Aspen Plus to execute to set H2ODRY and to calculate CONV from equation 3.

1 Enter the following Fortran statements:

```
H2ODRY = 10.0
CONV = (H2OIN - H2ODRY) / (100 - H2ODRY)
```

Note: Ensure that there are 6 spaces at the beginning of each line of the Fortran statements.

2 Click to continue.

Specifying When the Calculator Block Should Run

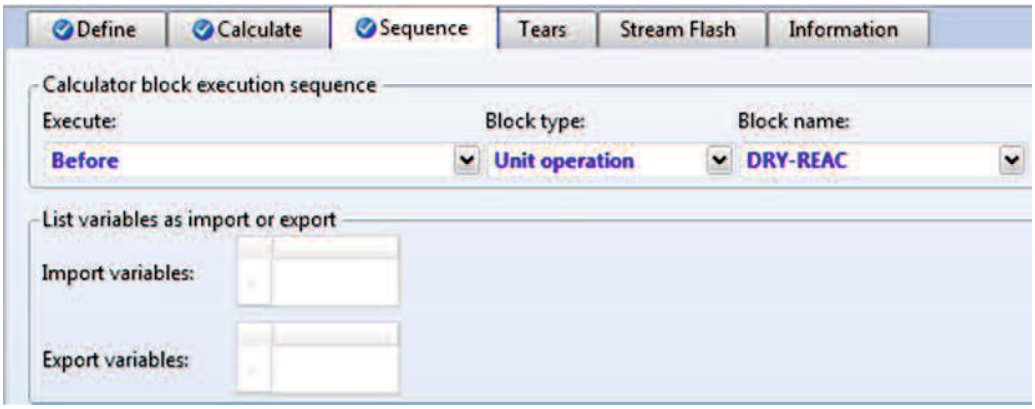
The **WATER | Sequence** sheet appears. Use this sheet to specify when Aspen Plus should execute this Calculator block. Since you have used inline

Fortran to modify the specifications for the RStoic block DRY-REAC, this Calculator block should execute immediately prior to DRY-REAC.

1 In the **Execute** field, click and select **Before**.

2 In the **Block type** field, click and select **Unit operation**.

3 In the **Block name** field, click and select **DRY-REAC**.



4 Click to continue.

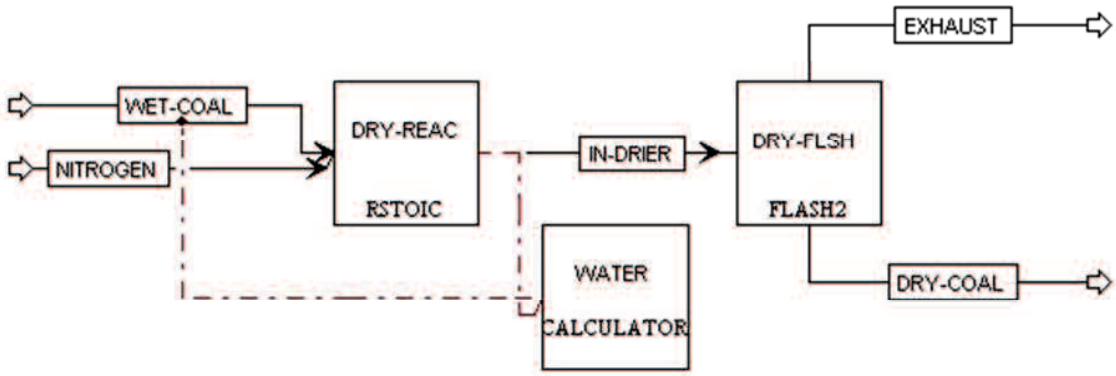
The **Required Input Complete** dialog box appears.

5 Click **Cancel**.

Viewing the Calculator Block on the Flowsheet

Go to the Flowsheet to verify that the Calculator block **WATER** has been placed. If it does not appear, on the **Flowsheet | Modify** tab of the ribbon, click **Display Options** and click the **Calculators** and **Calculator Connections** options to make sure that check marks appear in front of these items.

The Flowsheet with the Calculator block added looks like this:



The connections between the WATER block and the block DRY-REAC and stream WET-COAL appear as red dashed lines.

Running the Simulation

1 Click and click **OK** to run the simulation.

The **Control Panel** window appears, allowing you to monitor and interact with the Aspen Plus simulation calculations.

As Aspen Plus performs the analysis, status messages display in the Control Panel.

The simulation completes without warnings or errors.

When the calculations finish, the message *Results Available* appears in the status area at the bottom left of the main window.

2 Examine the results of your simulation.

Examining Simulation Results

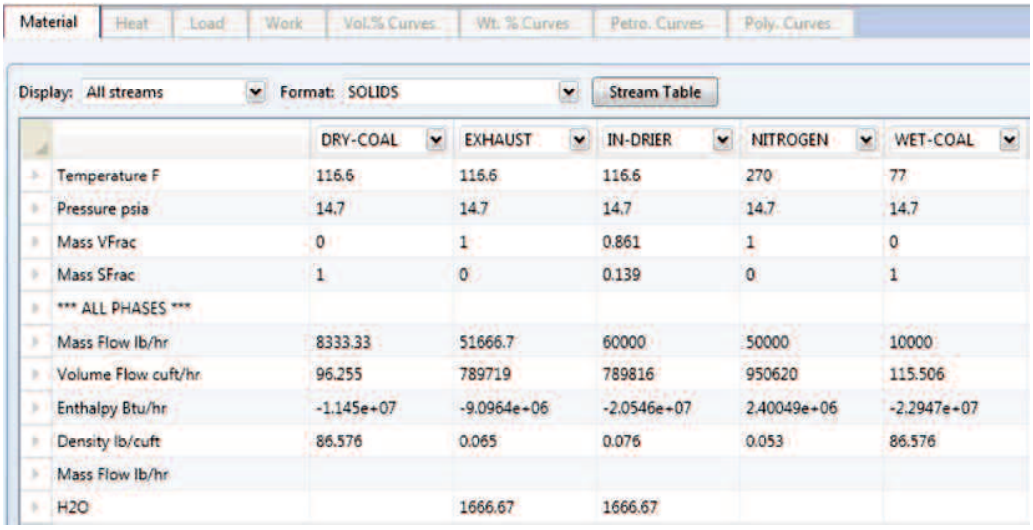
To View the Stream Results

1 In the Control Panel, click **Check Status**.

The **Results Summary - Run Status | Status** sheet appears, indicating that the simulation completed normally.

2 On the **Home** tab of the ribbon, in **Summary**, click **Stream Summary**.

The **Results Summary - Streams | Material** sheet appears.



	DRY-COAL	EXHAUST	IN-DRIER	NITROGEN	WET-COAL
Temperature F	116.6	116.6	116.6	270	77
Pressure psia	14.7	14.7	14.7	14.7	14.7
Mass VFrac	0	1	0.861	1	0
Mass SFrac	1	0	0.139	0	1
*** ALL PHASES ***					
Mass Flow lb/hr	8333.33	51666.7	60000	50000	10000
Volume Flow cuft/hr	96.255	789719	789816	950620	115.506
Enthalpy Btu/hr	-1.145e+07	-9.0964e+06	-2.0546e+07	2.40049e+06	-2.2947e+07
Density lb/cuft	86.576	0.065	0.076	0.053	86.576
Mass Flow lb/hr					
H2O		1666.67	1666.67		

3 Review the results on this sheet. Since this is a scrolling sheet, use the scrollbars to review results that are off the screen.

Aspen Plus populates the **Results Summary - Streams | Material** sheet using the **SOLIDS** format. The SOLIDS format reports results in three sections.

The top section reports the thermodynamic variables temperature pressure, vapor fraction, and solid fraction for the stream.

The second section, beginning with ***ALL PHASES***, reports properties and component mass flow rates summed over all substreams. Examination of the component mass flow rates indicates that 1667 lb/hr of H2O are removed from the coal by the drying process.

The third section, beginning with *** SUBSTREAM NCPSD ***, displays information that is appropriate only for the NCPSD substream. In this case, it displays the component attributes for coal, and the overall particle size distribution for the NCPSD substream. Note that the moisture in the PROXANAL is different for stream DRY-COAL and stream WET-COAL.

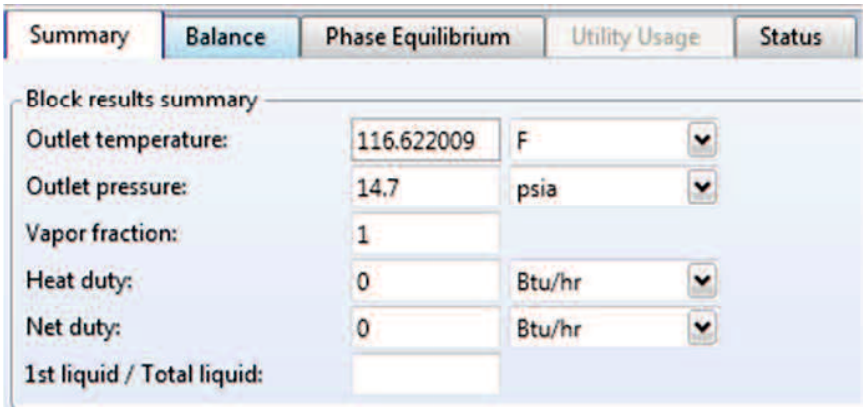
Stream summary results can also be displayed one substream at a time, by using the FULL format.

4 In the **Format** field, click  and select **FULL**.

5 Examine the results reported for the MIXED and NCPSD substreams. When you are done, return to the SOLIDS Format.

6 From the Navigation Pane, expand the **Blocks** folder and select the **DRY-FLSH** folder. Click **Results**.

The **DRY-FLSH (Flash2) - Results | Summary** sheet appears. This sheet reports mixture thermodynamic properties for the block, such as outlet temperature.



To View the Block Results

7 Click the **Balance** tab.

The **DRY-FLSH (Flash2) - Results | Balance** sheet appears. This sheet is used to report the overall mass and energy balance for the block.

8 Click the **Phase Equilibrium** tab.

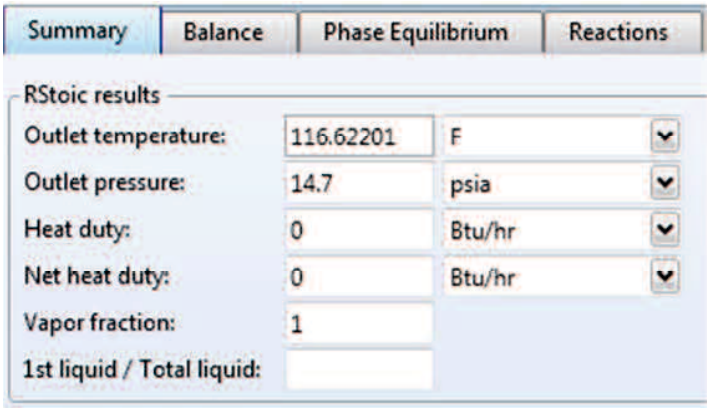
The **DRY-FLSH (Flash2) - Results | Phase Equilibrium** sheet appears. On this sheet, Aspen Plus reports the total molar flow rate, liquid mole fractions, vapor mole fractions and K-values. In this block, there is no liquid phase, so the liquid mole fractions and K-values refer to a hypothetical liquid phase.

9 Click **Blocks | DRY-FLSH | Stream Results** from the Navigation Pane.

The **DRY-FLSH (Flash2) - Stream Results | Material** sheet appears. This is similar to the **Results Summary - Streams | Material** sheet, but only lists streams entering or leaving this block.

10 Click **Blocks | DRY-REAC | Results** to move to the **DRY-REAC (RStoic) - Results | Summary** sheet.

This sheet, like the **DRY-FLSH (Flash2) - Results | Summary** sheet, displays the mixture thermodynamic results for the block, such as temperature.



11 Click the **Balance** tab to move to the next sheet with results.

The **DRY-REAC (RStoic) - Results | Balance** sheet appears. This sheet displays the mass and energy balance for the block. Because this block contains a reaction between the NCPSD substream and the MIXED substream, neither the conventional components nor the nonconventional are in mass balance. The total mass balance for the stream shows a very small relative difference.

12 Click the **Phase Equilibrium** tab to move to the next sheet with results.

The **DRY-REAC (RStoic) - Results | Phase Equilibrium** sheet appears. This sheet serves the same function as the **DRY-FLSH (Flash2) - Results | Phase Equilibrium** sheet.

Exiting Aspen Plus

When you are finished working with this model, save your simulation and exit Aspen Plus as follows:

1 From the ribbon, select **File | Save as | Aspen Plus Document**.

The **Save as** dialog box appears.

2 In the **File name** field, enter **Solid1**.

3 Click **Save**.

Aspen Plus saves the simulation as the Aspen Plus Document file, Solid1.apw, in your default working directory (displayed in the **Save in** field).

4 From the ribbon, select **File | Exit**.

Note: The chapter 2 simulation uses this run as the starting point.