This short guide will show you how easy and quick VisualAdrian is to use. A relief valve has been sized to relieve toluene (in the worst case) from a vessel and we are going to check that the pressure drops upstream & downstream of the relief valve are acceptable according to the guidelines recommended by ABB Consulting i.e. that the upstream pressure drop is <3% of the Set Pressure and the downstream pressure is <10% of the Set Pressure.

- Inlet contraction is abrupt.
- Vessel contains Toluene.
- Pipes upstream of Relief Valve = 2½” Schedule 40
- Pipes downstream of Relief Valve = 3½” Schedule 40
- All pipes are mild steel with moderate rust
- Bursting disc has no vacuum support.
- Bend is 90° with r/d=1.

Okay let's get going.

Starting Visual Adrian

1. Click Start > All Programs > PEL > VisualAdrian. Click Enable Macros and the VisualAdrian splash screen appears briefly on the screen.
   
   The first thing we need to do is add the Vessel.

2. Drag the Vessel shape onto the bottom of the drawing.
   
   Now we need to add the fittings as shown in the diagram opposite.

3. Drag the Bursting Disc onto the drawing vertically above the Vessel. The two are automatically connected by a Straight fitting.

4. Repeat to add a Relief Valve, add a Bend across to the right, and then finally add an Exit above the bend at the top of the drawing.
   
   You can use the Visio Align Shapes commands to arrange the shapes on the drawing.

   After a little practice, your drawing should look something like the one opposite so now is a good time to save it.

5. Click the Save button on the Visio toolbar and save the data in VisualAdrian.vsd in your My Documents folder.

Next we need to add the process data. Let's start with the Vessel.

6. Double-click the Vessel to open the Vessel Editor.

7. Select Abrupt for the contraction type, define the Inlet Flow as 2.2 kg/s and define the inlet pressure as 11 barg (i.e. the Set Pressure + 10% overpressure). The pressure is converted into 12.013 bar.
   
   We can use the Physical Property Calculator to calculate the physical properties we need for Toluene.

8. Enter a Stagnation Temperature of 229°C and then click the button on the right to open the Physical Properties Calculator.

9. When the calculator appears, if any components appear in the worksheet click Clear Worksheet to clear them. Next, click Add Component.
10. When the Select Components from Databank dialog appears, type TOL in the Search for Name box, select TOLUENE in the list, then click Add to Stream, and then Close to return to the Physical Properties Calculator.

   Note that the temperature & pressure have been transferred to the calculator so now we are ready to calculate.

11. Click Calculate and the physical properties are displayed in the grid. The values you should get are:

   Molecular Weight=92.14; Compressibility Factor=0.78; Isentropic Exponent=1.149; Viscosity=0.0128; Specific Heat=2087 J/kg.K

12. Click the calculated values to see the Quality Assurance associated with them. When you are satisfied with them, click OK to return to the Vessel Editor and then click OK to close the Vessel Editor.

   We are now ready to enter the process data for the pipe fittings.

13. Select any of the three fittings (the shapes on red circles), right-click and click Edit Fittings to open the Edit Fittings dialog.

   We can enter the process data for all the fittings using this editor

   • Select all the cells in the Roughness column, then right-click and click Roughness Calculator. Select Mild Steel (moderate rust layer) from the list and click OK. VisualAdrian will paste the value back into the Roughness box for all the fittings.

   • Click the Diameter In field for the first straight then right-click and select Pipe Inner Diameter Calculator. Select 2½" and 40/STD/40S and then click OK. VisualAdrian will paste the value back into the Diameter In field and propagate it down the pipe until it reaches the relief valve.

   • Click the Diameter Out field for the Relief Valve, right-click and click Pipe Inner Diameter Calculator. Select 3½" and 40/STD/40S and then click OK. VisualAdrian will paste the value back into the outlet diameter field and propagate it down the pipe to the last straight.

   • Set the lengths of the Straights to be 0.4m, 0.1m, 2m and 2m.

   • For the Relief Valve, set the Minimum Flow Area = 562mm² and the Discharge Coefficient = 0.975.

   • Finally for the Bend, click the Value field then right-click and click K-Value Calculator. When the K-Value Calculator opens, select the Bends tab, set r/d = 1, the Quantity=1, click Add and then OK.

   • Click OK to close the Edit Fittings dialog.

   The final input is to specify the back pressure at the Exit.

14. Double-click the Exit node and set the Outlet Back Pressure to 1 atm and click OK.

   That’s it for the input. Now we’re ready to calculate the results.

15. Click the Calculate button on the VisualAdrian toolbar. When the calculations are complete, the results appear in the Results of Calculation dialog. Click View Pipe Details on the toolbar to see the detailed pressure drops through the fittings. On the Detailed Results dialog, click the Pressure on the toolbar to see graphically how the pressure falls through the pipe.

16. Click ΔP Relief Valve, enter a Set Pressure of 10 barg and an Overpressure of 10% and click Calculate to see the upstream and downstream pressure drops as a percentage of set pressure. These should be 1.64% and 3.47% respectively, which are within the ABB Consulting guidelines.