## Calculation of Pseudo-critical Gas Properties Using Sutton's Correlation

Sutton developed a correlation for estimating for estimating $P_{pc}$ and $T_{pc}$ as functions of gas gravity, $\gamma_g$ thus:

$$P_{pch} = 756.8 - 131.0\gamma_h - 3.6\gamma_h^2 \text{ -------2.13}$$

$$T_{pch} = 169.2 + 349.5\gamma_h - 74.0\gamma_h^2 \text{ -------2.14}$$

Where $P_{pch}$ and $T_{pch}$ are the pseudo-critical pressure and pseudo-critical temperature of the hydrocarbon components alone, respectively, and $\gamma_h$ is the specific gravity of the hydrocarbon alone.

**Sutton's Procedure** is as follows:

1. **Determine $\gamma_h$**
   A. If the gas mixture contains <12 mol% of $CO_2$, < 3% of Nitrogen and no $H_2S$, then the parameter $\gamma_h$ is the given gas gravity; no need for any correction.
   B. However, If gas mixture contains >12 mol% of $CO_2$, OR >3% of Nitrogen OR any $H_2S$, then the given gas gravity need to be corrected to obtain parameter $\gamma_h$ determined thus:

$$\gamma_h = \frac{\gamma_w - 1.1767y_{H_2S} - 1.5196y_{CO_2} - 0.9672y_{N_2} - 0.622y_{H_2O}}{1 - y_{H_2S} - y_{CO_2} - y_{N_2} - y_{H_2O}} \text{ ------2.15}$$

2. Determine the pseudo-critical pressure and temperature for the hydrocarbon mixture using equations 2.13 and 2.14.
3. Determine the pseudo-pressure and pseudo-temperature for the entire mixture (hydrocarbon + non-hydrocarbon) using the following equations:

$$P_{pc} = (1 - y_{H_2s} - y_{CO_2} - y_{N_2} - y_{H_2o})P_{pch} + 1306y_{H_2s} + 1071y_{CO_2} + 493.1y_{N_2} + 3200.1y_{H_2o} \text{ ----2.16}$$

$$T_{pc} = (1 - y_{H_2s} - y_{CO_2} - y_{N_2} - y_{H_2o})T_{pch} + 672.35y_{H_2s} + 547.58y_{CO_2} + 227.16y_{N_2} + 1164.9y_{H_2o} \text{ ----2.17}$$