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Date: 5/17/05 12:12PM
Subject: MathCad Excerpt

Maitri,

Here is an excerpt from the MathCad worksheet. Gary indicated that the numbers he calculated were approximately 115,000 pounds and 109,660 pounds for the 1.5% and biased cases, respectively.

<<MathCad Excerpt.pdf>>

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Excerpt from the Mathcad worksheet that sums the 0.5% bias M/C and compares with the "as found" case

Notes:

M_{mc} = 0.5% bias M/C case flow integration

M_{mca} = "as found case" flow integration

M_1 = all valves drifted 1% high flow integration

$M_{1.5}$ = all valves drifted 1.5% high flow integration

Integrating the flow pressure curves

integrating the flow vs pressure functions and converting to lb/sec yields

$$M_1 := \frac{\int_{1150}^{1350} Q_{1tot}(p) dp}{3600} \quad M_1 = 1.252 \times 10^5$$

$$M_{mc} := \frac{\int_{1150}^{1350} Q_{mctot}(p) dp}{3600} \quad M_{mc} = 1.097 \times 10^5$$

$$M_{mca} := \frac{\int_{1150}^{1350} Q_{mctota}(p) dp}{3600} \quad M_{mca} = 1.114 \times 10^5$$

$$\frac{M_{mca}}{M_{mc}} = 1.016$$

the ratios between the base 1% case and the others is generated

$$\frac{M_{mc}}{M_1} = 0.876 \quad \text{Monte Carlo}$$

1.5% drift case

the identical approach is applied for the 1.5% drift case

$$\begin{array}{ll} \text{SP1} := 1135.1015 + 15 & \text{SP1} = 1.167 \times 10^3 \\ \text{SP2} := 1240.1015 + 15 & \text{SP2} = 1.274 \times 10^3 \\ \text{SP3} := 1250.1015 + 15 & \text{SP3} = 1.284 \times 10^3 \\ \text{SP4} := 1260.1015 + 15 & \text{SP4} = 1.294 \times 10^3 \end{array}$$

$$Q115(p) := \begin{cases} 0 & \text{if } p < \text{SP1} \\ \min \left[Q_{\text{TR}}(p), \frac{Q_{\text{TR}}(p)}{2} + \frac{Q_{\text{TR}}(p)}{2} \cdot \left(\frac{p - \text{SP1}}{.03 \cdot \text{SP1}} \right) \right] & \text{otherwise} \end{cases}$$

$$Q215(p) := \begin{cases} 0 & \text{if } p < \text{SP2} \\ \min \left[Q_{\text{mssv}}(p), \frac{Q_{\text{mssv}}(p)}{2} + \frac{Q_{\text{mssv}}(p)}{2} \cdot \left(\frac{p - \text{SP2}}{.03 \cdot \text{SP2}} \right) \right] & \text{otherwise} \end{cases}$$

$$Q315(p) := \begin{cases} 0 & \text{if } p < \text{SP3} \\ \min \left[Q_{\text{mssv}}(p), \frac{Q_{\text{mssv}}(p)}{2} + \frac{Q_{\text{mssv}}(p)}{2} \cdot \left(\frac{p - \text{SP3}}{.03 \cdot \text{SP3}} \right) \right] & \text{otherwise} \end{cases}$$

$$Q415(p) := \begin{cases} 0 & \text{if } p < \text{SP4} \\ \min \left[Q_{\text{mssv}}(p), \frac{Q_{\text{mssv}}(p)}{2} + \frac{Q_{\text{mssv}}(p)}{2} \cdot \left(\frac{p - \text{SP4}}{.03 \cdot \text{SP4}} \right) \right] & \text{otherwise} \end{cases}$$

$$Q15\text{tot}(p) := Q115(p) + 2 \cdot Q215(p) + 2 \cdot Q315(p) + 4 \cdot Q415(p)$$

$$M_{15} := \frac{\int_{1150}^{1350} Q15\text{tot}(p) \, dp}{3600} \quad M_{15} = 1.149 \times 10^5$$

$$\frac{M_{15}}{M_1} = 0.917 \quad M_{\text{mc}} = 1.097 \times 10^5$$

$$\frac{M_{\text{mc}}}{M_{15}} = 0.955 \quad \text{shows that Monte Carlo result and 1.5\% are fairly equivalent}$$