Standard Problem Exercise No. 3

Transition to Probabilistic Space

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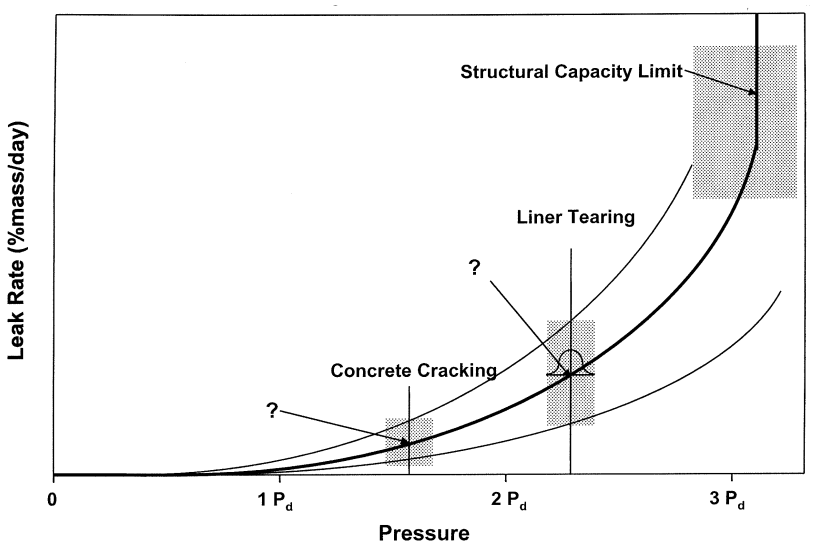
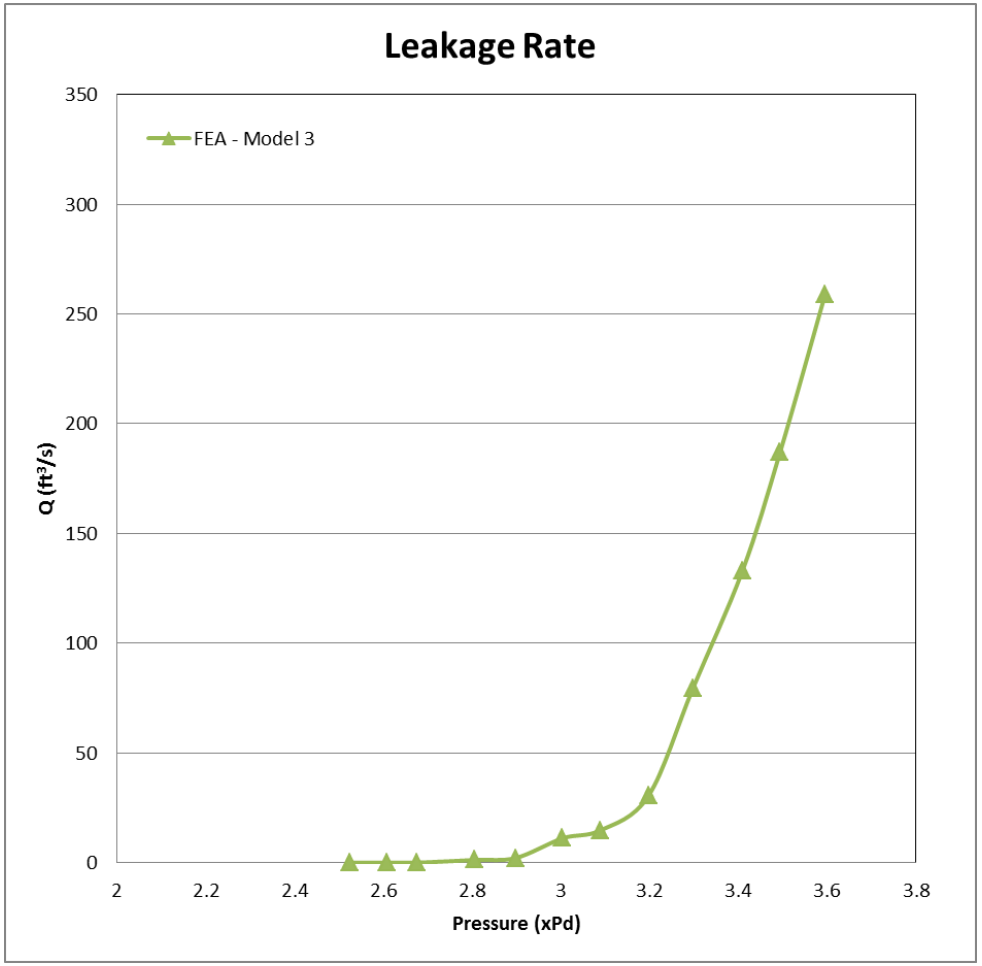
Pressure Versus Leak Rate





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Approaches to Assessing Uncertainty

- Start with global strain from FEA model
- Use Monte Carlo simulation to vary K in:
  - $\varepsilon_p = K B \varepsilon_{global}$
- Vary K using two different approaches
  - Multiply by a random number between 0.8 and 1.2
  - Multiply by a random number with normal distribution between 0.8 and 1.2
- Complete 2148 trials for each method
- Use this peak strain to calculate tearing and then leakage using the Rizkalla equation

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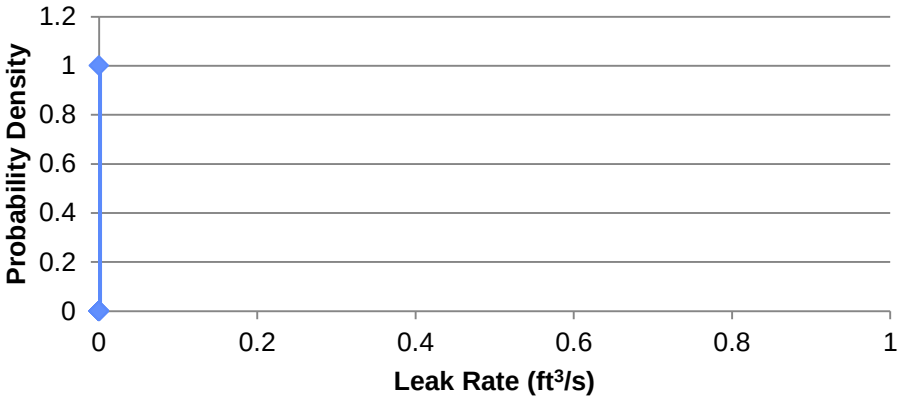
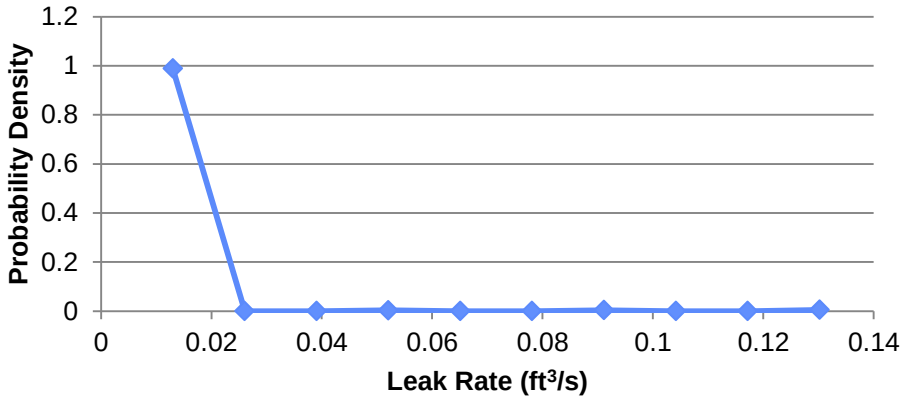
Comparison of Probability Densities at 2.5xP_d

Probability of Leak Rate at 2.5xP_d



Random Number

Probability of Leak Rate at 2.5xP_d



Normal Distribution

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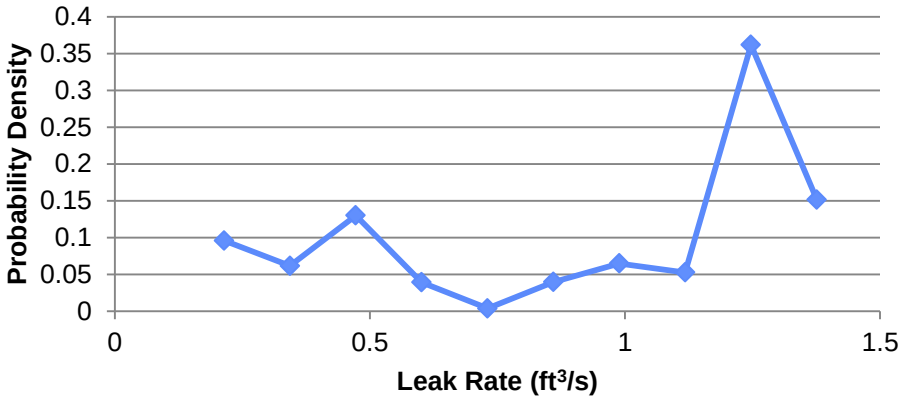
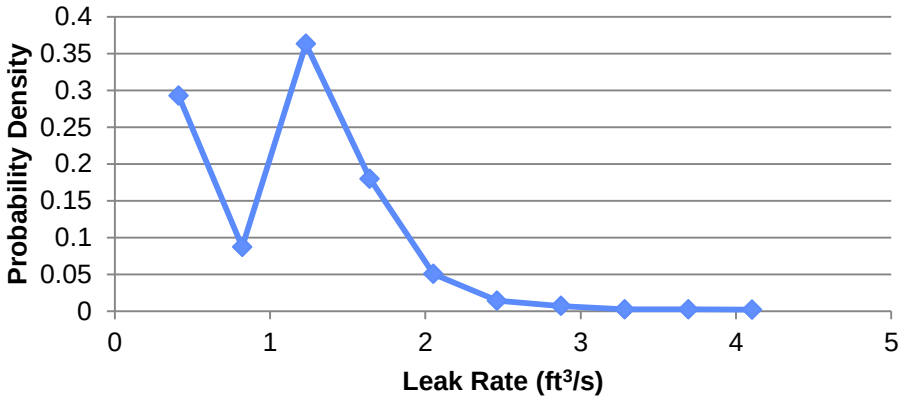
Comparison of Probability Densities at 3.0xP_d

Probability of Leak Rate at 3.0xP_d



Random Number

Probability of Leak Rate at 3.0xP_d



Normal Distribution

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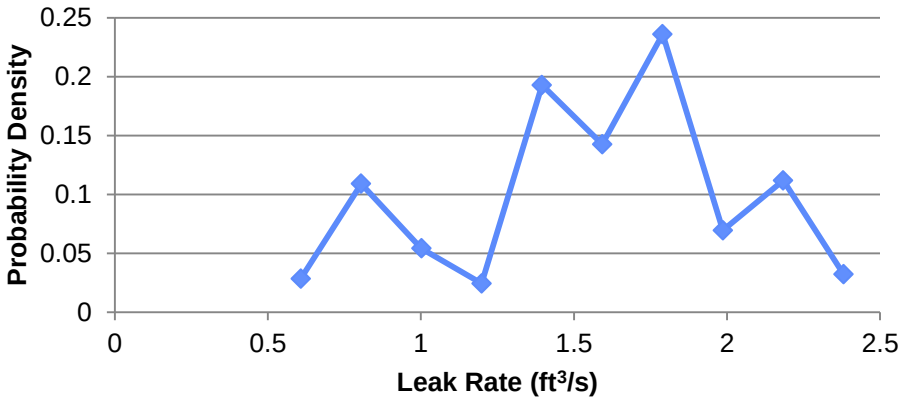
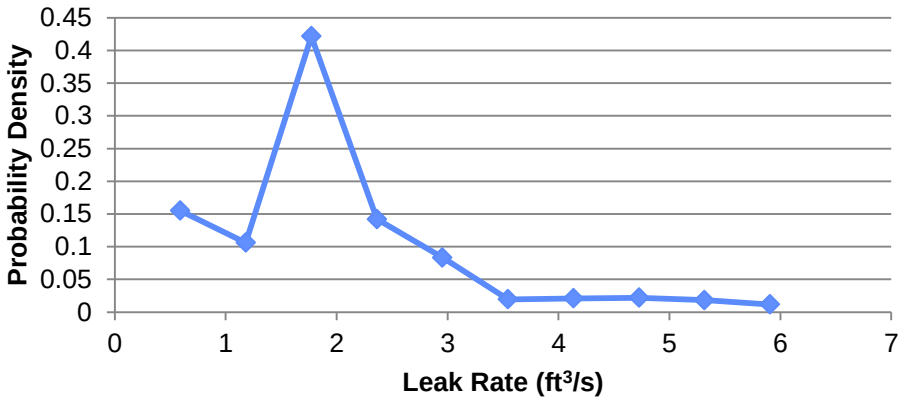
Comparison of Probability Densities at 3.1xP_d

Probability of Leak Rate at 3.1xP_d



Random Number

Probability of Leak Rate at 3.1xP_d



Normal Distribution

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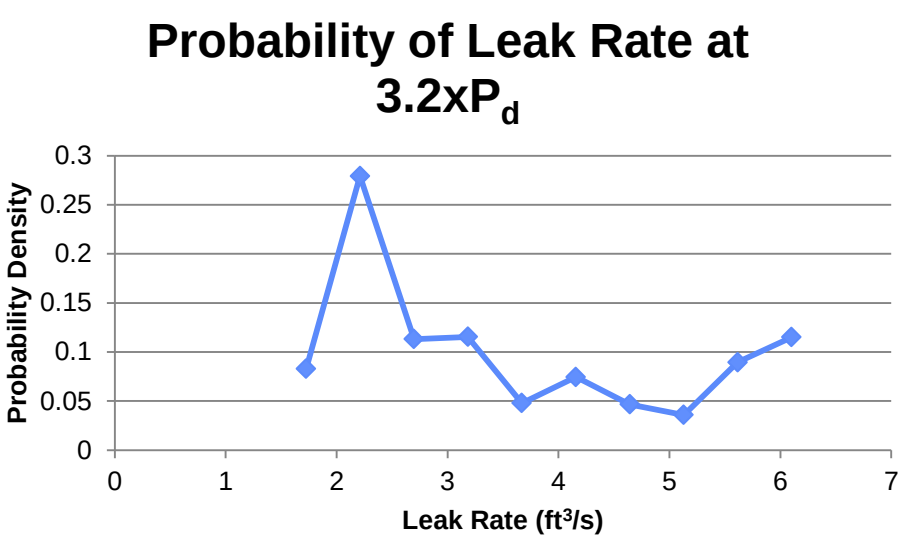
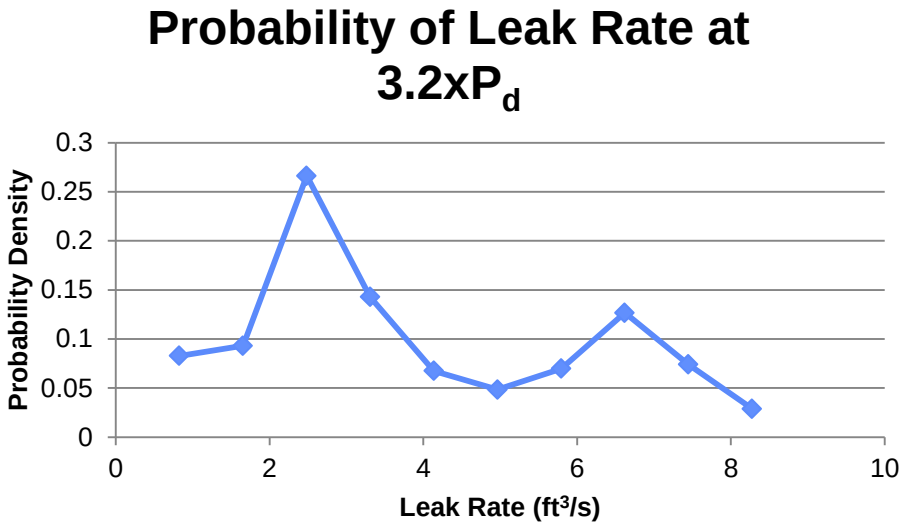
Comparison of Probability Densities at $3.2xP_d$





Random Number

Normal Distribution

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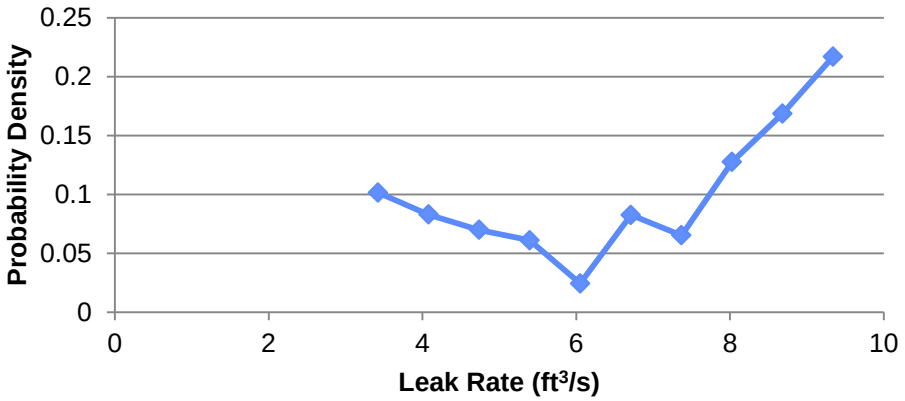
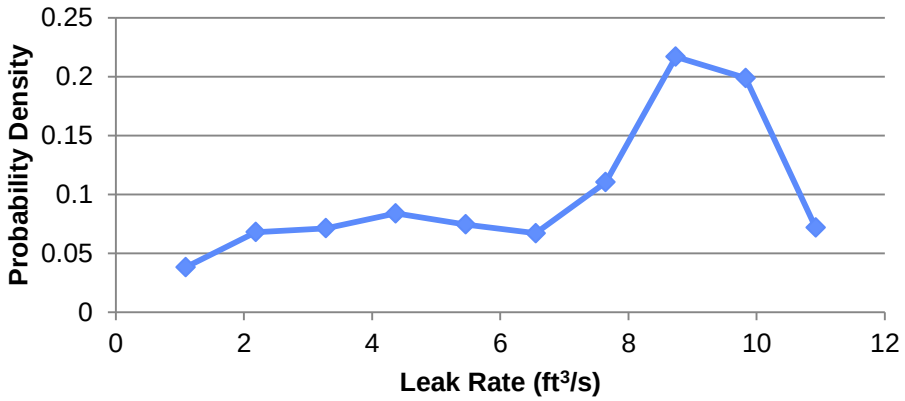
Comparison of Probability Densities at 3.3xP_d

Probability of Leak Rate at 3.3xP_d



Random Number

Probability of Leak Rate at 3.3xP_d



Normal Distribution

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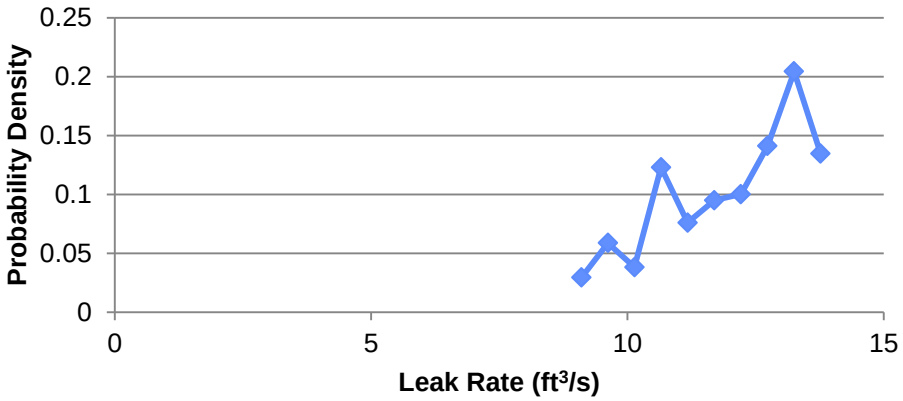
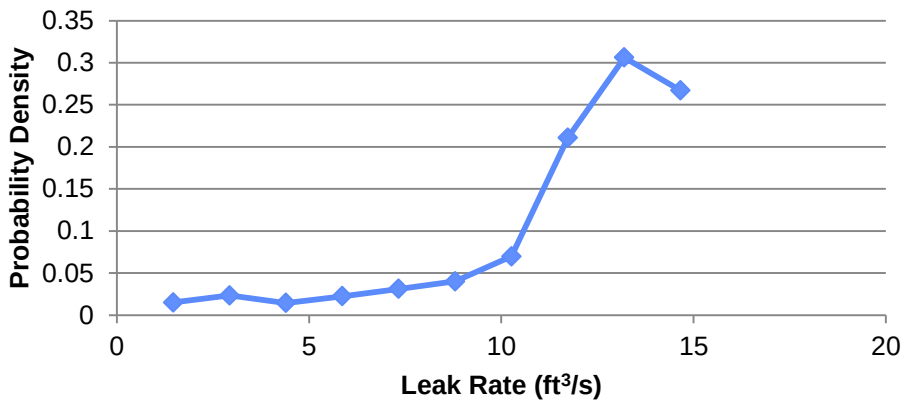
Comparison of Probability Densities at $3.4xP_d$





Random Number

Normal Distribution

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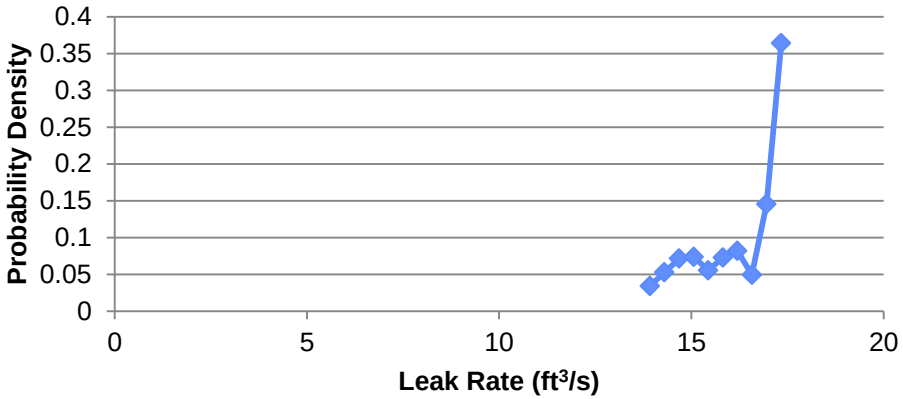
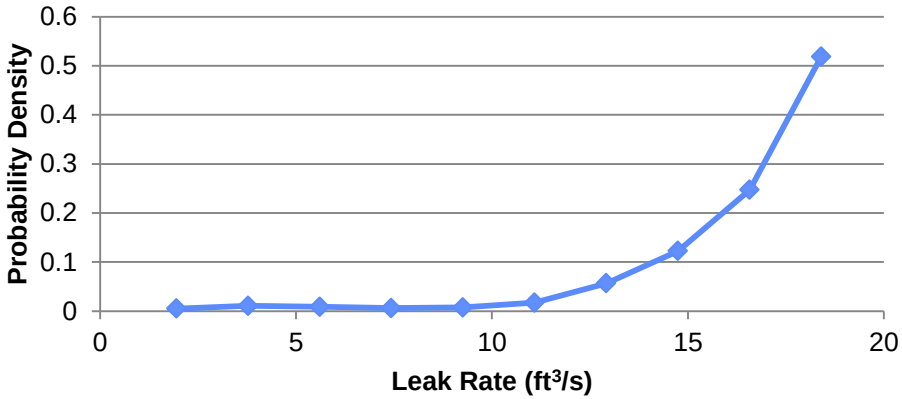
Comparison of Probability Densities at 3.5xP_d

Probability of Leak Rate at 3.5xP_d



Random Number

Probability of Leak Rate at 3.5xP_d



Normal Distribution

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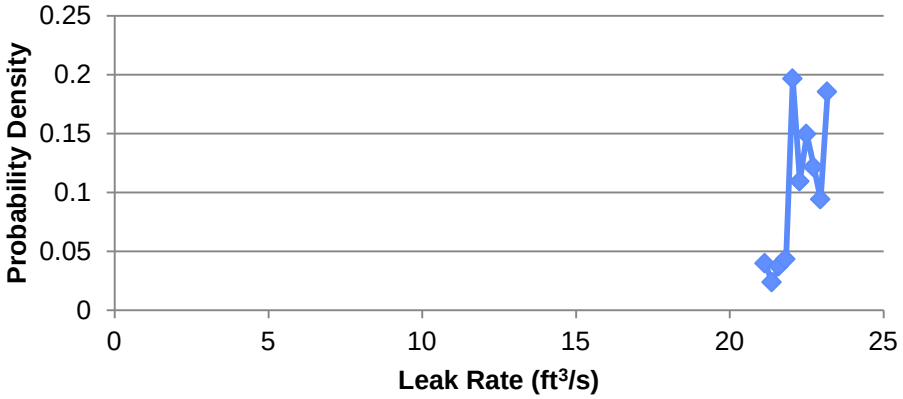
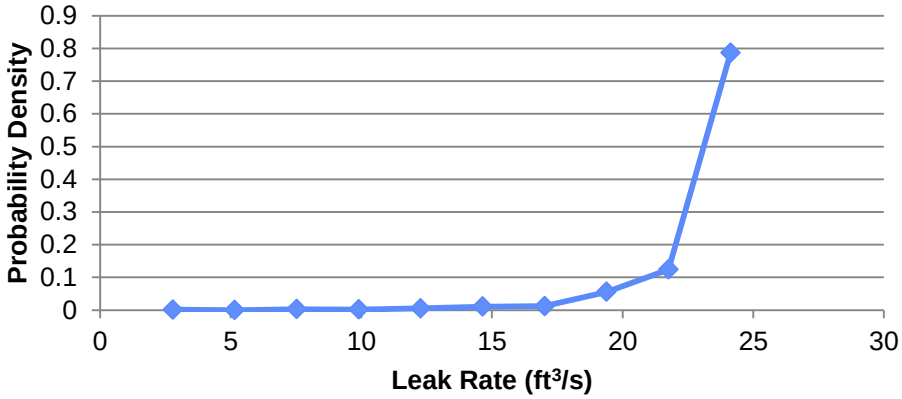
Comparison of Probability Densities at $3.6xP_d$

Probability of Leak Rate at $3.6xP_d$



Random Number

Probability of Leak Rate at $3.6xP_d$



Normal Distribution

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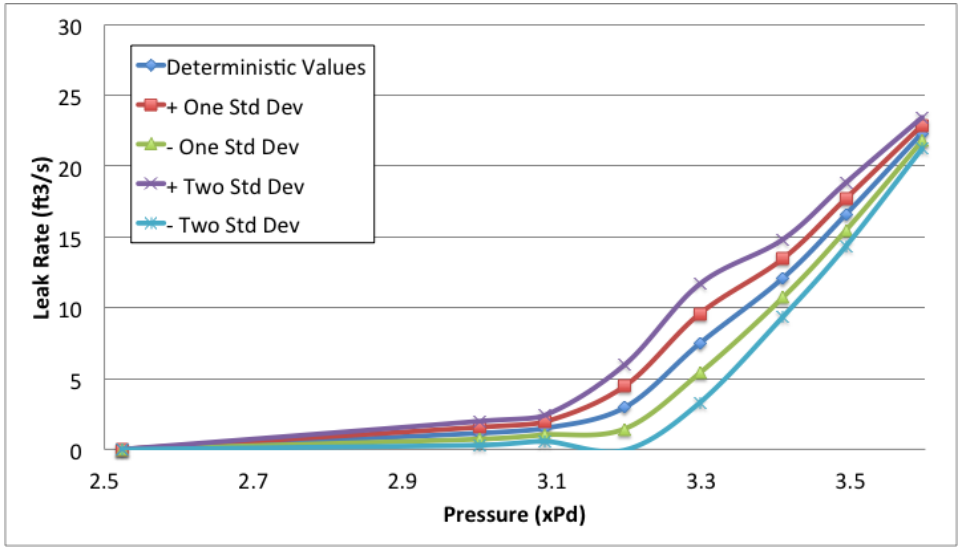
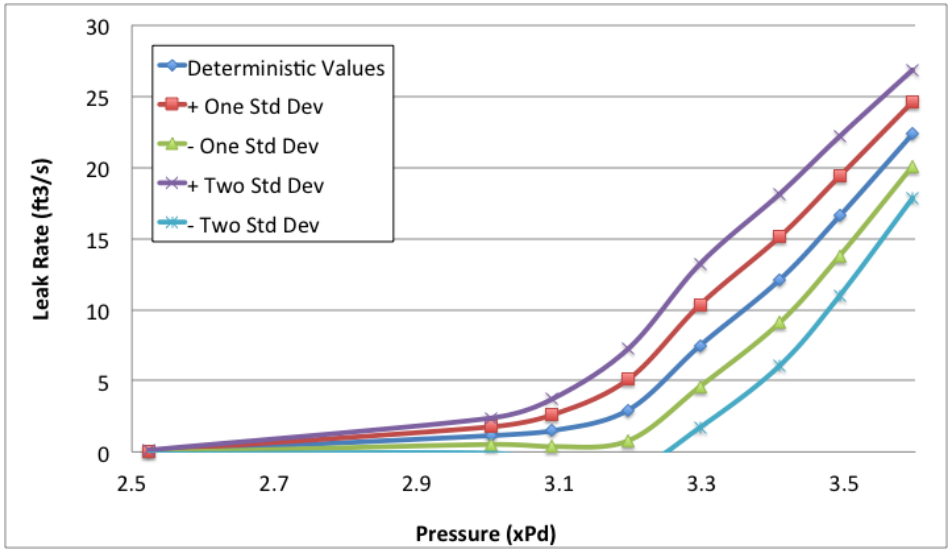
Leak Rate Versus Pressure





Random Number

Normal Distribution

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Future Variations

- In Rizkalla equation, vary:
  - L (wall thickness)
  - w (crack width)
  - B (crack height)
  - T (temperature for Case 1 and Case 2)
- Apply Method Discussed Previously to Case 1 and 2 Data