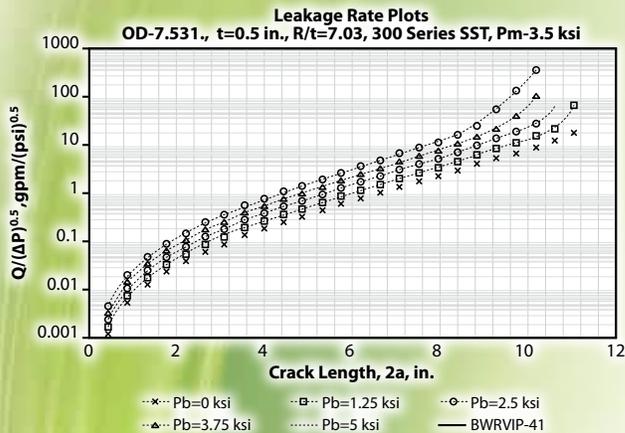




## BWR Core Spray Line and Jet Pump Assembly Leakage Rate Calculations



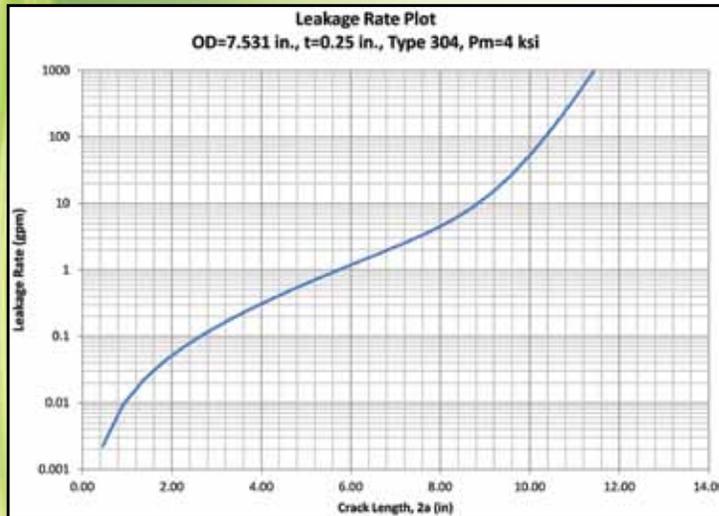
### SITUATION

With revised guidance incorporated into the BWRVIP Jet Pump and Core Spray Line I&E Guidelines (BWRVIP-18, Rev. 1, BWRVIP-41, Rev. 3) requiring consideration of leakage from un-inspectable welds, many utilities are faced with having to consider additional sources of leakage in these systems. Accurate and flexible BWR Core spray line and jet pump assembly leakage rate calculations are needed to help preserve margin in existing LOCA analyses.

### SOLUTION

Structural Integrity's experience with Leakage Rate Calculations based on Elastic-Plastic Fracture Mechanics can help.

2a (in)	Leakage Rate (gpm)
0.46	2.252E-03
0.91	9.357E-03
1.37	2.216E-02
1.83	4.194E-02
2.29	7.054E-02
2.74	1.105E-01
3.20	1.649E-01
3.66	2.382E-01
4.12	3.358E-01
4.57	4.645E-01
5.03	6.334E-01
5.49	8.543E-01
5.95	1.143E+00
6.40	1.524E+00
6.86	2.034E+00
7.32	2.741E+00
7.78	3.783E+00
8.23	5.449E+00
8.69	8.404E+00
9.15	1.432E+01
9.61	2.736E+01
10.06	5.886E+01
10.52	1.399E+02
10.98	3.595E+02
11.44	9.883E+02



OD	7.531	in	Pipe Outside Diameter
t	0.25	in	Pipe Thickness
ΔP	1	psi	Pressure Differential Across Leak
σ <sub>m</sub>	4	ksi	Membrane Stress at Flaw Location
σ <sub>b</sub>	3	ksi	Bending Stress at Flaw Location
Mat	Type 304		Pipe Material

### FEATURES AND BENEFITS

- Uses elastic-plastic fracture mechanics to provide valid crack opening displacements over a wide range of crack sizes and applied loading.
- Leakage rate curves provided for a range of  $P_m$  and  $P_b$  which bound plant specific loads such that if loads increase in the future because of implementation of flexibility options such as MEOD, ICF, FFWR, MELLA, etc., the utility does not need to revise the leakage rate calculation. This saves the utility money.
- Linear leakage solution can be scaled by fluid density and pressure to accommodate leakage rate solution at different fluid temperatures and pressure differences. This avoids utility expense from having to pay a vendor for additional calculations if fluid temperature (density) or driving head changes.
- Benchmarked against PICEP.

### DEPLOYMENT

Structural Integrity's BWR core spray line and jet pump assembly leakage rate calculation tool has currently been selected in support of 16 domestic operating BWRs. Our calculation tool is easy to implement and includes:

- A verified calculation package which can be controlled by utility document control system.
- A Microsoft Excel<sup>®</sup>-based engineering calculation application which can be used to perform detailed calculations. Excel was selected since most plant personnel have access to MS Office, as opposed to other applications such as PICEP.

For more information, please contact:

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