



**RIC 2013**  
**Recent Operating Reactors Materials Issues**  
**Quad Cities Unit 2 Instrument Nozzle Leakage**

Jeffrey Poehler, Daniel Widrevitz, Simon Sheng  
Office of Nuclear Reactor Regulation  
Division of Engineering

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**Purpose**

Provide NRC staff perspective on leakage of an instrument nozzle in a boiling water reactor pressure vessel, a first-of-a kind event.

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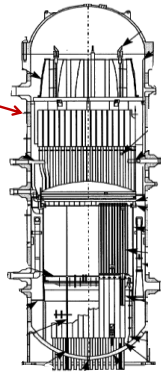
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**Boiling Water  
Reactor Pressure  
Vessel**

Leaking Instrument  
Nozzle Location



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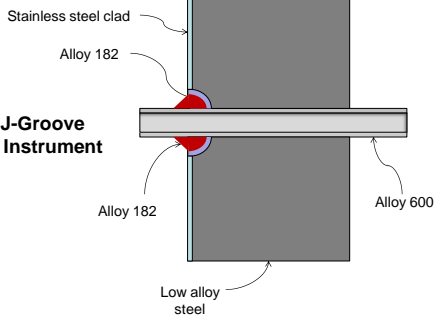
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**Typical J-Groove  
Welded Instrument  
Nozzle**



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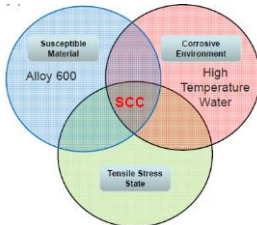
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**Stress Corrosion Cracking**

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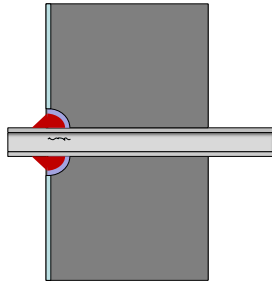
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### Location of Cracks (Typical)

Residual stresses from welding can lead to Primary Water Stress Corrosion Cracking (PWSCC)



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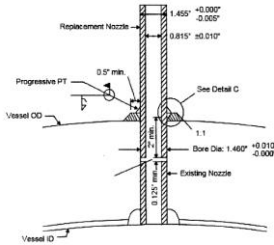
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Proposed Repair – "Half Nozzle" Design

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### Significance

- Stress corrosion cracking of this type of nozzle not previously observed in boiling water reactors
- Licensee evaluations demonstrated no safety issue from not removing flaw
- Root cause not proven because NRC staff granted relief from inspection to locate or size the flaw
- NRC staff and licensees should be sensitive to the need to prevent instrument nozzle leaks in boiling water reactors as plants age

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### Conclusions

- NRC Staff will continue to monitor operating experience related to leakage of J-groove welded nozzles in BWRs
- NRC does not find management of aging via leak detection acceptable
- BWR licensees should consider enhanced inspections or proactive mitigation/repair of instrument nozzles

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