



# **Boiling Water Reactor Vessel & Internals Project (BWRVIP)**

## **BWR Operating Experience**

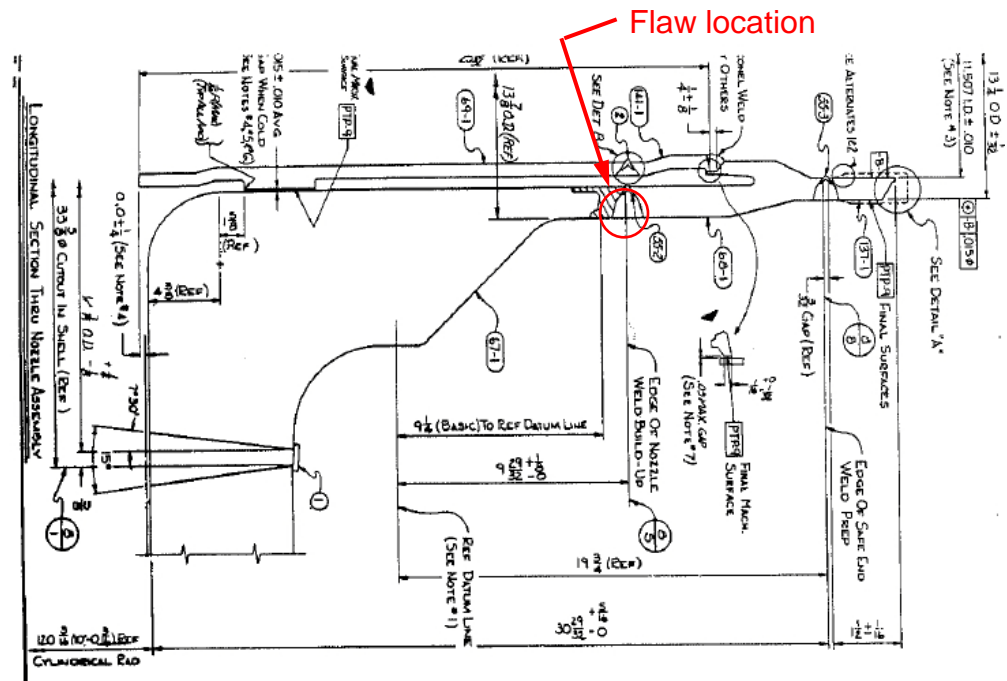
**Charles Wirtz, FirstEnergy**  
BWRVIP Integration Committee Chairman  
**Industry/NRC Executive Meeting on Materials Program**  
July 31, 2012

# Presentation Outline

- Grand Gulf Low Pressure Core Injection Nozzle to Safe-End Flaw
- Quad Cities Instrumentation Nozzle Leak

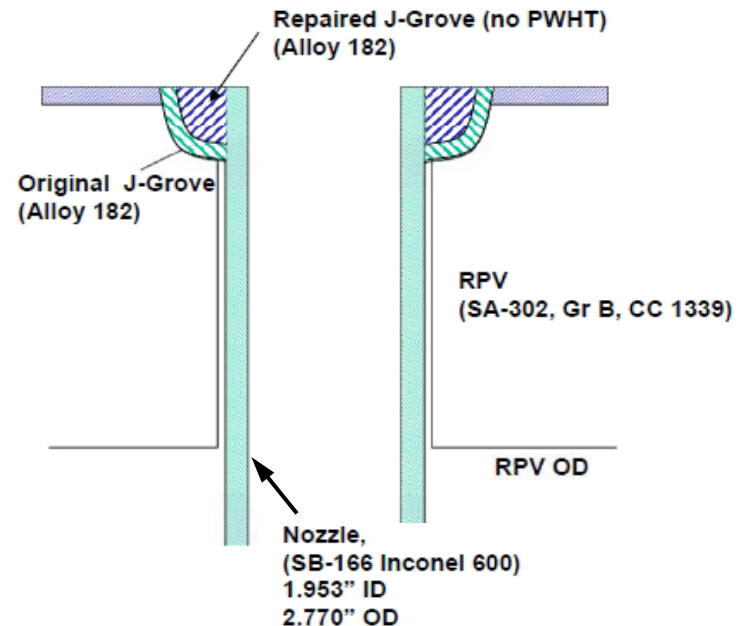
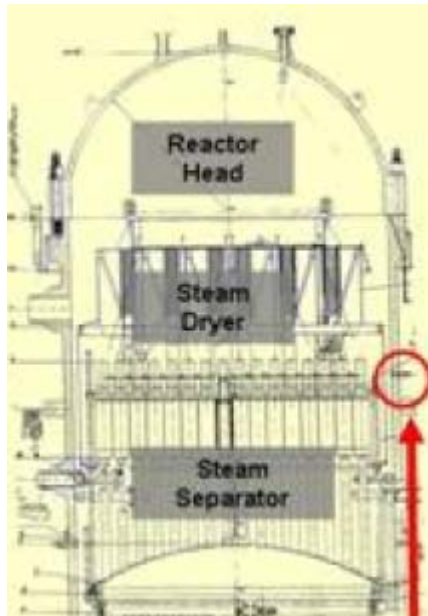
# Grand Gulf Dissimilar Metal (DM) Weld Flaw

- During Spring 2012 outage Grand Gulf found an axial flaw in their N6B Low Pressure Core Injection Nozzle to Safe-End DM weld.
    - Flaw approx. 0.47" deep (0.90" remaining ligament), 0.95" long, and in the 182 butter
    - Weld was stress-improved by Induction Heating Stress Improvement (IHSI) in 1990
    - Examination was one of 13 GL 88-01 Category C weld examinations being performed in accordance with BWRVIP-222, Accelerated Inspection Program for Category C DM Welds
    - Weld did not previously have a qualified Supplement 10 exam and had to be prepped prior to examination
    - Automated data from previous exam (2002) corrupt so no way to evaluate if flaw was pre-existing
    - Weld overlay repaired
    - Of the 271 Category C welds in the BWR Fleet with 182 filler material exposed to the environment, only 4 remain to be examined with a Supplement 10 exam and they are scheduled for Spring of 2014
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- The technical drawing is a longitudinal section of a nozzle assembly. It shows the internal structure of the nozzle, including the weld joint. A red arrow points to a flaw location on the weld. The drawing includes various dimensions, callouts, and labels. Key labels include 'LONGITUDINAL SECTION THRU NOZZLE ASSEMBLY', 'CRITICAL RAO', 'WELD SURFACE', 'FLAW LOCATION', and 'SEE DETAIL A'. The drawing also shows the 'EDGE OF NOZZLE WELD BUILD-UP' and 'EDGE OF SAFE END WELD PEEL'. Dimensions are given in inches, with some values in parentheses indicating alternative or reference values. The drawing is a detailed technical representation of the nozzle assembly, showing the internal structure and the location of the flaw.



# Quad Cities 2 Instrument Line Leak

- During Spring 2012 outage Quad Cities 2 identified a leak coming from their N11B (Upper Water Level) Instrument Nozzle Penetration



- Leakage was found by VT-2 examination during the routine end-of-outage RPV Leak Test
- First instance of a BWR instrument nozzle leaking from inside the vessel or inside the nozzle penetration

# Quad Cities 2 Instrument Line Leak

- Repaired by a half-nozzle repair (typical repair for PWR partial penetration nozzles)
- Apparent cause is IGSCC in the J-groove weld or Alloy 600 instrument nozzle
- Most likely location is in J-groove weld due to repair without PWHT and the fact that no flaws or abnormal metallurgical or chemical conditions were found in the portion of the nozzle that was removed for the half-nozzle repair
- Exelon retrieved and reviewed fabrication information for their instrumentation nozzles fleet-wide (~ 90 nozzles for 12 units) and did not identify any other instances of repairs or replacements
- BWRVIP inspection and evaluation guidance for instrumentation nozzles is contained in BWRVIP-49-A, which does not impose any inspection requirements beyond the normal Code VT-2 examinations
- BWRVIP Assessment Committee recently considered the safety impact (negligible) of the QC2 instrument nozzle leak on BWRVIP-49-A and decided no changes to BWRVIP-49-A are warranted at this time
- BWRVIP is working with Exelon to investigate NDE options for the N11B configuration and other instrument nozzle configurations that are in the BWR fleet

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