

# Zorita Materials Testing Assessment Report Update

## Industry Perspective

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# NRC Zorita Assessment Report

- NRC has funded several projects based on Zorita baffle plate and core barrel weld materials
  - ZIRP: EPRI, NRC, CSN, SSM, Axpo, Tractebel
  - Zorita Welds: EPRI + NRC
  - Halden: EPRI, NRC, + many others
- NRC also conducted testing at Argonne National Lab using specimens machined at Studsvik
- Additional Zorita materials are still available for testing
  - Baffle plate, core barrel welds/plate, bolts
- EPRI appreciates the opportunity to review and provide comments on the report.
  - Good consensus with respect to tensile properties, crack initiation rates, and microstructural evolutions.

Table 1: Summary of Zorita Materials Research Programs

	ZIRP	Zorita Welds	Halden	ANL/INL	BWRVIP Testing
<b>Funders</b>	NRC, EPRI, and others	NRC and EPRI	Halden members	NRC	EPRI
<b>Publications</b>	MRP-440	MRP-451	HWR-1236 and HWR-1320	ANL-19/45, ANL-20/50 and INL/EXT-21-62220	BWRVIP-294, Rev. 2, and BWRVIP-335
<b>Testing Location</b>	Studsvik	Studsvik	Halden	ANL & INL	Studsvik
<b>Materials</b>	10, 25, 50 dpa plate	1, 2 dpa weld/HAZ	40–50 dpa plate, 1–2 dpa weld/HAZ	<1–50 dpa plate (<0.1–1 dpa weld also available)	1–2 dpa weld
<b>Tensile Testing</b>	X	X			unknown
<b>Crack Initiation</b>	X				unknown
<b>CGR Testing</b>	X	X	X	X	X
<b>FT Testing</b>	X	X		X	X
<b>Optical/Scanning Electron Microscopy</b>	X	X	X	X	unknown
<b>TEM</b>	X		X	X	unknown
<b>Composition</b>				X	X

# NRC Zorita Assessment Report

## Crack Growth Rate Testing of Baffle Plate

- EPRI has met with Studsvik to discuss the high CGR data from Zorita and other programs.
  - Studsvik has provided a number of similar examples of high CGR test segments that had been evaluated during the development of ASME Code Case N-889.
  - Some of the test data were excluded from the data pool due to high K levels (K invalidity).
- Additional testing of Zorita baffle plate material under non-constant K conditions in an effort to duplicate the high CGRs could be considered.
  - Further understanding of the correlation between the test conditions and applicability to plant conditions is needed.

## Fracture Toughness of Core Barrel Welds

- Testing of Zorita weld and HAZ material by MRP, ANL, and BWRVIP indicate the materials (up to 2 dpa) have low fracture toughness behavior.
- FT results have been considered in the context of BWRVIP-100, Rev. 1-A and WCAP-17096-NP-A, Rev. 2, and WCAP-17096-NP, Rev. 3.
  - The results of the NRC assessment were published in November 2021\*, and it was concluded that while there was not an immediate safety issue, the issue should be monitored through the NRC inspection program to confirm industry addresses it appropriately.
- Identifying, acquiring, and testing of representative weld/HAZ material is a high priority.
  - SMILE and other harvesting programs will provide insights to fracture toughness behavior of weld materials.
  - Essential to acquire materials with known starting properties, weld procedure information, etc.

\*Buford, A., "Technical Assessment of Nonconservative Fracture Toughness in Boiling Water Reactor Vessel and Internals Project Topical Report, BWRVIP-100, Revision 1-A," November 17, 2021. (Agencywide Documents Access and Management System (ADAMS) Accession No. ML21312A543 (package))

A blue-tinted photograph of four people, two men and two women, standing together. They are wearing white lab coats or work shirts, some with the EPRI logo. The background is a solid blue color.

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