



MRP RPV Surveillance Programs and Research Initiatives

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MRP – NRC Technical Meeting

Rockville, MD

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Agenda

- Atom Probe Tomography (APT) Examination of Selected High-fluence PWR Surveillance Materials
- Coordinated PWR Reactor Vessel Surveillance Program (CRVSP) (MRP-326) Update
- PWR Supplemental Surveillance Program (PSSP)

APT on PWR Surveillance Specimens

- Under joint EPRI-CRIEPI research agreement, CRIEPI (Japan) to perform atom probe tomography (APT) on selected high-fluence PWR surveillance specimens
 - CRIEPI & BWRVIP have had similar program for many years
- Objective:
 - Identify microstructural changes in highly irradiated LAS specimens
 - Identify new embrittlement mechanisms (if any)

APT on PWR Surveillance Specimens

- Specimens of interest

Plant / Capsule	Fluence (10 ¹⁹ n/cm ²)	Base Metal Heat	Cu wt. %	Ni wt. %	Weld Type	Heat	Cu wt. %	Ni wt. %
Farley 1 / Z	8.47	--	--	--	Linde 0091	33A277	0.14	0.19
Farley 2 / V	8.73	SA-533B-1 (C7466-1)	0.2	0.6	SMAW	BOLA	0.03	0.9
Kewaunee / T	5.62	SA-508-2	0.06	0.75	Linde 1092	1P3571	0.22	0.72
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Maine Yankee / A35	6.11				Linde 1092	1P3571	0.36	0.78

- Contributing plants may have Regulatory commitments to retain tested surveillance specimens
- MRP can facilitate Plant Regulatory interaction
 - Staff interaction needed to define regulatory expectations

MRP Programs to Generate High-Fluence PWR Surveillance Data

Options for Obtaining More High-fluence PWR Surveillance Data

- Test CLB capsules at a higher fluence (CRVSP)
- Test additional existing high fluence spare or supplemental PWR capsules
 - Generally inefficient due to limited materials of interest per capsule
 - Reduces capsules available for subsequent license renewal
- Design, fabricate, irradiate and test a targeted capsule(s) (PSSP)
 - Allows selection of optimum materials to attain goals
 - Requires larger initial capital outlay, but highly information-efficient
- MRP is working projects to accomplish first and third options

Coordinated PWR Reactor Vessel Surveillance Program (CRVSP)

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- *Coordinated PWR Reactor Vessel Surveillance Program (MRP-326)*
 - Produces high fluence data ($3-10 \times 10^{19}$ n/cm²) from remaining Appendix H capsules by 2025 to support future ETC development
 - CRVSP defers capsules only if can attain $>3E+19$ n/cm² by 2025
 - Implemented as a “Needed” guidance under NEI 03-08
 - ~~45~~ 13 plant schedules affected
 - Interim guidance under consideration to not require 2 plants to accelerate capsule tests
- Requires NRC approval to implement schedule changes
 - Follow existing protocols for 10CFR50 Appendix H changes
 - Plant submittals sequenced to distribute review load
 - Submission of the request fulfills *Needed* action
 - Future change requests will be evaluated by NRC Staff

CRVSP Results

- Number of total capsules to be tested by 2025 at or above the stated fluence (**red assumes approval of Interim Guidance**)

Fluence (n/cm ²)	Pre- CRVSP	CRVSP
$\geq 3.0 \times 10^{19}$	25	34 29
$\geq 6.0 \times 10^{19}$	7	12
$\geq 8.0 \times 10^{19}$	1	6 5
$\geq 9.0 \times 10^{19}$	0	2

- CRVSP will increase fluence levels of many remaining capsules

PWR Supplemental Surveillance Program (PSSP)

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- Design/Fabricate/Irradiate a supplemental surveillance capsule(s) containing previously-irradiated PWR materials
 - Specimens can be reconstituted (ASTM E1253) either before or after irradiation and then tested
 - Goal: Obtain 15-30 new high-fluence TTS data
- Materials selected based on information value to the PWR ETC
- For research use, not plant-specific surveillance
 - Plants would not revise P-T operating curves from PSSP data
- NRC approval will be required to use surveillance material
 - MRP can facilitate Plant Regulatory interaction
 - Staff interaction needed to define regulatory expectations

PSSP Design and Planning

- Optional PSSP approaches
 - Fabricate 1 capsule containing inserts that are reconstituted after further irradiation
 - Lower initial cost but higher lifetime cost and higher risk to success
 - Fabricate 2 capsules, reconstitute specimens before capsule fabrication
 - Redundancy reduces risk from host plant issues
 - Allows for different fluence increments
- PSSP development spread over 3 years, 2012-2014
 - Planning for host plants and materials has started
- Goal: insert capsule(s) in 2014
 - Irradiate ~9 years

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