Overview: Concrete Harvesting and Research

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Outline

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Overview

Motivation:

- Increasing opportunities to harvest aged components and materials (CMs) from decommissioning nuclear power plants (NPPs) worldwide
- Harvested CMs are valuable because, unlike experimental samples, they have been exposed to actual in-service plant operating conditions (temperature, irradiation, chemical environment, time, stress, confinement, effects etc.)
- Data from NPPs will improve understanding of material degradation associated with extended operation of nuclear power plants from relevant aging conditions.

Vision:

- The international nuclear community to work together to optimize concrete harvesting efforts and maximize knowledge base
- Participants from NRC-NEA international metal harvesting workshops in 2020 and 2022 have highlighted, that a similar international concrete harvesting workshop would be beneficial to establish the status of concrete harvesting research and explore opportunities for further information sharing and for organizing collaborative research.

Overview

Desired Outcome:

- Identify activities (both ongoing and planned) within each country that are unique and most valuable to the international community and may be good candidates for information sharing and collaboration.

- Identify next steps to pursue information sharing or joint harvested concrete research among interested countries and organizations.

Challenges of Harvesting

- Harvesting of irradiated components and materials is expensive, complex, and time-consuming.

- Decommissioning companies are driven by fast-track schedules and have little incentive to support harvesting efforts.

- Acquiring documentation on materials and their service conditions once a plant shuts down and staff attrition occurs

Concrete Harvesting and Research

- NRC is collaborating with other organizations such as DOE, EPRI, and international organizations, which is vital to the success of harvesting efforts
- Experience gained from earlier concrete harvesting attempts from Zorita, Spain and San Onofre Nuclear Generating Station (SONGS)
- From SONGS gathered available plant documents, reports, drawings, concrete specifications
- Harvested unirradiated concrete from back of the steam generator enclosure in October 2021 and sponsored ORNL to analyze and determine susceptibility of irradiation-induced damage in concrete
- The susceptibility of irradiation-induced damage in concrete is governed by
    - the mineralogy of the concrete's aggregates (presence of high quartz content and chemical heterogeneity of the assemblage)
    - accumulated radiation level
    - higher fluence in PWRs
- Developed preliminary harvesting plan, research plan

Priorities - Concrete/Structural

Interest Description	Purpose & Priority	Technical Knowledge Gained	Harvesting Status
Irradiated concrete	Real life data, model verification. Mechanical properties and characterization. Potential further irradiation (H)	Gain insight for rate effects, scale effects compared to accelerated testing, and structural confinement effects. Address uncertainties on damage characterization, model verification, radiation attenuation, and structural evaluations.	Seeking opportunities (Attempted Zorita and SONGS
Reactor supports	Embrittlement, fracture toughness, microstructure (H)	Structural integrity and performance. Inform inspection scope.	Seeking opportunities
Post-tensioned structures	Degradation of Post-tensioning (PT) system and synergy with other degradation nodes (H)	In-situ internal degradation, cracking patterns including potential delamination, and effects of adjustments of bi-axial prestress forces. Inform aging management updates as needed	Seeking opportunities
Containments and other safety-related concrete structures	Corrosion of rebar, PT tendons and embedments, boric acid attack on the PWR SFP concrete structures, other degradation (MH)	Inform aging management updates as needed. Spent fuel pool (SFP) leak chase channel leakage conditions and possible degradation	Seeking opportunities

Thanks