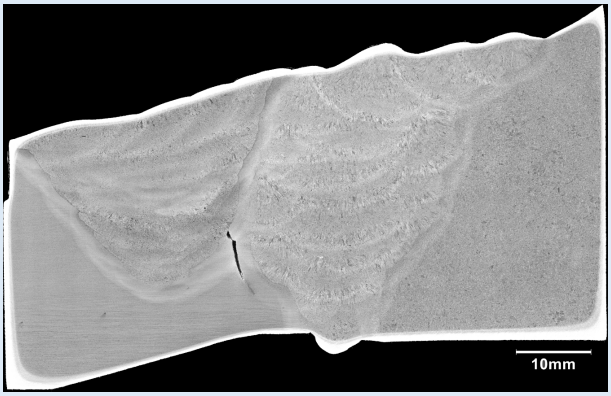
Supplemental Project Notice

APPLICATION OF WELL-ENGINEERED WELD REPAIRS FOR GRADE 91 AND OTHER CREEP STRENGTH-ENHANCED FERRITIC (CSEF) STEELS



PROJECT HIGHLIGHTS

- Provide long-term economical solutions using alternative weld repair options
- Facilitate the qualification of alternative weld repair procedures
- Codify promising repair options in the National Board Inspection Code
- Address practical repair constraints

Background, Objectives, and New Learnings

Creep strength-enhanced ferritic (CSEF) steels are widely utilized for new construction and replacement parts in the combined-cycle gas turbine and supercritical coal-fired fleets, including heavy wall piping or headers/manifolds, waterwalls, thin wall tubing, and castings. The decreasing capacity margin, emerging new power demands, and widespread use of CSEF steels are driving increased desire for repair options beyond new construction guidelines. The development and continued enhancement of alternative, well-engineered weld repair approaches that do not require post weld heat treatment (PWHT) provides the energy industry a significant opportunity to dramatically improve fleet flexibility and bring plants online more quickly during forced outages and/or in times of significant need. This supplemental program builds on a 15-year legacy in the development and codification of alternative weld repair approaches, including Welding Method 6, Welding Method 7, and Supplement 8 in the National Board Inspection Code (NBIC) Part 3 Repairs and Alterations.

Benefits

Alternative, well-engineered weld repairs provide the end-user/owner and repair vendor an opportunity to mitigate future damage development using a procedure that may or may not include PWHT, considers the use of an optimized joint geometry, specifies a filler material that will enhance long-term performance for a creep- or fatigue-dominated mechanism, and evaluates the contributing factors from design, fabrication, operation and metallurgy that led to the need for repair. Such weld repairs will afford the end-user signficant flexibility in an ever-evolving environment, including:

- The avoidance of considerable costs from fewer component replacments or outage costs associated with PWHT when implemented across the fleet in a controlled manner.
- A lower susceptibility to rupture and reduced risk to future unplanned outage(s) in the repaired component.
- More option(s) for addressing practical constraints, such as the inability to purge the inside of the component or accommodate the additional mass of a heater for preheating or PWHT.

Project Approach and Summary

This project will research and develop alternative, well-engineered weld repair procedures for CSEF steels. Work will be coordinated by the Materials Program (P229) and leverage 15 years of prior results. Project participants will prioritize individual projects for research. As new or emerging repair needs arise, they will be presented to the funders of the project as opportunities. The scope of this supplemental program includes four tasks:

Task 1 – Development of weld repair procedures. A dozen potential weld repair scenarios have been discussed or brought to the attention of EPRI as widespread industry needs. Scenarios include, but are not limited to, specific components or materials – stub-to-header repair, T23 and T24 waterwalls, dissimilar metal welds (DMWs) between a CSEF steel and a CrMo steel, DMWs between a CSEF steel and an austenitic stainless steel, and large castings (such as valve bodies or steam turbine casings) fabricated from CMV, C91, C911 or CB2. Validation of the weld repair procedures will include a range of material testing and disciplines, such as fracture toughness, elevated temperature creep, detailed metallographic evaluation, hardness mapping, destructive evaluation to relevant code requirements, and microscopy (light, laser, and state-of-the-art electron scanning microscopy).

Task 2 – Databases and best practice guidance. The data developed from the research of these various types of repair scenarios will be collected in specific databases and reported in best guidance manuals and recommendations for the larger technical community. In-service performance will be tracked as made available to the project or EPRI and regularly updated among the project participants.

Task 3 – Technology transfer. Regular interaction with standards committees, code bodies, insurance regulators, and other organizations will help ensure that weld repair procedures are codified. Education of end-users, repair vendors and other stakeholders in the weld repair industry may require tailored materials to ensure that weld repairs are properly conducted. At least one face-to-face meeting will be arranged each year for the project members to discuss the results from each task and provide a forum for ongoing collaboration, feedback, and identification of new potential research needs.

Task 4 – Procedure qualification records. When unique and alternative weld repair procedures are developed, the project participants will have the opportunity to witness procedure qualifications and incorporate these into their internal weld repair procedure manual(s).

Deliverables

Anticipated deliverables include best practice guidelines for weld repair of specific materials and/or components, position papers to help educate the industry-at-large and as identified by the project members, weld repair procedure qualification records as prioritized by the project members, and life management strategies for long-term in-service alternative weld repairs. Regular project updates, including the meeting materials, will be made available to members following project webcasts and face-to-face meetings.

Members will have access to the specific deliverables developed during the years of participation. While efforts will be made to complete individual projects during the calendar year, it is recognized that most projects may be quite complicated and could take multiple years to complete.

Price of Project

New funders can join the project with an initial three-year commitment for a total cost of $90,000. After the initial three-year period, funders can continue participation on an annual basis for $30,000 per year. The project qualifies for self-direct funding (SDF).

Project Status and Schedule

The project is ongoing and was initiated in 2015.

Who Should Join

Companies that need weld repair solutions for CSEF steels and dissimilar metal welds will benefit from participation in this project.

Contact Information

For more information, contact the EPRI Customer Assistance Center at 800.313.3774 (askepri@epri.com).

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