



TIP 428: PNNL - Cold Spray Cavitation Repair Demonstration and Evaluation

Context

Hydropower components that experience cavitation damage are frequently repaired with a fusion welding process. This current approach leads to ever increasing frequency of repair, as the fusion welded regions that have been repaired have less resistance to cavitation erosion compared to the base material. To address this issue, Pacific Northwest National Laboratory (PNNL) has been investigating the cold spray coating technology as an alternative repair process.

To date, PNNL has demonstrated that the cold spray process offers the potential opportunity to dramatically improve cavitation erosion resistance with results indicating a potential improvement of 400% over stainless steel base metal or overlays and up to 8 times that of heat affected zones in carbon steels used in turbine castings. This provides an opportunity for hydropower plants to significantly reduce repair and maintenance costs, reduce frequency of the outages, and extend the lives of treated hydro components exposed to cavitation producing conditions.

Description

The performance improvement of the cold spray repair process was demonstrated through laboratory testing of the treated material using fixed (stationary) cold spray equipment that is not suitable for repairs of hydropower components. Therefore, a portable and manual capable process is needed for hydropower industry application to power plant components. This project will further develop the cold spray process to deliver the portable and manual process capable of in-situ turbine repair.

For projects that have multiple funding sources, PNNL policy requires that there be a clear delineation between tasks to which the separate funding sources are applied. For this reason, the scope of work for BPA's participation is related only to post cold spray deposit testing and inspection. PNNL will also keep BPA apprised of the status and progress of other project work including, process development trials, portable equipment configuration, process parameters, etc. through periodic meetings and reports.

Phase 1 of PNNL's cold spray commercialization project involves optimization of the cold spray process on portable capable cold spray equipment. In the preceding phase, efforts were initiated to transfer the process from the

fixed/stationary equipment to equipment that is portable capable.

BPA participation will be related to testing and inspection. These efforts include:

- Test and inspection preparation activities related to post spray deposit coupon preparation and equipment setup, as well as any procurement related to the test.;
- Testing and inspections processes that include destructive and non-destructive testing; and
- Post Testing Analysis involving engineering and/or scientific review and summarization of the testing and results.

Phase 2 of PNNL's cold spray commercialization project involves simulation of the effects of human induced variables on the optimized process developed in Phase 1.

Why It Matters

A solid-state repair process will dramatically extend service life of repaired components and reduces frequency of outages due to blade repair if applied properly.

Goals and Objectives

The cold spray technology performance improvement was demonstrated in TIP 348 through laboratory testing of cold sprayed material created by using fixed (stationary) cold spray equipment. This project aims to demonstrate and evaluate a portable and manual capable process suitable for commercial application in the hydropower industry.

Deliverables

The Project Plan includes delivery of a PowerPoint presentation detailing status of inspection and testing related to Phase 2, and any results obtained.

There will also be a formal report of FY21 efforts. The final report will focus on Phase 1 results and will be issued as a PNNL report available to the public.

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Project Start Date: October 2020

Project End Date: September 2021

Related Projects

TIP 346: Cold Spray' Deposition for Improved Service Life of New and Repaired Hydroelectric Turbines

Participating Organizations

Pacific Northwest National Laboratories (PNNL)
U.S. Department of Energy
Bureau of Reclamation

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