

Trip Report for Bilateral Information Exchange Meeting between NRC and ASN to Discuss Materials Issues

On December 8-10, 2015, Robert Hardies and Ken Karwoski traveled to Dijon, France to meet with French regulatory counterparts at ASN. Discussion topics included reactor pressure vessel integrity, experience and regulatory approaches for management of primary water stress corrosion cracking of nickel alloys, fatigue, non-destructive examination, high density polyethylene piping, and steam generator integrity.

During discussion of reactor pressure vessel integrity ASN presented an overview of the French regulatory philosophy and described a proposal to apply a master curve based size correction to the minimum toughness curve. The NRC described how warm pre-stressing is applied in U.S. regulations. Both ASN and NRC described the current state of understanding related to the potential presence of hydrogen flaking in reactor pressure vessel forgings. The NRC discussed issues with increasing areas of the reactor pressure vessel being effected by embrittlement after long term operation. Both ASN and NRC described current practices related to reactor pressure vessel surveillance programs. ASN discussed the issues associated with carbon inhomogeneity in a newly forged reactor pressure vessel head. Finally, the NRC provided information related to potential non-conservatisms in procedures to estimate transverse fracture toughness properties from longitudinal Charpy impact test results.

During discussion of nickel alloys ASN described plans for repair of the Gravelines 1 bottom mounted instrument nozzle, including plans for metallurgical analysis of the cracked material. ASN also presented the plan for inspecting bottom mounted nozzles at all plants. NRC and ASN discussed respective programs for inspection of dissimilar metal welds. The NRC presented a description and status of the xLPR computer code for evaluation of the nuclear safety risk due to stress corrosion cracking of dissimilar metal welds. The NRC also described U.S. industry efforts to implement peening as a mitigation strategy.

With respect to fatigue, both ASN and NRC presented the programs for addressing thermal fatigue and environmental fatigue.

ASN described the French approach for non-destructive testing, including detailed presentations of steam generator divider plate inspections and evaluation of channel head degradation. The NRC presented the current practices and plans for inspection of divider plates and evaluation of channel head degradation. ASN described the inspection program for quasi-laminar indications in reactor pressure vessel forgings. The NRC described ultrasonic inspection issues in operating plants, experience with team scanning, and current research programs associated with non-destructive examination and human factors, and a research round robin assessment of visual testing.

ASN describe qualification of high density polyethylene piping for emergency water applications. The NRC described U.S. utility application of buried high density polyethylene piping in safety related applications.

With respect to steam generators the NRC described the regulatory approach in the U.S. and discussed clogging of tube support plates and tube fouling. The NRC also discussed experiences with steam generator tube sleeving. ASN made presentations on the same topics. Finally, the NRC described the scope of review of fluidelastic instabilities during licensing reviews.