Overview of EPRI Updated Gap Report

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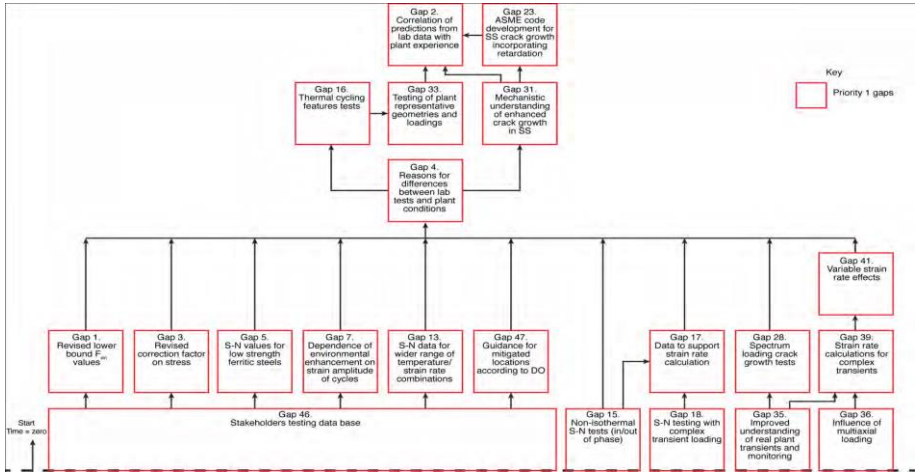
NRC Public Meeting on Environmentally Assisted Fatigue (EAF) Research and Related ASME Activities
September 25, 2018
NRC Headquarters - Rockville, MD

2012 Gap Report

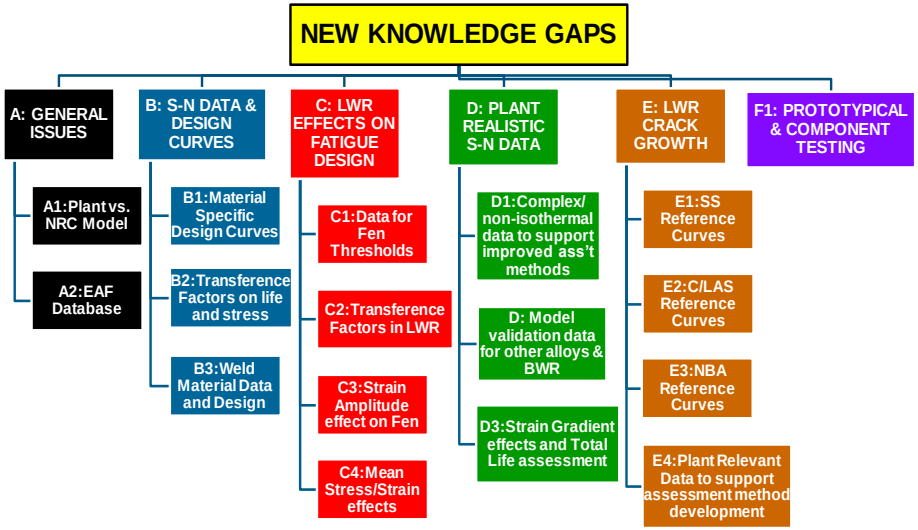
- *Environmentally Assisted Fatigue Gap Analysis and Roadmap for Future Research*, November 2012 (Product ID 1026724)
  - Gap prioritization performed by industry expert panel
  - 21 gaps identified as high priority
  - 7 hypotheses proposed to explain the apparent discrepancy between test data and field experience
  - The intent of the report is to identify knowledge gaps that can be used to direct research efforts
  - Report is publicly available

OLD KNOWLEDGE GAPS

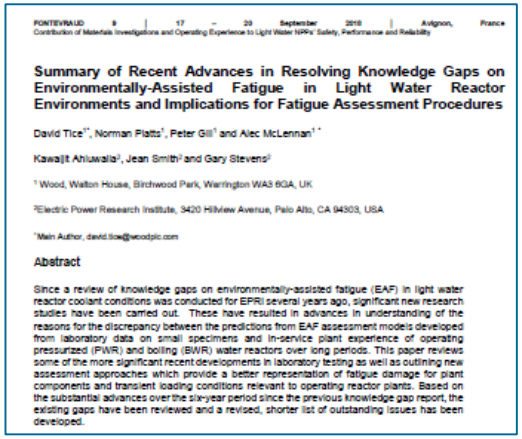


Updated Gap Report

- *Environmentally-Assisted Fatigue; Knowledge Gap Analysis - Update and Revision of the EAF Knowledge Gaps* (Product ID 3002013214)
  - Gaps were reviewed in the light of recent research
    - Based on direction of industry R&D programs
  - A revised and categorized list of gaps was developed:
    - Remove overlap and increase ease of use
    - Emphasize collaboration between testing and assessment
    - Revised gaps direct research without constraining organizations' requirements
  - Publication expected by end of September 2018; report will be publicly available



Paper and presentation was given at Fontevraud 9, September 17-20, 2018



FONTEVRAUD 9 | 17 – 20 September 2018 | Avignon, France
Contribution of Materials Investigations and Operating Experience to Light Water NPPs' Safety, Performance and Reliability

Summary of Recent Advances in Resolving Knowledge Gaps on Environmentally-Assisted Fatigue in Light Water Reactor Environments and Implications for Fatigue Assessment Procedures

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Abstract

Since a review of knowledge gaps on environmentally-assisted fatigue (EAF) in light water reactor coolant conditions was conducted for EPRI several years ago, significant new research studies have been carried out. These have resulted in advances in understanding of the reasons for the discrepancy between the predictions from EAF assessment models developed from laboratory data on small specimens and in-service plant experience of operating pressurized (PWR) and boiling (BWR) water reactors over long periods. This paper reviews some of the more significant recent developments in laboratory testing as well as outlining new assessment approaches which provide a better representation of fatigue damage for plant components and transient loading conditions relevant to operating reactor plants. Based on the substantial advances over the six-year period since the previous knowledge gap report, the existing gaps have been reviewed and a revised, shorter list of outstanding issues has been developed.

The EAF Knowledge Gaps were recently updated to reflect the most recent research and understanding

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Conclusions of Updated Gap Report

- Since the 2012 EAF Knowledge Gap Report, there has been extensive progress in EAF research aimed at closing some of the key gaps and developing improved assessment methodologies for EAF in LWR environments
- The main focus has been on austenitic stainless steels in PWR coolant
- Some of the most significant and promising new assessment methods and supporting data are at differing stages of development:
  - Recognition that transference factors differ between air and LWR environments so a proportion of F_{en} is already included in the ASME III design curve ($F_{en\text{-}integrated}$, $F_{en\text{-}threshold}$)
  - Weighting models for assessing both fatigue life and crack growth for complex and non-isothermal transients (SNW, WKR)
  - Consideration of using lower transference factors on stress and on life
  - Use of effective ΔK for crack growth calculation for transients with a compressive portion
  - Recognition of strain gradient effects for thermal transients which support the development of a Total Life Assessment methodology
- A revision of the Knowledge Gap report includes a revised, condensed, and categorized listing of the remaining knowledge gaps
  - This publicly available EPRI report is in final publication

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