PELLET CLAD INTERACTION, PROVIDED BY STRUCTURAL INTEGRITY ASSOCIATES

CLASSROOM INSTRUCTORS

Michael Kennard

Education:

- B.S. Mechanical Engineering, Illinois Institute of Technology

Accreditations/Industry Leadership:

- American Nuclear Society Member
- Mr. Kennard has authored a number of industry papers and was a principal contributor to the following EPRI publications:
  - Fuel Reliability Guidelines: Pellet-Cladding Interaction (EPRI 1015453, 2008)
  - PCI Margin Assessment: Westinghouse PWR and BWR Fuel (EPRI 1018036, 2009)
  - PCI Margin Assessment: AREVA PWR and BWR Fuel (EPRI 1018037, 2009)
  - PCI Margin Assessment: GNF BWR Fuel (EPRI 1018038, 2009)

Background:

- Mr. Kennard has over 30 years of experience directly related to the assessment of the performance of LWR fuel and core components. This experience has included reload fuel analyses core performance assessments and inspections. He is experienced in all facets of the in-core performance of fuel, including fabrication audits/surveillances, evaluation of new fuel designs/materials, root cause analysis of failures, and evaluation of the efficacy of design remedies to address reliability issues (for U.S., European, and Japanese utilities).

CONTACT INFORMATION

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INTENDED AUDIENCE

Licensed Senior Reactor Operators, fuel handling personnel, outage managers, nuclear engineering staff and probabilistic risk assessment staff that desire a deeper understanding of key factors affecting nuclear fuel reliability and strategies for improving fuel rod performance

TYPE

Classroom Training

DURATION

One day (7 PDH)

LEARNING OBJECTIVES

An important performance issue for nuclear fuel is power operation without incurring fuel failures from Pellet Clad Interaction (PCI). While classical PCI failures were not particularly unusual through the 1980s, the industry response consisting of improved fuel designs and power ramping guidelines for startups and restarts has proven effective. However, during the period between 2003 to 2006, the industry was surprised by the occurrence of multiple failures in several PWRs – the failure mechanism was determined through hot cell examination to be PCI-type failure in the presence of large missing pellet surface defects.

This training course enhances awareness of PCI-type failures and effective mitigation strategies. As such, the course addresses the PCI-type failure mechanism, including contributory local fuel and cladding phenomena.

In support of the nuclear industry's initiative to eliminate fuel failures, our fuel experts worked with the Electric Power Research Institute (EPRI) to develop multiple fuel reliability guidelines for use by utility personnel and industry oversight organizations:

- Fuel surveillance and inspection programs to identify and assess trends in key fuel performance characteristics for currently operating reactors following changes
- PCI failure mitigation in BWR and PWR fuel designs through the development of improved power maneuvering procedures
- Grid-to-rod fretting fuel failure recommendations to eliminate failures through improvements in debris mitigation features in fuel designs, core design modifications and fuel spacer grid design improvement

This overview course will provide practical application to enable students to successfully manage your fuel and PCI failure.

Topics Covered:

- Impacts of improper core and fuel management
- Impacts of local effects such as rod cluster control assembly withdrawal
- Classical and missing pellet surface failure mechanisms
- Power ramping programs to establish proper guidelines

KEY INDUSTRY DOCUMENTS

1. Fuel Reliability Guidelines: Pellet-Cladding Interaction, EPRI, Palo Alto, CA: 2008. 1015453
2. PCI Margin Assessment: Westinghouse PWR and BWR Fuel, EPRI, Palo Alto, CA: 2009. 1018036
3. PCI Margin Assessment: AREVA PWR and BWR Fuel, EPRI, Palo Alto, CA: 2009. 1018037
4. PCI Analyses and Startup Ramp Rate Recommendations for Westinghouse Fuel in Exelon PWRs, EPRI, Palo Alto, CA: 2006. 1012915
5. SI Report 1600529.402 Rev. 0, Analysis of the Braidwood Unit 2 Cycle 20 Startup with a 60 Mil Missing Pellet Surface Defect, March 2017 (and Similar)
6. SI Report 1501059.401 Rev. 0, Development of Failure Thresholds for Application of Falcon Version 1.3.1 to Byron and Braidwood PCI Margin Evaluations: Phase I Report – Development of ZIRLO Failure Threshold, February 2017
7. Y. Aleshin et. al., The Effect of Pellet and Local Power Variations on PCI Margin, Proceedings of Top Fuel 2010, September 26-29, 2010, Paper 41 (and Similar)