

BWR Fuel Channel Distortion - Recent Experience and Consequences

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Abstract

Fuel channels in boiling water reactors undergo distortions like bow, bulge and twist due to their operating conditions. These distortions may adversely impact planned operating strategy, and therefore need to be adequately addressed during various stages of fuel channel design and manufacturing, core design and operation monitoring. Fuel channel distortion may lead to interference between the fuel channel and adjacent control blade. If severe, such interference can impair both positioning of control blades during normal operations and rapid control blade insertion during a reactor scram.

During the last 5 years, unexpected high fuel channel distortions leading to problems in control blade operations have been observed in some C- and S-lattice BWR plants in the U.S. operating on 18 - 24 month cycles. As a result, US operators have implemented costly surveillance programs to detect the onset of high distortions and have had to declare control blades as inoperable when unacceptable control blade operation occurs. This type of fuel channel distortion has not been observed with AREVA NP fuel supplied in Europe, Taiwan or Japan in this scale. Nevertheless fuel channel distortion related problems have recently been observed in one reactor outside the U.S. with early control blade operation.

The mechanisms causing this unexpected fuel channel distortion and the influencing factors are not completely understood worldwide for the time being. Therefore, a prediction of channels which will exhibit high bow is very challenging.

A status is given from the AREVA-NP perspective on:

- the existing fuel channel distortion database,
- the understanding of phenomenon,
- measures to gather further information and improve existing tools, materials and designs and
- Customer actions to reduce potential high channel bow and associated control blade issues