Office for Nuclear Regulation

An agency of HSE

Redgrave Court Merton Road Bootle Merseyside L20 7HS
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# WESTINGHOUSE AP1000® GENERIC DESIGN ASSESSMENT

## GDA ISSUE

## FUEL PIN MODELLING SAFETY JUSTIFICATION

## GI-AP1000-FD-01 REVISION 0

| | | | |
|---|---|---|---|
| **Technical Area** | | **FUEL DESIGN** | |
| **Related Technical Areas** | | Fault Studies | |
| **GDA Issue Reference** | **GI-AP1000-FD-01** | **GDA Issue Action Reference** | **GI-AP1000-FD-01.A1** |
| **GDA Issue** | There is a need to provide comprehensive documentation demonstrating that PAD predictions of temperatures for fresh fuel will in all cases exceed the expected temperatures of irradiated fuel, including allowances for uncertainty.<br>Further, that fission gas release predictions are pessimistic after suitable allowances.<br>In order to ensure this, a suitable constraint on fuel ratings as a function of irradiation needs to be qualified and adopted. | | |
| **GDA Issue Action** | Demonstrate in a documented safety case, to a high level of confidence that for fresh fuel temperatures predicted by PAD are bounding of all irradiated fuel within the burnup range considered.<br>Define a formal limiting condition applied to the core design process to ensure that the assumptions utilised in this Action are realised.<br>The current version of the PAD fuel performance code is deficient as the reduction in thermal conductivity of fuel material with irradiation is not represented.<br>Westinghouse bases its safety case for fuel temperatures on the argument that fresh fuel is limiting due to the reduction of fuel reactivity with irradiation. However, this argument is based on assumptions about the power of the fuel and needs to be made<br>This constraint needs to be considered a limiting condition of operation and controlled as such.<br>The derivation of the constraint will need to make due allowance for uncertainty.<br>With agreement from the Regulator this action may be completed by alternative means. | | |

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| **GDA Issue Reference** | **GI-AP1000-FD-01** | **GDA Issue Action Reference** | **GI-AP1000-FD-01.A2** |
| **GDA Issue Action** | Present a formal safety justification of the uncertainty of the current models of fission gas release and their limits of applicability.<br>The current version of the PAD fuel performance code is deficient as the empirical fission gas release model does not include a gas release threshold model. Consequentially the prediction of the rate of gas release tends to be too high initially, and then too low later.<br>Westinghouse bases its safety case for fuel pin pressures on the argument that empirical data can be used as a basis for prediction of fission gas release, but AP1000 envisages operating at fuel pin ratings and irradiations in excess of the current bulk of the data.<br>This brings into question the basis for the assessment of uncertainty in the current safety case and requires a thorough justification of its statistical basis at the limiting conditions of relevance.<br>With agreement from the Regulator this action may be completed by alternative means. | | |