

Comparisons of Feedback under UTOPA with In Pin Fuel Motion Dynamics in Fast Reactors

Friday, 22 April 2022 11:18 (12 minutes)

Safety studies of fast reactors are carried out on a medium sized core and found that, under Unprotected Transient Over Power Accidents (UTOPA) there is fuel melting and there is feedback due to in pin fuel motion. From the UTOPA analyses it is found that, the in pin fuel motion feedback reduces the peak reactor power and hence it reduces the hot spot clad and coolant temperatures at the end of the transients. Under such transients, when there is change in reactor power, for the given primary & secondary systems, the balance of plant gets affected. This results in change in inlet coolant temperature, which affects the temperature profile and has a considerable contribution in shaping the power profile and its respective feedbacks. To study the effect of UTOPA with different boundary conditions, analyses has been carried out with constant inlet coolant temperature (CICT), Time Dependent Inlet Coolant Temperature (TDICT) profile, with and without In Pin Fuel Motion (IPFM) feedback, etc. Comparisons of those results give a better understanding of their respective feedbacks & calculation methodology with respect to different boundary conditions. Considered UTOPA studies with different boundary conditions are,

1. The uncontrolled withdrawal of control rod with CICT, without IPFM. It is based on the assumption that, the molten fuel is hypothetically stationary (available in the same location) even after melting.

1. The uncontrolled withdrawal of control rod with TDICT, without IPFM.
2. Uncontrolled withdrawal of control rod with CICT and IPFM after the initiation of fuel melting.
3. Uncontrolled withdrawal of control rod with TDICT and IPFM feedback after the initiation of fuel melting.

From the comparison of results, it is learnt that the IPFM is significant in bringing the reactor to a safe state under UTOPA. The involved conservatism of the result is observed in the analyses where the IPFM feedback is not considered as compared to the best estimate analyses of considering IPFM feedback. From the study, it is concluded that if a reactor is found to be safe without IPFM feedback, it can actually converged to a safe state with IPFM feedback. Thus the results without IPFM feedback are conservative.

Country/Int. organization

India

Speaker's email address

sheela@igcar.gov.in

Speaker's title

Ms

Affiliation/Organization

Indira Gandhi Centre for Atomic Research, Kalpakkam, India

Primary author: Mrs T., Sathiyasheela (IGCAR, India)

Co-authors: Mr DUBEY, Anuj (IGCAR, India); Dr G. S. , Srinivasan (IGCAR, India); Dr K., Devan (IGCAR, India)

Presenter: Mrs T., Sathiyasheela (IGCAR, India)

Session Classification: 2.4 Severe Accidents

Track Classification: Track 2. Fast Reactor Safety