Updated LOCA/LOFA Analyses for Blanket and Shield Only Regions

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LOCA/LOFA Analysis Update

1. Models for blanket and shield zones have been updated to reflected latest build configuration.

2. Shield-only model has been modified to include radiation from first wall across plasma.
Latest Radial Build

- Changes from previous model include two breeding zones in the blanket and the manifold region behind shield.
- Modeling and heat generation detail were also significantly improved from previous analyses.
Updated Blanket and Shield FE Model

- Natural convection to water in vacuum vessel still assumed. Perfect contact modeled between blanket and shield.
- Manifold assumed to be empty (no LiPb or He) with radiation blockage to account for internal structure.
Thermal Results LOFA for LiPb and Water and LOCA for He

- Maximum temperature is 28 C lower for new configuration.
- Difference can be attributed to the lower decay heating in LiPb.

Updated Model
Maximum temperature – 673 C

Previous Configuration
Maximum temperature – 701 C
Decay Heat for LiPb Compared to Previous Data

- New LiPb decay heats calculated by Laila El-Guebaly are significantly lower than estimates used previously – most notably in the outboard breeding zone.
Thermal Response for LOCA in Blanket/Shield and LOFA in Vacuum Vessel

- Maximum FW temperature is 5 C higher for the new configuration.
- Higher Temperature attributable to reduced radiative heat transfer in blanket due to the intermediate wall and to addition of the manifold.
- Maximum temperature for LOCA (711 C) case 40 C higher than LOFA (673 C) for this build configuration.
Updated Shield Only Zone Analysis
Model Modified to Include Radiation from FW

FW in shield only region sees mainly cooler shield & blanket zones

FW Wall Regions

Radiation to cooler

FEA Model

Replaceable
LOCA Thermal Results for Shield Only Region

- Maximum temperature is 368°C lower when first wall radiation is included, but still greatly exceeds 740°C FS temperature limit.
- Affect of thermal radiation on blanket and shield regions should be minimal since shield only region is a small fraction of total FW wall surface area.
Summary

1. Model for blanket and shield zone has been updated to latest build configuration. Maximum FW temperature for LOFA in the LiPb is 28 C lower than previous analysis due to lower predicted LiPb afterheat.

2. Adding gap between blanket and shield raises maximum FW temperature by ~ 15 C.

3. Shield only model has been modified to include radiation from first wall across plasma. Maximum temperature is reduced 368 C, but still greatly exceeds 740 C FS temperature limit.