NRC Request for Consideration of
RACKLIFE Prediction and BADGER Testing Uncertainties

NRC Request

Provide documentation explaining how the uncertainty associated with RACKLIFE and BADGER testing is handled consistent with the requirement to determine Keff with a 95% probability and 95% confidence level.

FPL Response

FPL is using RACKLIFE predictions and the supporting BADGER measurements in a conservative manner to ensure that all uncertainties in both RACKLIFE and BADGER are covered. There are two main items to note regarding this conservative approach:

(1) FPL takes compensatory action when one panel in a spent fuel pool cell is projected to fall below an areal density of 0.0075 $gms-B_{10}/cm^2$, instead of the criticality analyses assumption of 0.006 $gms-B_{10}/cm^2$; and

(2) FPL implements RACKLIFE with a conservative bias; for the four panels in a spent fuel pool cell, RACKLIFE over-predicts dissolution by a cumulative 10.4% over what is measured by BADGER.

For the first item, FPL's Boraflex management program requires that compensatory actions (insert additional poison material and/or empty cells to create water holes) be taken when RACKLIFE predicts a panel to fall below an areal density of 0.0075 $gms-B_{10}/cm^2$. The criticality analysis of record, as described in the Turkey Point UFSAR, includes an assumption that every Boraflex panel in the spent fuel pool has an areal density of 0.006 $gms-B_{10}/cm^2$. Therefore, the threshold used by FPL in the Boraflex management program for taking compensatory action has considerable margin (>10%) to the value assumed in the criticality analysis.

The second item notes that RACKLIFE is over-predicting dissolution as measured by BADGER. This is not typical for RACKLIFE-BADGER Boraflex management programs, as utilities have the capability of tuning the RACKLIFE models to get the predictions closer to the measurements, with an average difference closer to zero. FPL does not adjust the RACKLIFE prediction model based on Silica levels or BADGER measurements, allowing it to remain more conservative than if adjusted.

Statistical analyses have been performed on the RACKLIFE predictions and BADGER measurements for Turkey Point Unit 3, with the conclusion that when looking at the four independent panels in a given spent fuel pool cell, there is a 95% probability with 95% confidence that RACKLIFE will over-predict dissolution by a cumulative total of 10.4%. Thus, if one of the panels in the cells has a non-conservative measurement, the over-prediction in the other three panels in the cell will compensate for the under-predicted panel.

Enclosure 4

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The two items presented provide considerable margin to bound the RACKLIFE and BADGER uncertainties. On a nominal basis, the RACKLIFE model will consistently over-predict dissolution for each of the panels, and compensatory actions will be taken with considerable margin (>10%) prior to reaching the areal density assumption of 0.006 $gms\text{-}B_{10}/cm^2$ in the spent fuel pool criticality analysis.

In the event that RACKLIFE under-predicts dissolution for one of the panels as measured by BADGER, the statistical analyses show that on a 95/95 basis, RACKLIFE over-predicts dissolution (as measured by BADGER) by a cumulative total of 10.4% for the four panels in the cell. That 95/95 cumulative over-prediction is higher than the BADGER measurement uncertainty of 10%, thus the FPL Boraflex management program accounts for the RACKLIFE-BADGER uncertainties even in the worst case scenario.

In summary, FPL accounts for all uncertainties in the as-built areal density, RACKLIFE model predictions, and BADGER measurement uncertainties with a conservative, 95/95 approach for each step in the process. For the as-built areal density, FPL addresses the uncertainty directly by using the 95/95 lower confidence limit as the starting areal density for all panels in the spent fuel pool. Each panel is then degraded by the RACKLIFE model predictions, which have been conservatively biased against the BADGER measurements. As noted, the statistical analyses show that on a 95/95 basis, RACKLIFE over-predicts dissolution (as measured by BADGER) by a cumulative total of 10.4% for the four panels in a cell. This RACKLIFE conservative over-prediction bounds RACKLIFE model uncertainties as well as the BADGER measurement uncertainty.

Additional details concerning the treatment of the RACKLIFE and BADGER uncertainties can be found in Attachment 4 of the recently submitted Turkey Point Unit 3 License Amendment Request #204 (FPL Letter L-2010-035, dated February 25, 2010).