

Local Fuel Duty Monitor

Background

Pellet clad interaction (PCI) is a serious concern for operation of nuclear power plants under transient conditions such as those that occur during startup, temporary down power for maintenance activities, load follow or dropped rod recovery. Under these conditions, fuel failure can occur if the core is ramped too quickly. However, the definition of “too quickly” depends on fuel operating history; thus, if a single “rule of thumb” ramp rate is used it will be necessarily conservative and the plant will be delayed in getting maximum power on to the grid. The local fuel duty monitor (LFDM) performs detailed calculations of local ramp rate and power history, allowing an accurate assessment of PCI risk resulting in maximum megawatts on the grid for the given conditions.

Description

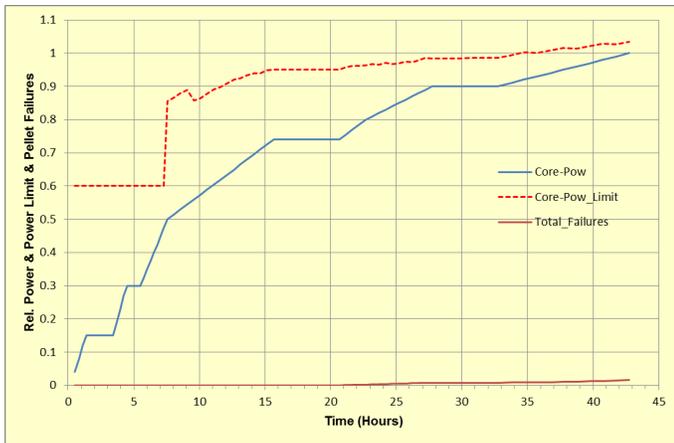
LFDM uses BEACON™ system calculated pin ramp rates and fuel operational history along with known historical data and postulated missing pellet surface to calculate the risk of PCI as a function of time for a given operational maneuver. With this information, the plant operations staff can see where risk of PCI increases to unacceptable levels for a planned maneuver, and adjust ramp rates at the right times to limit risk to acceptable levels, while not overly limiting the plant where risk is low. LFDM can be used to evaluate any type of expected plant condition including dropped rod recovery.

Benefits

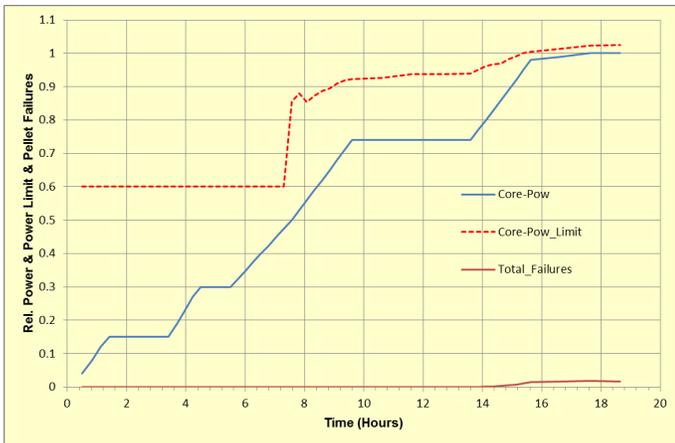
The main benefit that the LFDM offers is maximum megawatts on the grid while keeping PCI risk low.

Experience

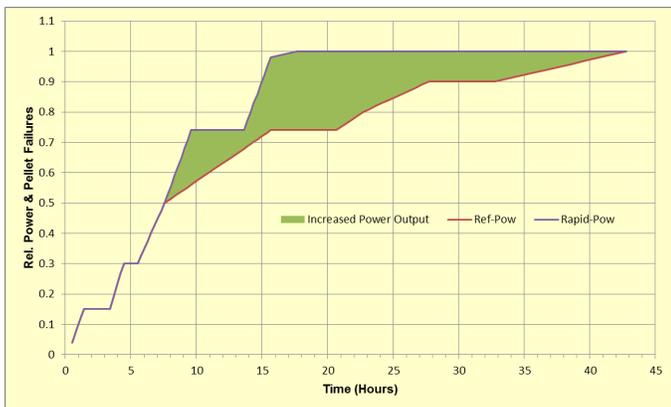
The LFDM was used to evaluate two early reloads that had fuel failures suspected to be caused by missing pellet surfaces. One core had a slow startup rate and one had a faster startup rate. Spikes in the predicted total pellet failures using this method agree with the actual times of increased coolant activity, thus validating the predictive capability of the LFDM method.



Ramp rate versus calculated limit using traditional guidance



Improved ramp using knowledge of the PCI risk



Extra power on the grid with no increase in risk

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