

Branch Technical Position HICB-5

Guidance on Spurious Withdrawals of Single Control Rods in Pressurized Water Reactors

A. Background

Operating experience with pressurized water reactors (PWRs) and subsequent reviews of PWR designs with regard to the requirements of 10 CFR 50 Appendix A, General Design Criteria (GDC) 20 and 25 have shown that single failures can cause inadvertent single-rod withdrawals. The intent of this branch technical position is to provide specific guidance toward an acceptable interpretation and application of GDC 20 and 25.

B. Branch Technical Position

GDC 20 requires that the protection system shall be designed to initiate automatically the operation of appropriate systems, including the reactivity control systems, to ensure that specified acceptable fuel design limits are not exceeded as a result of anticipated operational occurrences. GDC 25 requires that these limits shall not be exceeded for any single malfunction of the reactivity control systems, such as accidental withdrawal (not ejection) of control rods. Within the context of GDC 20 the Staff considers operator error to be an anticipated operational occurrence, in addition to the consideration of single malfunction requirements of GDC 25, for which conformance to these requirements is to be evaluated. The applicant should perform analyses of the reactivity control systems¹ and analyze the consequences of operator error to assess the impact of these events on fuel design limits. If the results of these analyses show that specified acceptable fuel design limits may be exceeded for these events, the protection system must be designed to detect and terminate these events prior to exceeding these limits.

With regard to the evaluation of malfunctions within the reactivity control systems, consideration should be given to failures that cause actions as well as prevent actions, such that all possible effects are examined. Further, failures that could lead to single or multiple rod position changes or out-of-sequence rod patterns should be analyzed, as well as failures that could lead to reactivity changes by boron control systems.

¹Reactivity control systems include interlocks within the system that limit the consequences of control system failures.

