Global Nuclear Fuel

A Joint Venture of GE, Toshiba, & Hitachi

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MFN 16-013

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U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555-0001

Subject: **Withdrawal of GESTAR II US Supplement Banked Position Withdrawal Sequence Changes from Amendment 37**

In Reference 1, GNF submitted Amendment 37 to NEDE-24011-P-A, General Electric Standard Application for Reactor Fuel (GESTAR II) and the US Supplement. Amendment 37 contained a number of changes.

One of those changes involved a revision to US Supplement Section S.2.2.3.3.1 to clarify the actions that a plant must take if the plant deviates from the generically analyzed Banked Position Withdrawl Sequence (BPWS) bank notch positions.

GNF is withdrawing those changes from Amendment 37. The GNF technical staff has elected to study these BPWS changes further and potentially perform additional evaluations.

Section S.2.2.3.3.1 in the US Supplement to GESTAR II is affected by this withdrawal. An updated Section S.2.2.3.3.1 has been provided in Enclosure 1 to reflect that the changes requested in Reference 1 have been removed.

If you have any questions about the information provided here, please contact me at (910) 819-6684 or Jim Harrison at (910) 620-1826.

Sincerely,

Brian R. Moore

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Reference:

1. Letter, Andrew A. Lingenfelter (GNF) to Document Control Desk (NRC), Subject: Amendment 37 to NEDE-24011-P-A-19 and NEDE-24011-P-A-19-US, General Electric Standard Application for Reactor Fuel (GESTAR II) and the US Supplement, MFN 13-006, February 13, 2013.

Enclosure:

1. Markup of GESTAR II US Supplement – Non-Proprietary Information – Class I (Public)

cc: J Golla, USNRC
PL Campbell, GEH/Washington
JG Head, GEH/Wilmington
JF Harrison, GEH/Wilmington
PLM Specification NEDE-24011_US Revision 22.1

ENCLOSURE 1

MFN 16-013

Markup of GESTAR II US Supplement

Non-Proprietary Information – Class I (Public) less than once in every one hundred years for every operating BWR. The broad spectrum of postulated accidents is covered by five categories of design basis events. These events are the control rod drop, loss–of–coolant, main steam line break, one recirculation pump seizure, and refueling accident.

S.2.2.3.1 Control Rod Drop Accident Evaluation

There are many ways of inserting reactivity into a boiling water reactor; however, most of them result in a relatively slow rate of reactivity insertion and therefore pose no threat to the system. It is possible, however, that a rapid removal of a high worth control rod could result in a potentially significant excursion; therefore, the accident that has been chosen to encompass the consequences of a reactivity excursion is the control rod drop accident (CRDA). The dropping of the rod results in a high local reactivity in a small region of the core and for large, loosely coupled cores, significant shifts in the spatial power generation during the course of the excursion.

S.2.2.3.1.1 Sequence of Events

The sequence of events and approximate time of occurrence for this accident are described below:

Banked Position Withdrawal Sequence (BPWS) Plants — Event	Approximate Elapsed Time
(a) Reactor is at a control rod pattern corresponding to maximum increment rod worth.	–
(b) Rod pattern control systems (Rod Worth Minimizer, Rod Sequence Control System, or Rod Pattern Controller) or operators are functioning within constraints of BPWS. The control rod that will result in the maximum incremental reactivity worth addition at any time in core life under any operating condition while employing the BPWS becomes decoupled from the control rod drive.	–
(c) Operator selects and withdraws the drive of the decoupled rod along with the other required control rods assigned to the Banked–position group such that the proper core geometry for the maximum incremental rod worth exists.	–
(d) Decoupled control rod sticks in the fully inserted position.	–
(e) Control rod becomes unstuck and drops at the maximum velocity determined from experimental data (3.11 fps).	0
(f) Reactor goes on a positive period and initial power burst is terminated by the Doppler reactivity feedback.	≤ 1 sec.
(g) APRM 120% power signal scrams reactor (conservative; in startup mode APRM scram would be operative + IRM).	–
(h) Scram terminates accident.	≤ 5 sec.

(1) **Banked Position Withdrawal Sequence (BPWS) Plants**:

All plants except those listed in Table S–4 utilize the BPWS. Those Group Notch plants in Table S–4 that have modified their Rod Worth Minimizer (RWM) and have provided a separate submittal to the NRC, which enforces the BPWS as described in Reference S–~~9~~**14**, are included in this group.

Those plants listed in Table S–4 that have implemented the modifications described in Reference S–~~10~~ **15** are also included in this group. Plants that implement the modifications described in Reference S–~~10~~ **15** must modify their technical specifications to assure high operability of their rod pattern control system, review procedures and quality control for second operator substitution, and provide a discussion of this review to the NRC.

To limit the worth of the rod that would be dropped in a BPWS plant, the rod pattern control systems are used below the plant–specific low power setpoint to enforce the rod withdrawal sequence. These systems are programmed to follow the bank position withdrawal sequences (BPWS), which are generically defined in Reference S–~~11~~**16**. Plants that have implemented the BPWS in accordance with Reference S-~~11~~ **16** may also implement the Improved BPWS Control Rod Insertion Process as defined in Reference S-~~100~~**17**.

Group Notch Plants — Event	**Approximate Elapsed Time**
(a) Reactor is at a control rod pattern corresponding to maximum increment rod worth.	–
(b) Rod worth minimizer is not functioning. Maximum worth control blade that can be developed at any time in core life under any operating conditions with the group notch RSCS operational becomes decoupled from the control rod drive.	–
(c) Operator selects and withdraws the control rod drive of the decoupled maximum worth rod along with the other required control rods assigned to its Rod Sequence Control System group such that the proper core geometry for the maximum incremental rod worth exists.	–
(d) Decoupled control rod sticks in the fully inserted position.	–
(e) Blade becomes unstuck and drops at the maximum velocity determined from experimental data (3.11 fps).	0
(f) Reactor goes prompt critical and initial power burst is terminated by the Doppler reactivity feedback.	≤ 1 sec.
(g) APRM 120% power signal scrams reactor (conservative; in startup mode APRM scram would be operative + IRM).	–
(h) Scram terminates accident.	≤ 5 sec.

(2) **Group Notch Plants**

Plants listed in Table S–4 are Group Notch plants. Those Group Notch plants that enforce the BPWS as described in Reference S–~~9~~**14**, are not included in this group. In addition, those plants that have implemented the modifications of Reference S–~~10~~ **15** are also not included in this group.

To limit the worth of the rod that could be dropped in a group notch plant that has not implemented the modifications of Reference S–~~10~~**15**, a group notch rod sequence control system (RSCS) is installed to control the sequence of rod withdrawal. This system prevents the movement of an out–of–sequence rod before the 50% rod density configuration is achieved (except for plants operating in the BPWS mode described in Reference S–~~9~~**14**), and prevents high–control rod worth beyond the 50% rod density configuration by enforcing a group notch mode of rod withdrawal. The 50% rod density configuration occurs during each reactor startup and corresponds to a "checkerboard" rod pattern in which 50% of the rods are fully inserted in the core and 50% are fully withdrawn. The rod drop accident design limit restricts peak enthalpies in excess of 280 cal/gm for any possible plant operation or core exposure.

S.2.2.3.1.2 Analytical Methods.

Techniques and models used to analyze the control rod drop accident (CRDA) are documented in References S–~~12~~**18**, S–~~13~~**19**, S–~~14~~ **20** and S–~~9~~**14**. The information in these documents has been used for the development of design approaches to make the consequences of CRDA acceptable.

(1) Banked Position Withdrawal Sequence (BPWS) Plants

Control rod drop accident (CRDA) results from BPWS plants have been statistically analyzed and documented in Reference S–~~15~~**21**. The results show that, in all cases, the peak fuel enthalpy in an RDA would be much less than the 280–cal/gm design limit even with a maximum incremental rod worth corresponding to 95% probability at the 95% confidence level. Based on these results, it was proposed to the NRC, and subsequently found acceptable, to delete the CRDA from the standard GE BWR reload package for the BPWS plants.

Because of the large margin available to CRDA design limits for BPWS plants, implementation of the advanced physics methods (Reference S–~~16~~**22**) does not result in challenging the 280–cal/gm limit. Therefore, the impact of using the advanced physics methods of Reference S–~~16~~ **22** as compared to the physics methods described in Reference S–~~17~~ **23** on the generic BPWS analysis, is considered negligible. Applicability of the generic BPWS analysis to GE fuel designs is ~~given~~ **provided** in ~~Reference S–2~~**the GESTAR II compliance report for each fuel product line**.