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SHIELDS L. DALTROFF
VICE PRESIDENT
ELECTRIC PRODUCTION

July 27, 1979

Re: Docket Nos.: 50-277
50-278

IE Bulletin 79-12

Mr. Boyce H. Grier, Director
Office of Inspection & Enforcement
Region I
United States Nuclear Regulatory Commission
631 Park Avenue
King of Prussia, PA 19406

Dear Mr. Grier:

This letter serves to provide our response to IE Bulletin 79-12, forwarded to us on May 31, 1979, which concerns short period scrams at BWR facilities. The subject bulletin describes three separate incidents of the event of concern. All three incidents have in common the fact of being initiated by the continuous withdrawal of a control rod when near the point of criticality. Therefore, the solution that we feel appropriate would be adding procedural restrictions forcing the notch withdrawal of control rods at points of expected high notch worths. This solution would be much more conservative and conducive to safety than to attempt to predict criticals. In large loosely coupled low enriched cores, characteristic of GE BWR power reactors, criticality is essentially a local phonomenon dependent upon various reactivity variables (e.g., local xenon distribution, moderator temperatures, etc.). As a result of the strong influence of the time dependent local xenon distribution, it is not felt that an accurate criticality estimate can even be made in the hot xenon recovery situation. This is further demonstrated by the fact that the initial cold criticality prediction at the beginning of cycle is typically one to twenty rods different than the actual critical rod pattern configuration. Additionally, an attempt to predict criticality may be misleading as it induces a false sense of security in the operator in that he will tend to be less vigilant before the

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point of expected criticality is reached; if the prediction is not conservative then one would potentially cause a high worth scram rather than avoiding it. Therefore, Philadelphia Electric's response to the five items in IE Bulletin 79-12 is as follows:

Action To Be Taken By Licensee

Action Item No. 1

Review and revise, as necessary, your operating procedures to ensure that an estimate of the critical rod pattern be made prior to each approach to critical. The method of estimating critical rod patterns should take into account all important reactivity variables (e.g., core xenon, moderator temperature, etc.).

Response

We have reviewed our operating procedures and believe that the withdrawal sequence improvements, as defined in Items 2 and 3 below, would best serve the purpose of reducing the probability of short period scrams. With regard to performing critical predictions, our experience shows that:

a) It is not technically feasible to make an accurate critical prediction (less than $\pm$ 1% K) at the cold beginning of cycle condition, and that an accurate critical prediction taking into account all of the variables of a hot xenon recovery is even more inaccurate.

b) Because of the inherent inaccuracies in the current BWR core physics predictive models, a 'critical' estimate may be in error to the point where it induces a false sense of security in the operator.

Action Item No. 2

Where inaccuracies in critical rod pattern estimates are anticipated due to unusual conditions, such as high xenon, procedures should require that notch-step withdrawal be used well before the estimated critical position is reached and all SRM channel indicators are monitored so as to permit selection of the most significant data.

Response

Since reactor operating experience demonstrates that inaccuracies of one (1) to twenty (20) rods may exist in predicted critical rod pattern estimates, we propose to utilize the Banked Position Withdrawal Sequence (BPWS)

method of rod withdrawals beginning with rod Groups 3 and 4 (75% to [illegible]% rod density) and ending upon criticality. This method serves to minimize the rod notch worth by radially distributing core reactivity increases using a notch out technique at rod positions between rod positions 04 and 12, thereby minimizing the probability of the short period scram. Beyond 50% rod density, no additional restrictions are necessary, as Peach Bottom has installed the RSCS Group Notch System which enforces notch withdrawal of control rods in this regime thereby precluding significant high notch worths. Before 75% rod density, additional restrictions need not be applied, because operating experience has demonstrated that the rod configurations and nuclear coupling conditions necessary to cause a short period scram do not exist prior to reaching Group 3. The inherent withdrawal sequence in this region produces low incremental rod notch worths.

Action Item No. 3

Review and evaluate your control rod withdrawal sequences to assure that they minimize the notch worth of individual control rods, especially those withdrawn immediately at the point of criticality. Your review should ensure that the following related criteria are also satisfied:

a. Special rod sequences should be considered for peak xenon conditions.

b. Provide cautions to the operators on situations which can result in high notch worth (e.g. first rod in a new group will usually exhibit high rod worth).

Response

The use of the Banked Position Withdrawal Sequence (BPWS) for Groups 3 and 4 minimizes the notch worth of individual control rods, especially those withdrawn immediately at the point of criticality.

The rod sequences used at Peach Bottom beyond 50% rod density are developed to minimize rod worths; they are modified versions of the BPWS method that satisfied the Group Notch RSCS constraints. Responses to items a and b are as follows:

a. The current GE RWM rod withdrawal sequences (first 4 groups) 'spiral' in from the periphery to the center thereby reducing the worth of the initial rod for withdrawal in the group. This technique best serves to prevent high notch worth during a cold xenon-free start-up. Consideration has been given to the peak xenon startup and we believe that the previously described Banked Rod Withdrawal scheme best serves the

purpose of minimizing the notch worths during the peak xenon start-up.

b. A caution has been added to the Plant Start-Up procedure (GP-2), which alerts and advises the operators as to the nature of the short period scram. Appropriate procedural changes providing caution to the reactor operator regarding the high worth of the withdrawal of the first rod of a new group have been initiated.

Action Item No. 4

Review and evaluate the operability of your "emergency rod in" switch to perform its function under prolonged severe use.

Response

The "emergency rod in" switch is a General Electric Type SBN switch. This type switch has proven to be a rugged and reliable switch. This switch seldom is used in the insert direction as normal operation does not require its use.

In order to assure the operability of the "emergency rod in" switch during start up, a procedural change providing for one (1) control rod in Group I to be inserted using the "emergency rod in" switch has been initiated. Performing this test during withdrawal of Group I rods will assure the operability of the "emergency rod in" switch before withdrawal of any control rods that could cause criticality to occur.

Action Item No. 5

Provide a description of how your reactor operator training program covers the considerations above (i.e., items 1 thru 3).

Response

a. Response to Item 1.

The effects of the aforementioned (Action Item No. 1) physics parameters on reactivity (and therefore critical rod positions) are thoroughly discussed in the operator license training program and re-qualification training program (annual). This particular training is conducted by our Reactor Engineering staff and by qualified vendors as required.

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b. Response to Item 2.

Procedure GP-2 (Plant Start-Up) includes appropriate precautions when approaching critical under the cold xenon-free conditions and the hot xenon conditions. In particular, GP-2 discusses the use of notch override, notch step withdrawal, and the monitoring of SRM's and IRM's. This procedure is reviewed in detail in license training, requalification training, and prior to a start-up. The operator license and requalification training program emphasizes the need to understand and to follow procedures.

c. Response to Item 3.

The theory of differential rod worth and the conditions which change notch worth are covered in the license training program and requalification training program for reactor operators. The reactor operators are advised by this training to exercise caution and consult with a reactor engineer when high notch worths are experienced. A procedural change to start-up procedure GP-2 and the rod withdrawal sequences, to this effect, has been initiated.

The Reactor Engineering and Core Management groups are continuing their studies which are directed toward improving our predictive capability.

The above described procedural changes are expected to be completed by August 31, 1979.

Very truly yours,

cc: United States Nuclear Regulatory Commission
Office of Inspection and Enforcement
Division of Reactor Operations Inspection
Washington, DC 20555

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