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Mr. Richard C. DeYoung, Director
Office of Inspection and Enforcement
US NRC
Washington, DC 20055

Dear Mr. DeYoung:

Babcock & Wilcox is hereby informing you of the results of an engineering assessment performed to determine the safety significance associated with the potential defeat of the FOGG (Feed Only Good Generator) system. This matter affects only two B&W Projects, Bellefont 1 and 2 for TVA and WNP 1 and 4 for the Supply System. In view of the fact that the NRC is aware of the potential consequences associated with the inability to detect and isolate a damaged steam generator loop (as indicated in IE Bulletin No. 80-40, "Analysis of a PWR Main Steam Line Break With Continued Feedwater Addition," February 8, 1980), we do not believe that 10 CFR21 requires reporting this type of event. However, because B&W has not performed an evaluation to determine whether a substantial safety hazard exists, we are submitting the following to your office for information.

A Preliminary Safety Concern identified two steamline break analyses where the FOGG logic will not isolate EFW (Emergency Feed Water) to the affected steam generator. Failure to terminate EFW to the affected steam generator could potentially lead to containment overpressure or a return to critical which could result in consequences more severe than previous analyses.

The purpose of the B&W FOGG system is to provide automatic protection, in combination with the ESFAS (Engineered Safety Features Actuation System) main steam and feedwater isolation functions, for steam line breaks. The FOGG system's functional design goal was to diagnose the affected steam generator and to isolate EFW to the affected steam generator.

The B&W FOGG system has the following control logic:

Steam Generator (SG) Pressure	Control Action on EFW
Both SG $\geq$ 600 psig	EFW is added to both SGs
One SG $\geq$ 600 psig and one SG $\leq$ 600 psig	EFW is added to only the SG which is $\geq$ 600 psig
Both SGs $\leq$ 600 psig	EFW is added to both SGs

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As indicated, the control actions provided by the FOGG system are based on the continuously monitored SG pressure. Consequently the FOGG system will align EFW as SG pressure conditions change during the transient. A defeat of the FOGG system, wherein EFW would be supplied to the affected SG, will evolve during a steam line break accident if the secondary side pressure of both steam generators decreases below 600 psig. If the FOGG system is defeated, high reactor building pressures could result from steam line breaks within the containment building and a return to critical could occur due to an excessive amount of overcooling.

Previous SAR analyses of large steam line breaks indicated that for the time period analyzed the FOGG system performs its intended function. However, more recent analyses performed in response to reference 1* have indicated that when the time period investigated is extended a defeat of the FOGG system can occur.

These analyses maintained conservative SAR assumptions, i.e., high EFW flow, no SG level control etc., but used realistic reactivity addition for rod insertion which maximizes the potential for void formation in the primary system. Analyses of a limited number of small steam line breaks have also indicated the potential for a defeat of the FOGG system.

Analyses performed for the steam line break accident were reviewed, and it was determined that numerous conservative assumptions were made which contributed to the calculated defeat of the FOGG system. These conservative assumptions can lead to defeat of the FOGG system in less than 10 minutes which in today's licensing environment, precludes taking credit for operator action to terminate the transient. The analyses assumed EFW flow rates which are higher than the actual anticipated flow rates and the steam generator level control was assumed to be failed for the duration of the transient. The latter assumption results in an overfeed of EFW to one or, for small steam line breaks, both SGs. Since the EFW controls are safety related equipment, they will be qualified for use during design basis events such as a steam line break. Therefore, in order for this assumption to be true, single or multiple failures within the safety related EFW controls or equipment must also occur in addition to the typical failures considered for steam line break analyses eg's LOOP, failure of HPI pump.

Specifically, for steam line break transients the main safety concerns are the effect on the reactor building pressure and the potential for a return to critical which results in core damage. The review of previous steam line break analyses revealed

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*1 - H. R. Denton Letter to All B&W Plants With CPs, 10 CFR 50.54f Order Regarding the Design Adequacy of B&W NSS Utilizing the OTSG, October 25, 1979.

that the reactor building pressure does not normally approach design values. Therefore, even if the FOGG system is subsequently defeated later in the transient, the reactor building can withstand additional mass and energy release for a finite period of time. Also if less conservative assumptions, i.e., use of only one single active failure, were used in the analyses (1) FOGG defeat may not occur and (2) if FOGG defeat did occur it would not be expected until later in the accident such that adequate time is available for justification of operator action to prevent exceeding the reactor building pressure design limit.

The review of previous SAR overcooling analyses also indicated that minimum subcritical margins, and therefore the potential for a return to critical, occurs shortly after (less than 60 sec) the steam line break accident is initiated. These analyses have also shown that during this time period the FOGG system is not defeated. If the FOGG system is defeated and the reactor returns to critical later in the accident, core damage could potentially occur. However, it is believed that if the thermal-hydraulic analyses were performed using peaking distributions obtained from spatial kinetics codes, that core damage, if any, would be within the acceptance criteria for steam line break accidents. In addition, if the analyses were performed using less conservative assumptions but still adhering to single failure licensing criteria (i.e., (1) failure of SG water level control and two HPI pumps available or (2) failure of one HPI pump and SG level control available) the potential for a FOGG defeat would be diminished and a return to critical would not be anticipated should a FOGG defeat occur. This latter expectation is based in part on the fact that a FOGG defeat is more likely when single failures are postulated which effect secondary side performance (eg., failure which results in a EFW overfill condition). For these circumstances, the negative reactivity insertion due to the injection of borated water by means of the high pressure injection (HPI) system may more than compensate for the reactivity changes caused by the overcooling associated with the defeat of the FOGG system.

Using engineering judgement, it is thus concluded that a defeat of the FOGG system during SLB accidents is not likely to cause a return to critical which results in unacceptable core damage and that operator action can be accounted for to prevent exceeding the reactor building design pressure for breaks inside containment.

Since the defeat of the FOGG system results in more dependence on timely operator action to ensure the mitigation of steam line break accidents, the FOGG system will be modified to eliminate the above described potential concern.

The proposed modified design consists of implementing a steam generator pressure difference to supplement the present FOGG system logic. This feature will result in isolating EFW to the steam generator which is at the lower pressure and will result in eliminating the need for operator action when the pressure in both steam generators decreases below 600 psig. Steam line break analyses will then be performed to establish the setpoint for the steam generator pressure difference and FOGG operation will be verified.

If you have any questions or comments on this information, please feel free to contact me on (804) 385-2817.

Very truly yours,

J H Taylor

J. H. Taylor
Manager, Licensing

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cc: R. B. Borsum