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U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Document Control Desk

Subject: Response to Request for Additional Information Regarding Determination of Dynamic Component Setpoint Uncertainties

Braidwood Station Units 1 and 2
Byron Station Units 1 and 2
NRC Docket Numbers: 50-456/457 and 50-454/455

Reference: G. Dick letter to I. Johnson dated May 5, 1997, transmitting Request for Additional Information Regarding Determination of Dynamic Component Setpoint Uncertainties

In the reference letter the Nuclear Regulatory Commission (NRC) transmitted a Request for Additional Information (RAI) regarding the determination of dynamic component setpoint uncertainties at Byron and Braidwood Stations. Attached is the Commonwealth Edison Company's response. If you have any questions concerning this correspondence, please contact this office.

Sincerely,

John B. Hosmer

John B. Hosmer
Engineering Vice President

Attachment

cc: G. Dick, Byron/Braidwood Project Manager - NRR
S. Burgess, Senior Resident Inspector - Byron
C. Phillips, Senior Resident Inspector - Braidwood
A.B. Beach, Regional Administrator - RIII
Office of Nuclear Safety - IDNS

A001

Attachment

1. **For both Byron and Braidwood, list all safety related protection channels that use dynamic components (e.g., Overtemperature Delta-T (OTΔT), Overpower Delta-T (OPΔT) and low pressurizer pressure). For each channel credited in the UFSAR, Chapter 15, or other accident analyses, if a trip function associated with dynamic components is credited as the primary trip, discuss whether another channel trip function without dynamic components could provide the same protection (e.g., low pressurizer pressure is credited; however, low pressurizer level would also be expected to actuate).**

The Byron and Braidwood safety related protection channels that use dynamic components are:

- Overtemperature Delta-T
- Overpower Delta-T
- Pressurizer Pressure Low
- Steam Line Pressure Low
- Low-Low Tavg

The following Chapter 15 events depend on one of the above protection channels for their primary trip

- Steam Line Break (Hot Zero Power): UFSAR section 15.1.5 credits the Safety Injection from ESF as the primary trip for this event. The Steam Line Pressure Low trip input to Safety Injection initiation contains dynamic components. The following potential trip, that does not contain dynamic components and results from this event, is available: Power Range High Flux trip.

- Turbine Trip (with pressure control & maximum reactivity): UFSAR section 15.2.3 credits the Overtemperature Delta-T channel as the primary trip for this event. The following potential trips, that do not contain dynamic components and result from this event, are available: Pressurizer Pressure High Pressure trip, Pressurizer Water Level High trip (above P7), Steam Generator Level Low-Low trip, and Turbine Trip (above P8).

- Single RCCA Withdrawal at Power: UFSAR section 15.4.3 credits the Overtemperature Delta-T trip as the primary trip for this event. The following potential trip, that does not contain dynamic components and results from this event, is available: Power Range High Flux trip.

- CVCS Malfunction - Decrease in Boron Concentration: UFSAR section 15.4.6 credits the Overtemperature Delta-T channel as the primary trip for this event at power. The following potential trip, that does not contain dynamic components and results from this event at power, is available: Power Range High Flux trip.

- Inadvertent ECCS Operation at Power (DNBR Case): UFSAR section 15.5.1 credits the Pressurizer Pressure Low Pressure trip as the primary trip for this event. The following potential trips resulting from this event are available: Safety Injection from ESF. However, since it is expected that the Safety Injection would result from the Pressurizer Pressure Low Pressure trip, there are no other associated channel trip functions that do not contain dynamic components.

- Inadvertent ECCS Operation at Power (Pressurizer Fill Case): UFSAR section 15.5.1 credits the Safety Injection initiation from ESF as the primary trip for this event. The Safety Injection function is initiated by the Steam Line Low Pressure trip or Pressurizer Pressure Low trip, where both channels contain dynamic components, and by the Containment Pressure High-1 trip, which contains no dynamic components. Since Containment Pressure High-1 is not expected to initiate the Safety Injection, there are no other channel trip functions associated with this event that do not contain dynamic components.

- Inadvertent Opening of Pressurizer Safety or Relief Valve: UFSAR section 15.6.1 credits the Overtemperature Delta-T trip as the primary trip for this event. The Pressurizer Pressure Low Pressure trip is also a potential trip resulting from this event. No other trip resulting from this event is identified that includes a channel without dynamic components.

- Steam Generator Tube Rupture (Offsite dose Case): UFSAR section 15.6.3 credits either the Overtemperature Delta-T or the Pressurizer Pressure Low Pressure trip, which ever is limiting, as the primary trip for this event. No other trip resulting from this event is identified that includes a channel without dynamic components.

- Steam Generator Tube Rupture (Margin to overfill case): UFSAR section 15.6.3 credits the Overtemperature Delta-T trip or the Pressurizer Pressure Low Pressure trip, which ever is limiting, as the primary trip for this event. No other trip resulting from this event is identified that includes a channel without dynamic components.

- Large Break LOCA: UFSAR section 15.6.5.2.1 credits the Pressurizer Pressure Low Pressure trip (above P7) as the primary trip for this event. The following potential trip, that does not contain dynamic components and results from this event at power, is available: Safety Injection from ESF where the Safety Injection is initiated from the Containment Pressure High-1 trip.

- Small Break LOCA: UFSAR section 15.6.5.2.2 credits the Pressurizer Pressure Low Pressure trip (above P7) as the primary trip for this event. The following potential trip, that does not contain dynamic components and results from this event at power, is available: Safety Injection from ESF where the Safety Injection is initiated from the Containment Pressure High-1 trip.

2. **Describe the process used to account for dynamic component setpoint uncertainties in the Braidwood UFSAR accident analyses. Include in this discussion, dynamic components in channels other than the OPΔT. This information should be sufficient for the Staff to verify that the use of dynamic testing and the acceptance criteria are bounded by the FSAR accident analyses.**

The Byron and Braidwood protection system setpoints were evaluated based on the setpoint methodology outlined in the "Westinghouse Setpoint Methodology for Protection Systems, December 1982". The methodology is based on the SRSS and combining of dependent and independent allowances. This methodology has been reviewed previously by the Staff and found to be acceptable. Changes to the Byron Unit 1 and Braidwood Unit 1 Technical Specifications, approved by a letter dated March 25 1992, revised the D4 Steam Generator Low-Low trip setpoint. This change was consistent with Westinghouse Topical Report WCAP-12583, "Westinghouse Setpoint Methodology for Protection Systems, May 1990" and an updated setpoint methodology that accounted for additional uncertainties in steam generator level. WCAP-12583 used a setpoint methodology consistent with previous Byron and Braidwood applications and was approved with the D4 setpoint change.

Commonwealth Edison Company performed a self-initiated setpoint reconciliation program in 1991 which was consistent with the setpoint methodology presented in WCAP-12583. The setpoint reconciliation program incorporated plant specific error terms and assumptions, and represented plant as-built conditions and surveillance requirements. The Staff found the allowable values and setpoints developed by this program to be acceptable and a Technical Specification amendment was approved April 13, 1993.

The setpoint methodology used by Byron and Braidwood is consistent with the Westinghouse safety analyses. The equations used to determine the channel statistical analysis term, or total channel error, and the associated allowable value do not incorporate specific terms for dynamic component uncertainties. In the non-LOCA safety analysis, most parameters are set to their nominal values. Selected key

parameters, which are determined to be important to the analysis results, are identified and the values used in the analyses for these parameters are set in a conservative fashion to demonstrate that the applicable safety criteria are met. The remaining parameters are analyzed as nominal values. It is not necessary for conservative values of these parameters to be analyzed. Westinghouse has concluded that the analyses that model nominal values for the dynamic compensation terms at Byron and Braidwood are sufficiently conservative and that no additional analyses need to be performed. This method yields a sufficiently conservative licensing basis.

The surveillance program implemented at Byron and Braidwood ensures that the channel functions, including the nominal time constant values and the required channel calibration accuracies, are periodically verified in accordance with the Technical Specification requirements.

3. **Describe the process used to combine dynamic component setpoint uncertainties with static component setpoint uncertainties to establish TS acceptance criteria. If the dynamic component setpoint uncertainties are not included in the TS acceptance criteria, describe the process by which these uncertainties are included in the Braidwood trip setpoints.**

The setpoint methodology used by Byron and Braidwood is consistent with the Westinghouse setpoint methodology provided in Westinghouse Topical Report WCAP-12583. This methodology requires that the as-left condition of the instrument channel and protective function be maintained within a specific calibration tolerance. This tolerance sets limits on how much the as-left trip setpoint can deviate from the nominal safety system setting. The Westinghouse methodology combines this tolerance and other applicable errors and uncertainties to obtain a Channel Statistical Allowance (CSA), or total channel accuracy. The CSA term is then used to ensure that the trip setpoint is sufficiently conservative to provide an acceptable level of confidence that a Safety Analysis Limit will not be exceeded. The calibration tolerance is described by 2 terms in the Westinghouse setpoint methodology. The Rack Calibration Accuracy (RCA) term is the accuracy that can be expected during a calibration at reference conditions. The Rack Comparator Setting Accuracy (RCSA) term is the tolerance on the precision with which a comparator trip value can be set. In the Westinghouse methodology these terms refer to the static accuracy of the instrument channel and ensure that a bistable output will occur prior to exceeding a specific process value or condition. The dynamic uncertainties, or the time at which this bistable output will occur, are not included with the static component setpoint uncertainties. As described in the response to question 2, deviation from the nominal dynamic values (time constants) is not incorporated in the Westinghouse model and the result is sufficiently conservative to justify not including the dynamic uncertainties resulting from deviation from these nominal dynamic values. The Westinghouse setpoint methodology determines a sufficiently conservative protection setpoint to ensure that Safety Analysis Limits are not exceeded.

The calibration methodology utilized by Braidwood is unique in that the static calibration accuracy and the dynamic calibration accuracy do not have to be performed separately. In fact, the effects of the static components and the dynamic components cannot readily be separated and analyzed independently. The MESAC calibration system provides a

constant rate of change input signal, and looks at the channel operation resulting from the simultaneous action of the static and dynamic components. Deviation from the nominal trip setpoint or deviation from the nominal time constant values will produce the same effect on the static tolerance of the protection channel. For example, a positive error in the static accuracy of the channel will cause the bistable to trip slightly higher than the nominal trip setpoint. Similarly, for an increasing setpoint, a slightly slower dynamic response will result in a slightly higher than nominal trip setpoint. Regardless of what actually caused the slightly higher trip setpoint, the Westinghouse methodology sets limits on how high the setpoint may be and still be conservative with respect to the Technical Specifications (effectively ensuring that a Safety Analysis Limit will not be exceeded at a 95% confidence level). Using the Braidwood MESAC calibration system, it is not necessary to separately analyze the static and dynamic uncertainties since their effect on the static trip setpoint will be identical. The combination of both types of uncertainties must not exceed the RCA and RCSA terms used in determining the total channel accuracy, this in turn will ensure that the static setpoint is not left less conservatively than required by the setpoint methodology.

Since it is unnecessary to separate the effects of the static and dynamic uncertainties, the implementation of the Westinghouse methodology at Braidwood evaluates the combined effects of the static and dynamic uncertainties to ensure that the required as-left condition of the channel is met regardless of which uncertainty causes a deviation in the nominal trip setpoint. Thus, the actual RCA and RCSA terms used in the Braidwood setpoint methodology for channels that have dynamic components may result either entirely from a static error, entirely from a dynamic error or most probably from a combination of the two. This implementation of the RCA and RCSA terms as a combination of the static and dynamic uncertainties results in the inclusion, and not the isolation, of the dynamic uncertainties in the Braidwood setpoint methodology.

4. **For both Byron and Braidwood, describe the process used to account for the effect of dynamic component uncertainties on channel total uncertainty determinations during periodic surveillances.**

As described in the response to question 2, the dynamic component uncertainties resulting from deviations from the nominal time constant are not modeled in the Westinghouse safety analyses. At Byron, the performance of the dynamic components is verified separately from the performance of the static components during calibration and functional testing of the instrument channel. At Byron, the time constants are maintained within ± 10% of the nominal value, which is consistent with initial start-up recommendations provided by Westinghouse.

As described in the response to question 3, separate dynamic and static errors are not easily obtained and not necessary for evaluating the performance of Braidwood protection channels containing dynamic components. Due to the MESAC testing system, the RCA and RCSA terms used in the setpoint methodology combine the effects of maintaining the nominal time constants (within ±3%), with any static uncertainty. This results in the inclusion of the dynamic uncertainty and resulting additional conservatism when determining the CSA term, the allowable value and the required Technical Specification setpoint.