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Nuclear Westinghouse Division

An advisory notice of a recent technical development pertaining to the installation or operation of Westinghouse-supplied Nuclear Plant equipment. Recipients should evaluate the information and recommendation, and initiate action where appropriate.

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Subject: UNDERVOLTAGE TRIP PROTECTION			Number: NSD-TB- 92-03-RO
System(s): REACTOR PROTECTION SYSTEM			Date: 05/15/92
Affected Plants: ALL PLANTS WITH UNDERVOLTAGE PROTECTION			S.O.(s): 386
References: TECHNICAL SPECIFICATIONS	Affects Safety Related Equipment: Yes [X] No [ ]		Sheet: 1 of 3

BACKGROUND INFORMATION

It has been brought to the attention of Westinghouse that there may be confusion at some plants about the Reactor Trip System Response Time accounted for in the plant Safety Analyses and listed in the plant Technical Specifications for the Reactor Coolant Pump (RCP) Undervoltage Trip function. The confusion is a result of the interpretation of the definition of response time in the plant Technical Specifications, wording in some plant's Bases section of the plant Technical Specifications, and the unique accounting of channel response time in the Safety Analyses for the Complete Loss of Flow accident scenario which credits the Undervoltage Trip function.

The definition of Reactor Trip System Response Time in the Technical Specifications is: "The REACTOR TRIP SYSTEM RESPONSE TIME shall be the time interval from when the monitored parameter exceeds its trip setpoint at the channel sensor until loss of stationary gripper coil voltage." Westinghouse analysis interprets loss of stationary gripper coil voltage to mean "rods are free to fall." Based on this definition of response time and the response time values listed in the Technical Specifications, plants typically write response time test procedures to test and verify that channels are in compliance with the Technical Specifications.

The RCP Undervoltage Trip channel response time, like other channel response times in the Technical Specifications, is the same value as accounted for in the Safety Analyses crediting that channel. Typically, Safety Analyses response times includes hardware related time only. However, the response time accounted for in the Safety Analysis for the Complete Loss of Flow Accident is unique in that non-hardware related times are included in the total analyzed time. Included in the response time for the Complete Loss of Flow Safety Analysis is an allowance for the anticipated time it would take for the

Additional Information, if Required, may be Obtained from the Originator. Telephone 412- 374-6457 or (WIN) 284-6457

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Domestic Customer Projects

Undervoltage Relay to detect a loss of voltage when there is an instantaneous loss of bus voltage. When the supply voltage to the Reactor Coolant Pumps is lost instantaneously, the potential exists for the RCP's, or other loads on the bus, to generate an Electro-Motive Force (EMF) back onto the bus during coastdown. The effect of this back EMF is to cause the voltage across the bus to decay at some finite rate instead of instantaneously. The Undervoltage Relay may not detect the instantaneous loss of voltage but may be influenced (held up) by the EMF being generated by the bus loads. This will cause a delay in the time it takes for the bus voltage to decay to a value below the Undervoltage Relay Trip setpoint (this is not to be confused with the intentional time delay set into the Undervoltage Relay actuation to prevent spurious trips due to momentary fluctuations in bus voltage). Based on the definition of response time in the Technical Specifications, the monitored parameter has exceeded its trip setpoint, but the channel sensor (Undervoltage Relay) is unable to detect this due to the back EMF.

RECOMMENDED ACTION

The Safety Analysis assumes a total time response of either 1.2 or 1.5 seconds depending on the plant and analysis, and this is the time response that is listed in the plant Technical Specifications. This time is comprised of several components.

a) The EMF delay from the time of the loss of bus voltage until the EMF generated by the bus loads has decayed to a value less than the Undervoltage Trip setpoint.

b) The inherent Undervoltage sensing circuitry time delay (including time for Measurement & Test Equipment) from the time the Undervoltage Trip setpoint is reached until an Undervoltage Reactor Trip signal is generated. This value is based on the manufacturer's specifications for all the components used in the Undervoltage circuitry.

c) The intentional time delay set into the Undervoltage Relay actuation to prevent spurious reactor trips from momentary electrical power transients.

d) The time delay for the Reactor Trip Breaker to open and the RCCA grippers to release.

These values are added to obtain a total time response for the RCP Undervoltage Relay channels. Of these values, the EMF delay time (a) and the RCCA gripper release time component of (d) are not determined during surveillance testing for Technical Specification Compliance of the channel time response.

Westinghouse assumes that the sites have accounted for the bus decay time for their particular plant configuration and the gripper release time of 150 ms when preparing the test procedure for the Undervoltage response time. Westinghouse assumes an allowance for the bus decay time in

the analyses, but the actual bus decay time should be determined for each plant based on knowledge of bus loads which would contribute to the decay time. Plant testing procedures typically require testing of the channel hardware only. Therefore, if the channel hardware is tested within the total Safety Analysis times minus the bus decay time, the total time accounted for will not exceed the Safety Analysis time.

Westinghouse recommends that plants review their procedures to verify that bus decay time is applicable to their plant bus configuration and properly accounted for in plant test procedures.