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DAVIS, A. B.	Region 3, Ofc of the Director

SUBJECT: Forwards results of analysis of instrument response time Unresolved Issues 282/88012-02 & 306/88012-02, per Insp Repts 50-282/88-12 & 50-306/88-12. Response time testing issue also determined for Monticello.

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SUBJECT: Forwards results of analysis of instrument response time per Insp Repts 50-282/88-12 & 50-306/88-12.

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	NRR/DREP/EPB 10	1	1	NRR/DREP/RPB 10	2	2
	NRR/PMAS/ILRB12	1	1	NUDOCS-ABSTRACT	1	1
	OE LIEBERMAN,J	1	1	ELD/HDS2	1	1
	OGC/HDS2	1	1	REG FILE 02	1	1
	RES MORISSEAU,D	1	1	RGN3 FILE 01	1	1
EXTERNAL:	LPDR	1	1	NRC PDR	1	1
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October 31, 1988

Unresolved Items 282/88012-01
306/88012-02

Mr A Bert Davis, Regional Administrator
US Nuclear Regulatory Commission Region III
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Glen Ellyn, Illinois 60137

MONTICELLO NUCLEAR GENERATING PLANT
DOCKET NO. 50-263 LICENSE NO. DPR-22

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
DOCKET NOS. 50-282 LICENSE NOS. DPR-42
50-306 DPR-60

Response Time Testing of Instrumentation

Reference: (a) Letter dated August 22, 1988 from Mr W L Axelson, Chief, Projects Branch 2, Region III, USNRC, Inspection Reports 50-282/88012(DRP) & 50-306/88012(DRP)

The purpose of this letter is to provide you with the results of an analysis of instrument response time issues completed by our Nuclear Analysis Department and plant technical staffs. These issues were identified as unresolved issues 282/88012-01 and 306/88012-02 in Reference (a).

Our analysis of the six issues identified in Reference (a) is provided in the attached report. As noted in the report, additional confirmation and testing will be required at the Prairie Island plant to fully address these issues. This additional work will be completed by the end of the next Unit 2 outage (about April 26, 1989) unless testing of installed equipment in Unit 1 is required. If testing of Unit 1 equipment is necessary, all work will be completed prior to the end of the next Unit 1 outage (about February 7, 1990).

IE01

Please contact us if you have any questions related to our resolution of these issues.

C E Larson
Vice President Nuclear Generation

c: Sr NRC Resident Inspectors
NRC-NRR Project Managers
G Charnoff

Attachment

RESPONSE TO RESPONSE TIME TESTING ISSUES

(1) Determine the process instrument channels that were assumed to mitigate the most limiting transients analyzed in the USAR.

Monticello

There are seven SCRAM signals considered for the USAR chapter 14 transients, which are: high neutron flux, turbine stop valve (TSV) closure, turbine control valve (TCV) fast closure, main steam line isolation valve (MSIV) closure, high vessel pressure, low vessel level and high vessel level. High vessel level results in a turbine trip, indirectly causing a SCRAM. Of the seven, only high neutron flux, TSV closure and TCV fast closure are assumed to mitigate the most limiting transients analyzed in the USAR.

The MSIV closure SCRAM is assumed disabled for the MSIV closure transient and is not used for other transients. The high vessel pressure SCRAM is not used because transients SCRAM on high neutron flux before the high pressure setpoint is reached. The low vessel level SCRAM is not used by any limiting transients. The high vessel level is used in the feedwater controller failure transient, but does not significantly affect the MCPR. In the feedwater controller failure, high level causes a turbine trip and the TSV closure then causes the SCRAM. The high level signal instrument response time only governs when the turbine trips; the MCPR depends on the TSV closure and the SCRAM.

Prairie Island

There are ten trip signals considered for the USAR chapter 14 transients, which are: high neutron flux, high negative flux rate, overpower delta-T, overtemperature delta-T, low reactor coolant (RC) flow, reactor coolant pump (RCP) undervoltage, high pressurizer pressure, low pressurizer pressure, low-low steam generation (SG) level and high pressurizer level. Of these only the high neutron flux, high negative flux rate, overpower delta-T, overtemperature delta T, low pressurizer pressure and the low RC flow are assumed to mitigate the most limiting transients analyzed in the USAR.

The RCP undervoltage trip is used in the 2/2 pump trip transient. A change in the RCP undervoltage trip time delay will not reduce margins because the low RC flow trip would prevent this transient from becoming most limiting. The high pressurizer pressure trip is used to terminate the loss of load-turbine trip transient which is an overpressurization transient.

The pressurizer safety valves limit the pressure; therefore, a change in the high pressurizer pressure trip delay will not significantly effect the margin to limits. The low-low SG trip is used in the loss of A.C. power and loss of normal feedwater transients. These events are both over 1.5 hours long and are backed up by the overpower delta-T trip function, therefore, they are not sensitive to the low-low SG trip delay time. The high pressurizer level trip is not used in any of the chapter 14 transients.

(2) Determine the total channel response times for these instrument channels from plant data, type testing data, or actual performance.

Monticello

Table 1 shows the best estimate and the reload safety evaluation (RSE) SCRAM delay times which mitigate the most limiting transients. The SCRAM delay times consist of three parts: sensor delay, which is the time from a condition physically existing until the sensor contact changes; logic delay, which is the time from the sensor contact changing until de-energization of the SCRAM solenoids; and motion delay, which is the time from de-energization of the SCRAM solenoids until the control rods move.

The logic delay is tested each refueling outage and the average logic delay is 34 ms. The motion delay is measured as part of the control rod SCRAM time, which is required by Technical Specifications to be measured once per cycle. The best estimate motion delay is estimated to be 100 msec. Both the logic and motion delays are the same for all SCRAMs.

The high neutron flux sensor delay is measured each cycle and the average sensor delay is 12 ms. The TSV closure SCRAM is initiated by a mechanical switch mounted on the TSV. Since the switch is on the valve stem, the sensor delay is assumed to be 0.0 seconds. The TCV sensor was type tested in October, 1988 with the average of three reading giving 9.3 msec.

Prairie Island

Table 2 shows the best estimate and the RSE trip delay times which mitigate the most limiting transients. The trip delay times consist of three parts: sensor delay, which is the time from a condition physically existing until the sensor responds; logic delay, which is the time from when the sensor responds until trip signal is sent to the trip breakers; and motion delay, which is the time from trip signal is sent to the trip breakers until the trip breakers open causing gripper coil to lose voltage. A second time is used in the analysis which is the control rod drop time, which is the time from trip breakers open causing gripper coil to lose voltage until the control rods reach rod bottom. This definition includes the gripper release time as part of the control rod drop time and not as part of the trip delay time as defined by the USAR. The definition used here is consistent with the way the plant measures control rod drop times and the input to our transient analysis code. The gripper release time is estimated to be 0.15 seconds, therefore, the USAR values are 0.15 seconds larger than shown on Table 2.

The motion delay is measured each outage and the average value is 0.082 seconds for PI 1 and 0.079 seconds for PI 2. This is the same for all trip delays.

The high neutron flux and high negative flux rate sensor delays are not measured but the estimated values are assumed to be negligible with respect to the total trip delay time. The logic delay is measured each outage with the average values shown on Table 2.

The overpower delta-T and overtemperature delta-T sensor delays are made up of two parts. First is the transport delay required for a change in the coolant temperature at the core exit to propagate to the RTD manifold. A very conservative value of 2.0 seconds is assumed. The RTD response time is assumed to be 2.3 seconds for Unit 1 and 0.5 seconds for Unit 2 which comes from the design specifications. Units 1 and 2 do have different types of RTD's. This will result in sensor delays of 4.3 seconds for Unit 1 and 2.5 seconds for Unit 2. The logic delays are measured each outage and the average values are shown on Table 2.

The low pressurizer pressure sensor delay is assumed to be 0.40 seconds which is the design specification for the sensor. The logic delays were measured at plant startup and are listed on Table 2. The values are believed to be conservative.

The low RC flow sensor delay is assumed to be 0.20 seconds which is the design specification for the sensor. The logic delays were measured at plant startup and are listed on Table 2. The values are believed to be conservative.

TABLE 1

Monticello SCRAM's (in msec)

SCRAM Signal	Sensor Delay		Logic Delay		Motion Delay		Total Scram Delay	
	Best Est.	RSE	Best Est.	RSE	Best Est.	RSE	Best Est.	RSE
High neutron flux	12	60	34	50	100	200	146	290*
TSV Closure	0	10	34	50	100	200	134	260
TCV Closure	9	30	34	50	100	200	143	280

* The maximum high neutron flux sensor and logic response time is 90 ms rather than the sum of the sensor (60 ms) and the logic (50 ms) response times.

TABLE 2

Prairie Island Trip Delays (seconds)

Trip Function	Unit	Best Estimate: Sensor Delay	Logic Delay	Motion Delay	Total Trip Delay	RSE Value
High Neutron Flux						
High Setpoint	1	0.0	0.028	0.082	0.110	0.35
	2	0.0	0.023	0.079	0.102	0.35
Low Setpoint	1	0.0	0.028	0.082	0.110	0.35
	2	0.0	0.032	0.079	0.110	0.35
High Negative Flux Rate	1	0.0	0.171	0.082	0.253	0.35
	2	0.0	0.155	0.079	0.235	0.35
Overpower Delta-T	1	4.3	0.200	0.082	4.582	5.85
	2	2.5	1.480	0.079	4.080	5.85
Overtemperature Delta-T	1	4.3	0.256	0.082	4.638	5.85
	2	2.5	1.551	0.079	4.130	5.85
Low Pressurizer Pressure	1	0.4	0.120	0.082	0.602	0.85
	2	0.4	0.094	0.079	0.573	0.85
Low RC Flow	1	0.2	0.064	0.082	0.346	0.45
	2	0.2	0.064	0.079	0.343	0.45

(3) Determine from the above data, that the plants are not operating in an unanalyzed condition.

Monticello

The SCRAMs which are used to mitigate the limiting transients have significantly lower total SCRAM delay times than the values used for the RSE, as shown in Table 1. The values used in the RSE analysis do account for the entire delay time. Therefore, Monticello is not operating in an unanalyzed condition.

Prairie Island

The trips which are used to mitigate the limiting transients have significantly lower total trip delay times than the values used for the RSE as shown in Table 2. The values used in the RSE analysis do account for the entire delay time. Therefore, Prairie Island is not operating in an unanalyzed condition.

(4) Determine if changes in response time testing methodology are warranted.

Monticello

The high neutron flux SCRAM delay is currently measured each outage, so no change is needed. The TSV closure is a mechanical switch on the valve stem, so no additional measurement is necessary.

The TCV closure delay was measured to be 9 msec; a value of 30 msec is used in the RSE analysis, which is very conservative.

Furthermore, substantial additional conservatisms exist in the assumptions used in modeling this event.

The model assumes that the scram signal is initiated 30 msec after the control valves actually start to close. The switches that initiate the SCRAM sense the control signal to the valves at the acceleration relay, where the fast closure signal originates. This means that the switches "see" the valve closure demand prior to the signal reaching the valves. Other testing and documentation indicates that the time from initiating the closure signal to actual valve movement is in the range of 60 to 100 msec. Thus, in reality, even with the conservative switch response time of 30 msec, the SCRAM signal will likely be generated before the control valves even begin to move.

LMT

Given this level of conservatism, it is reasonable to conclude that periodic response time testing of these switches to detect age-related degradation is not required. The routine testing and calibration required by Technical Specifications would be sufficient to detect response time testing degradation.

Prairie Island

Some of the delay times shown on Table 2 are based on manufacturers data and design specifications. These delay times will be confirmed using one or more of the following sources:

- Manufacturers data
- Industry data
- Type testing
- Testing of actual installed equipment
- Analysis

This confirmation will be done for both units by the end of the 1989 Unit 2 refueling outage. However, if testing of installed equipment on Unit 1 is needed, the trip delay times for Unit 1 will be confirmed by the end of the 1990 Unit 1 refueling outage.

It is not clear at this time whether a change in the response time testing program is needed or not. This question will be answered when it is determined how the trip delay times are confirmed.

(5) Determine if any changes are required to the safety analysis, Technical Specification response time definition, Technical Specification Basis, and surveillance testing.

Monticello

Based on the previous response no changes are required.

Prairie Island

The Prairie Island staff believes no changes are needed to the safety analysis, technical specifications, response time definition or technical specification basis.

The analysis needed to confirm the trip delay times will also be used to determine if changes are needed to surveillance testing. This will be determined by the end of the 1989 Unit 2 outage.

(6) Develop a schedule for implementing any of the above changes.

Monticello

There are no changes necessary, therefore, no schedule is required.

Prairie Island

The schedule is listed under the previous sections.