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SUBJECT: Provides documentation required by 10CFR50.62 necessary to demonstrate compliance w/ATWS rule for alternate rod injection (ARI) sys. ARI sys utilizes sensors & initiation logic of recirculation pump trip mods reviewed & approved.

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10 CFR Part 50
Section 50.62(c)(6)

Director
Office of Nuclear Reactor Regulation
U S Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D C 20555

MONTICELLO NUCLEAR GENERATING PLANT
Docket No. 50-263 License No. DPR-22

Anticipated Transients Without Scram
Alternate Rod Injection System Documentation

Reference: (a) Letter from D M Musolf (NSP) to the Director of NRR dated October 11, 1985, "Schedule for Compliance with 10 CFR Part 50, Section 50.62, "Requirements for Reduction of Risk form Anticipated Transients Without Scram (ATWS) Events for Light-Water Nuclear Power Plants." "

(b) Letter from L O Mayer (NSP) to D L Ziemann (NRC) dated September 15, 1976, "Completion Response to 8/21/75 NRC Letter on Anticipated Transients Without Scram (ATWS)"

(c) Letter from K R Goller (NRC) to L O Mayer (NSP) dated February 23, 1977, "Safety Evaluation by the Office of Nuclear Reactor Regulation, Supporting Installation of Recirculation Pump Trip Modification"

(d) Letter from D M Musolf (NSP) to the Director of NRR dated June 22, 1987, "License Amendment Request Dated June 22, 1987, ATWS Rule Requirements"

(e) Letter from G Lainas (NRC) to T A Pickens (BWROG) dated October 21, 1986, "Acceptance for Referencing of Licensing Topical Report NEDE-31096-P, "Anticipated Transients Without Scram; Response to NRC ATWS Rule, 10 CFR 50.62" "

This letter provides the documentation required by 10 CFR Part 50, Section 50.62(c)(6), necessary to demonstrate compliance with the ATWS Rule for the Alternate Rod Injection System (ARI). As stated in Reference (a), documentation for the Recirculation Pump Trip modifications was submitted as part of Reference (b) and was approved by the NRC staff in Reference (c). Documentation of compliance for Standby Liquid Control System modifications was submitted in Reference (d). This letter completes the documentation necessary to demonstrate compliance with the ATWS Rule.

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System Design

The Monticello ARI System has been operable since 1980. The sensors and initiation logic for the RPT System, which were reviewed and approved by the NRC Staff in Reference (c), are also used for the ARI System. The sensors and initiation logic provide a signal which energizes two ATWS ARI solenoid valves which are ASCO valves similar to the type used for the back-up scram valves. The valves are piped as shown in Attachment 1. The materials and installation were accomplished in accordance with original plant design specifications. Power for the solenoid valves is supplied from 125 VDC distribution panels.

Checklist

Northern States Power participated in the Boiling Water Reactor Owners' Group Committee on ATWS Compliance Alternatives. As part of that Committee's work Licensing Topical Report NEDE-31096-P, "Anticipated Transients Without Scram: Response to NRC ATWS Rule, 10 CFR 50.62" was submitted to the NRC and was approved by Reference (e). The NRC Staff's Safety Evaluation Report includes a checklist for documenting the acceptability of the Alternate Rod Injection System design. This checklist has been completed and is included as Attachment 2.

Function Time

Item 1 of the checklist addresses ARI System function time. The specifications for rod injection motion starting within 15 seconds and rod injection motion being completed within 25 seconds from ARI initiation, were developed by generic ATWS analyses. At the time of installation of the Monticello ARI System a performance test was performed utilizing a single ARI solenoid valve to bleed off the scram air header. Test results indicated that the final rod started motion in 27 to 30 seconds. General Electric evaluated this data and concluded that, although the observed 30-second time delay is larger than that used in the ATWS licensing reports the impact on the results of the analyses is insignificant. This is further supported by the BWR Owners Group Licensing Topical Report which demonstrates the design objectives affected by the rod motion times (Paragraphs 3.2.1 thru 3.2.5 of NEDE-31096-P) would be met as long as rod motion was completed within 60 seconds. Performance tests were again recently performed at Monticello during a short outage which confirmed the 27 to 30 second time frame. From the time of the final rod starting motion an additional 3 to 5 seconds is required for the scram to be completed. This yields a final time of approximately 35 seconds for all rods being inserted by the ARI System at Monticello and provides adequate margin to the 60 seconds required to meet the ARI System design objectives.

Scram Discharge Volume Considerations

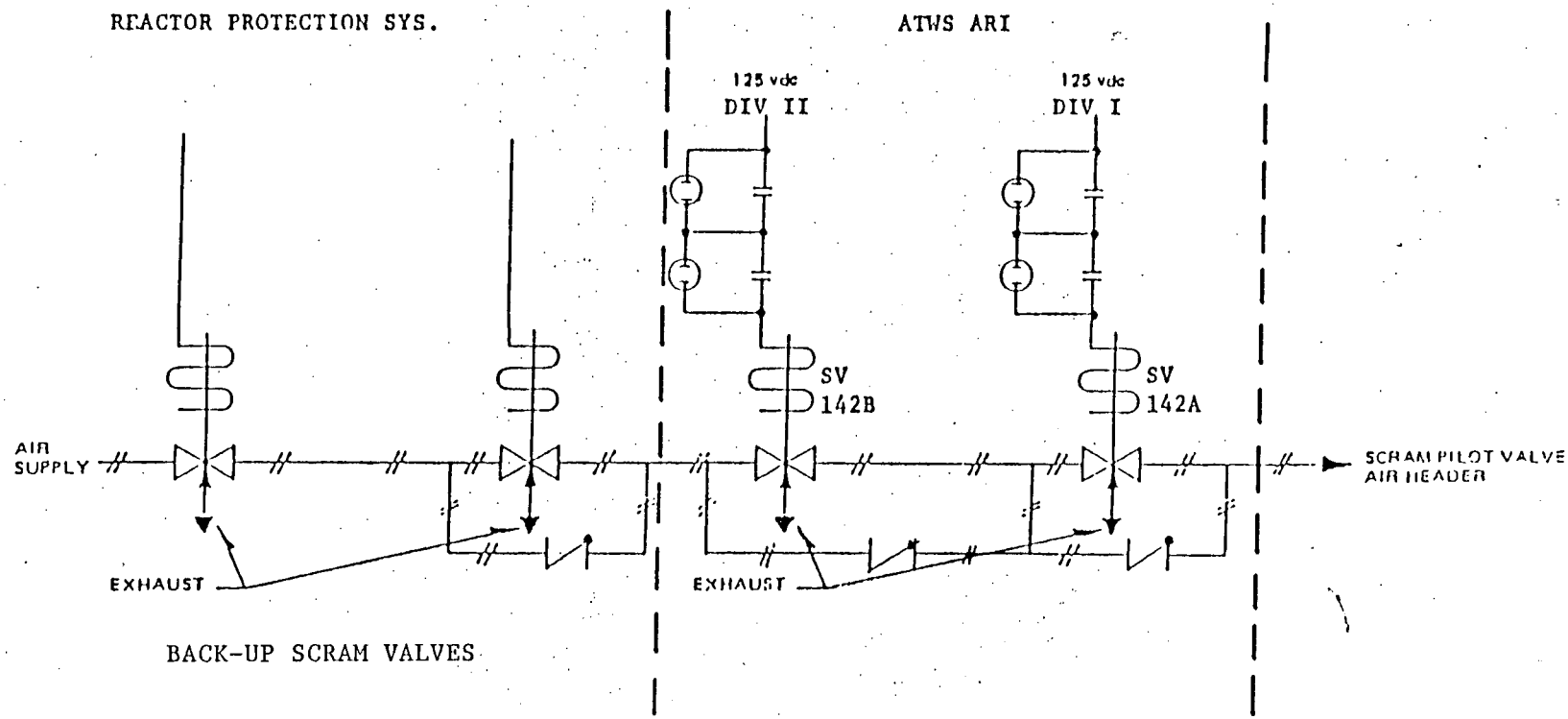
The BWR Owners' Group Licensing Topical Report also recognized that an important reason for minimizing the rod motion completion time is to ensure that the Scram Discharge Volumes (SDV's) have sufficient volume to accommodate whatever leakage will occur during the time when the air header is bleeding down and rod motion has not begun as well as the water from the scram. An evaluation of scram discharge volume fill rate as a function of rod insertion time concluded, for a rod insertion completion time of 35 seconds from the time of ARI initiation, sufficient volume exists in the SDV's to allow a full scram. Attachment 3 contains the detailed evaluation.

In summary, the ARI System utilizes the sensors and initiation logic of the Recirculation Pump Trip modifications which have been reviewed and approved by the NRC Staff. The configuration of the ARI valves on the scram air header allows rod motion to start and be completed in approximately 35 seconds which meets the design objectives of the ARI system. In addition, an evaluation has been performed which demonstrates that the scram discharge volumes have adequate capacity to accept the water from a scram initiated by the ARI system.

David Musolf
Manager - Nuclear Support Services

c: Regional Administrator - III, NRC
NRR Project Manager, NRC
NRC Resident Inspector
G Charnoff

Attachments



ARI VALVE ARRANGEMENT

APPENDIX A

CHECKLIST FOR PLANT SPECIFIC REVIEW OF ALTERNATE ROD INJECTION SYSTEM (ARI)

	Conformance with ARI SER
1. ARI system function time	
Rod injection motion will begin within 15 seconds and be completed within 25 seconds from ARI initiation	No, see evaluation Attachment 3
2. Safety-related requirements	
(a) Class 1E isolators are used to interface with safety-related systems	NA No Interface
(b) Class 1E isolators are powered from a Class 1E source	NA No Interface
(c) Isolator qualification documents are available for staff audit	NA No Interface
3. Redundancy	
The ARI system performs a function redundant to the backup scram system	Yes
4. Diversity from existing RTS	
(a) ARI system is energize-to-function	Yes
(b) ARI system uses DC powered valves	Yes
(c) Instrument channel components (excluding sensors but including all signal conditioning and isolation devices) are diverse from the the existing RTS components.	No, See Note 1
5. Electrical independence from the existing RTS	
(a) ARI actuation logic separate from RTS logic	Yes
(b) ARI circuits are isolated from safety related circuits	Yes, See Note 2

6. Physical separation from the existing RTS	Yes, in accordance with original plant criteria
(a) ARI system is physically separated from RTS	
7. Environmental Qualification	
ARI equipments are qualified to conditions during an ATWS event up to the time the ARI function is completed	Yes, See Note 3
8. Quality Assurance	
(a) Comply with Generic Letter 85-06	Yes, See Note 4
9. Safety-related power supply	
(a) ARI system power independent from RTS	Yes
(b) ARI system can perform its function during any loss-of-offsite power event	Yes
10. Testability at Power	
(a) ARI testable at power	Yes
(b) Bypass features conform to bypass criteria used in RTS	NA, 2 out of 2 logic utilized
11. Inadvertent Actuation	
(a) ARI Actuation setpoints will not challenge scram	Yes
(b) Coincident logic is utilized in ARI design	Yes
12. Manual Initiation	
(a) Manual initiation capability is provided	Yes
13. Information Readout	
(a) Information readout is provided in main control room	Yes
14. Completion of protective action once it is initiated	Yes

Note 1

For level analog trip units which are the same as those used in the RPS are used. For pressure diverse means are utilized.

Note 2

Item (9) of Section 6.2 of Reference (e) states, "If the ARI system has to use a safety related power supply through "proper isolation," the two qualified Class 1E breakers* in series with proper relay coordination should be provided for that isolation function. (*Two fuses in series or a combination of one fuse and one breaker will also be acceptable.)"

The Monticello ARI System utilizes a safety related power supply. Isolation was provided in accordance with the original plant design criteria which called for a single fuse.

Note 3

The BWR Owners' Group report called for environmental qualification of equipment to temperature, pressure, humidity and radiation levels associated with Anticipated Operational Occurrences. The NRC staff in its SER stated, "Equipment must be qualified to conditions during an ATWS event up to the time that the ARI function is completed." Northern States Power considers this to be a mild environment. As such, equipment was procured consistent with the requirements for a mild environment in effect at the time of procurement.

Note 4

While the ARI System is classified as a non-safety related system, during design, procurement and installation the NSP Quality Assurance Program was fully applied.

Scram Discharge Volume (SDV) Evaluation for a Scram Initiated by the Alternate Rod Injection System (ARI)

The free volume of the scram discharge volumes available prior to a scram is 354.1 gallons for the East Side Volume and 402.2 gallons for the West Side Volume. There are a total of 121 Control Rod Drives (CRDs), 60 of which empty into the East Side Volume and 61 of which empty into the West Side Volume. If one were to make the following conservative assumptions:

1) At the instant of scram initiation by the ARI System the SDV drain valves close and the SDV starts filling,

2) At the instant of scram initiation by the ARI System all CRDs start leaking at the maximum value (5 gpm) established by the NRC (Reference 1) and continue until all rod motion is completed,

3) It takes 5 seconds for the last control rod to scram once rod motion has started, and

4) The volume required by each control to fully insert is 0.965 gallons.

It could then be determined by the following equation when the last control rod would need to start its motion to ensure that sufficient capacity remained in the SDV to allow all control rods to complete their motion.

$\{[(t_1+t_2)/60] \times CRD \times LEAK\} + CRD \times VOL = SDV$ where;

t_1 = time for all control rods to start motion (sec)
t_2 = time for a control rod to scram once motion has started (sec) = 5 sec
CRD = # of CRDs = 60 (East) & 61 (West)
LEAK = leakage per CRD (gpm) = 5 gpm
VOL = volume necessary for a single CRD to insert (gal) = 0.956 gal
SDV = free volume of the SDV (gal) = 254.1 gal (East) & 402.2 gal (West)

Utilizing the values assumed above yields a maximum time for the control rods to begin motion of 54 seconds for the East SDV and 62 seconds for the West SDV.

Performance tests were performed on the Monticello Alternate Rod Injection System following installation and again recently. These test were performed by video taping the blue lights on the control panel in the control room which indicate when the scram valve is not fully closed. This provides information that the air header has bled down to a pressure which allows the scram pilot solenoid valves to actuate, thereby allowing the scram valves to open and cause control rod scram. The results of the recent test are presented below. The first test was done by initiating a single ARI valve and the second test was done by initiating both ARI valves. Test results are comparable to those obtained following the installation of the ARI system.

ARI System Test No. 1

First Scram Valve Starts Opening; 5 Seconds*
Last Scram Valve Starts Opening; 27 Seconds*

* As indicated by the blue lights in the Control Room

Time Since ATWS ARI Initiation (Seconds)	No. of Blue Lights On			Increase Since Last Time Mark		
	West	East	Total	West	East	Total
0	0	0	0	0	0	0
2.25	0	0	0	0	0	0
4.5	1	0	1	1	0	1
6.75	2	0	2	1	0	1
9	2	11	13	0	11	11
11.25	23	27	50	21	16	37
13.5	38	43	81	15	16	31
15.75	53	48	101	15	5	20
18	60	53	113	7	5	12
20.25	60	54	114	0	1	1
22.5	60	55	115	0	1	1
24.75	61	58	119	1	3	4
27	61	60	121	0	2	2

ARI System Test No.2

First Scram Valve Starts Opening; Approximately 2 Seconds*
Last Scram Valve Starts Opening; Approximately 22.5 Seconds*

* As indicated by the Blue Lights in the Control Room

Time Since ATWS ARI Initiation (Seconds)	No. of Blue Lights On			Increase Since Last Time Mark		
	West	East	Total	West	East	Total
0	0	0	0	0	0	0
2.25	1	0	1	1	0	1
4.5	2	0	2	1	0	1
6.75	3	3	6	1	3	4
9	9	18	27	6	15	21
11.25	42	46	88	33	28	61
13.5	59	52	111	17	6	23
15.75	59	55	114	0	3	3
18	60	55	115	1	0	1
20.25	61	57	118	1	2	3
22.5	61	60	121	0	3	3

The scram valves are fast acting valves. Conservatively assuming up to three seconds for them to actuate results in rod motion beginning in approximately 30 seconds. When compared to the calculated value of 54 seconds for the East SDV and 62 seconds for the West SDV it can be seen that a margin of a factor of almost 100% exists. This margin can be shown to be even larger by using realistic assumptions. Examples of more realistic assumptions are a leakage rate of 2 gpm instead of 5 gpm as evidenced by recent test data taken at Monticello, using real time values for drain valve closure rather than assuming instantaneous closure at the time of scram initiation, and using the actual distribution of scram valve openings times to initiate leakage for each CRD instead of assuming leakage of all CRDs at initiation of the scram signal. In conclusion, more than adequate margin exists for the SDV's in accepting the water from a scram initiated by the ARI System.

References

1. NEDM-25412, "Scram Discharge Volume (SDV) Design Basis for the Loss of Scram Valve Air Pressure", November 1981, J E Klimazewski, General Electric Company