NRC FORM 195
(2-76)

U.S. NUCLEAR REGULATORY COMMISSION

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FILE NUMBER:

TO: D.L. ZIEMANN

FROM: NORTHERN STATES POWER CO. MINNEAPOLIS, MINN. L.O. MAYER

DATE OF DOCUMENT: 9-27-76

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DESCRIPTION

LTR. RE. OUR 8-23-76 LTR.......TRANS THE FOLLOWING

PLANT NAME: MONTICELLO

ENCLOSURE

RESPONSE TO REQUEST FOR INFORMATION REGARDING A POTENTIAL DEFICIENCY ....W/ATTACHED RE-STATEMENT....

(40 CARBON SIGNED CY. RECEIVED)
(8 PAGES)

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NRC FORM 195 (2-76)

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NSP

NORTHERN STATES POWER COMPANY

MINNEAPOLIS, MINNESOTA 55401

September 27, 1976

Mr D L Ziemann, Chief
Operating Reactors Branch #2
Division of Operating Reactors
U S Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr Ziemann:

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

Response to 8/23/76 Letter Regarding
Potential LPCI Deficiency

Your August 23, 1976 letter requested specific information regarding a potential deficiency of the Monticello LPCI system. The information, along with a re-statement of your request, is attached.

The requested information concludes that no deficiency exists in the Monticello LPCI system.

Yours very truly,

L. O. Mayer

L O Mayer, PE
Manager of Nuclear Support Services

LOM/MHV/deb

cc: J G Keppler
G Charnoff
MPCA
Attn: J W Ferman

9932

ADDITIONAL INFORMATION REQUIREMENTS - LPCI RUNOUT

MONTICELLO

NRC Request #1A

What break location was assumed when evaluating the maximum flow possible from two LPCI pumps pumping directly to a break?

NSP Response

The break location was assumed to be at the location of the LPCI line connection to the recirculation line.

NRC Request #1B

Describe how the system losses were calculated, including a sketch of the system assumed and a tabulation of the head loss in feet for each component in the system (valves, orifices, heat exchangers, etc.).

NSP Response

The method used to determine system losses is based on a method contained in Flow of Fluids Through Valves, Fittings and Pipe, Technical Paper No. 410, Engineering Division, CRANE, fourteenth Printing, 1974. Two steps are required using this method:

1) Find the equivalent length of the component or system from tables and formulas.

2) Find the pressure drop from tables for given flow through the equivalent length of piping found above.

The system assumed is the as-built "B" loop of the RHR System (see FSAR Figure 6-2-6). "A" loop piping configuration is similar to the "B" loop. The difference in runout flow and head losses would be negligible.

See attached Table for RHR component head losses.

NRC Request #2A

Describe the NPSH available (ANPSH) to the LPCI pump for the worst pump configuration (single failure resulting in highest pump flow) as a function of time, both short-term and long-term, in the event of a postulated loss-of-coolant accident.

NSP Response

ANPSH as a function of time is described by the Figure attached.

NRC Request #2B

Suppression pool temperature versus time should be indicated and the effect of pool temperature should be included in the calculation.

NSP Response

Suppression pool temperature versus time is indicated by FSAR Figure 5-2-16. Effect of pool temperature was included in the calculation of system head losses and in the calculation of ANPSH.

NRC Request #3A

Provide the required NPSH (RNPSH) vs. time for a postulated LOCA with the worst pump configuration (single failure resulting in highest pump flow) for both short and long-term cooling.

NSP Response

RNPSH vs. time is provided by the Figure attached. The RNPSH is based on the conservative assumption that the two LPCI pumps pumping to the broken loop are left in the LPCI mode.

NRC Request #3B

Based on a recirculation line break at the flange where LPCI piping connects to the recirculation loop, if at any time RNPSH (this question) > ANPSH (question 3), then provide either a justification that operator action can be expected before this time, or provide a complete description of any tests, performed by you or the pump manufacturer to demonstrate that the RHR pumps can operate at less than recommended design NPSH conditions without sustaining damage. The description should include the test procedures, the test points, and data taken at each point, i.e., pump flow, pump suction pressure, pump discharge pressure, vibration, water temperature; etc. Give operating times (estimated if not recorded) over which the pumps operated at less than design NPSH. Include observations concerning pump vibration, noise and cavitation, during the tests.

NSP Response

All safeguard functions which must be accomplished immediately following a Loss of Coolant Accident are provided with automatic actuation. The only operator action required during this time is to survey control room instrumentation to assure that the reactor is shutdown and that the safeguard systems are functioning as required. Our procedures include instructions to monitor RHR pump flows, torus temperature and torus pressure and adjust flow to assure pump cavitation is avoided. It is reasonable to expect that this action can be accomplished within the time period required to avoid cavitation.

It is noted that an assumption used in the LPCI runout analysis is that the suppression chamber would not be pressurized during a DBA LOCA. With this conservative assumption the ANPSH is never more than 0.16 feet less than the RNPSH. Under actual LOCA conditions the minimum suppression chamber pressure during the interval 1.3×10^3 seconds to 5×10^3 seconds (the interval during which cavitation is depicted on the Figure attached) is 17.5 feet of water (see FSAR Figure 5-2-14). It is, therefore, expected that under actual LOCA conditions no cavitation will occur. Results of the analysis indicate, in fact, that if the containment is pressurized to only 0.16 feet of water during the LOCA, cavitation will be avoided completely.

NRC Request #4A

Following a LOCA, what indication of RHR pump flows would the operator have in the control room?

NSP Response

The operator is provided with indication of LPCI flow and containment cooling flow for both loops of the RHR System (see FSAR Figure 6-2-6).

NRC Request #4B

What indications would the operator have to know that the RHR pumps were cavitating?

NSP Response

The operator is provided with indication of torus temperature, torus pressure and RHR flow. These three indications and prepared guidelines enable the operator to decide if the RHR pumps are cavitating.

NRC Request #4C

What action could be taken to alleviate such operation, and how long would such action take?

NSP Response

RHR pump cavitation can be alleviated by decreasing flow. RHR flow can be decreased by throttling the injection valve. This response can be completed in less than one-minute.

NRC Request #5

Specify the number of pumps assumed to be available in your ECCS Appendix K Long Term analysis.

NSP Response

There are two definitions of "long term" used in ECCS analysis. Most of the attention of the ECCS hearings focused on the first few minutes after a postulated break. In our analysis in response to Appendix K, "short term" refers to the period prior to the end of lower plenum flashing. "Long term" refers to the interval from the end of flashing to core reflood. The analysis shows that the most limiting case involves the failure of the LPCI injection valve to open. All four RHR pumps are assumed to be available for all of their various functions, except the ability to discharge into the unbroken recirculation group. The LPCI injection valve failure case is more limiting than to assume the failure of a single pump.

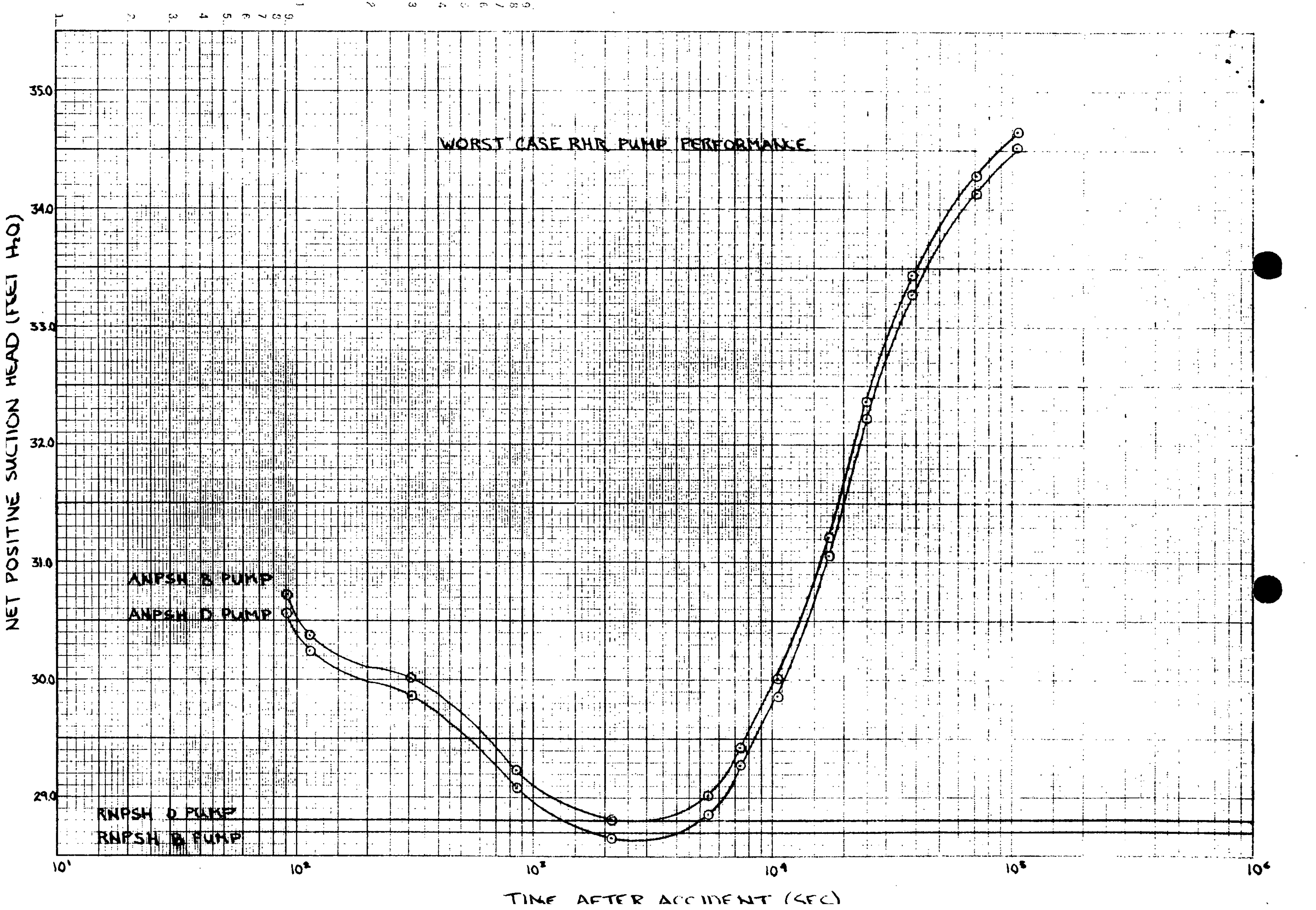
The definition of "long term" germane to this discussion is the period of decay heat removal from containment after core reflood. During this time the vessel inventory will be maintained by core spray or LPCI while the vessel will be steaming and venting to containment. The analysis of this phase of the event is presented in Section 5 of the Monticello FSAR. Acceptable conditions are shown to exist for five cases based on various combinations of cooling equipment in service. If the single failure assumed in the ECCS analysis were the failure of the LPCI loop selection logic, as postulated in your letter, the above information shows that RHR pumps will not experience cavitation. The FSAR case compatible with this situation is therefore that of all four RHR pumps being available for long term cooling after the DBA.

HEAD LOSS (h_L) AT RUNOUT FLOW FOR RHR SYSTEM COMPONENTS

	h_L (ft)
Basket Strainer	0.84
Torus Ring Header	3.00
MO 13B	0.28
Pipe and Fittings in Common Suction Line to Pumps	3.01
RHR 152 B (B Pump Suction)	0.32
Pipe and Fittings in Suction Line to B pump	2.28
RHR 152 D (D Pump Suction)	0.32
Pipe and Fittings in Suction Line to D Pump	2.43
RHR 48B (B Pump Discharge)	3.70
RHR 47B (B Pump Discharge)	0.96
Pipe and Fittings in B Pump Discharge Line	8.19
RHR 48D (D Pump Discharge)	3.73
RHR 47D (D Pump Discharge)	0.97
Pipe and Fittings in D Pump Discharge Line	8.75
Pipe and Fittings in Common Line to Point where Flow Splits between Heat Exchanger Path and Bypass Path.	0.06
RHR 23B (Heat Exchanger Inlet)	0.29
RHR Heat Exchanger	7.03
RHR 28B (Heat Exchanger Outlet)	0.29
Pipe and Fittings in Heat Exchanger Path	4.49
MO 65B (Heat Exchanger Bypass)	9.54
Pipe and Fittings in Bypass Path	2.56
Pipe and Fittings from Point where Flow Combines downstream of Heat Exchanger Path and Bypass Path to Flow Element	17.75
FE 108B	10.72
MO 27B	22.42

HEAD LOSS (h_L) AT RUNOUT FLOW FOR RHR SYSTEM COMPONENTS

	h_L (ft)
MO 25B	0.86
AO 46B	3.43
RHR 81B	0.86
Pipe and Fittings from Flow Element to System Termination	29.43


WORST CASE RHR PUMP PERFORMANCE
NET POSITIVE SUCTION HEAD (FEET H_2O)
35.0
34.0
33.0
32.0
31.0
30.0
29.0
ANPSH B PUMP
ANPSH D PUMP
RNPSH D PUMP
RNPSH B PUMP
10^1
10^2
10^3
10^4
10^5
10^6
TIME AFTER ACCIDENT (SEC)