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August 13, 1973

Mr. D. L. Ziemann, Chief
Operating Reactors Branch #2
Directorate of Licensing
U.S. Atomic Energy Commission
Washington, D.C. 20545

Subject: Dresden and Quad-Cities Stations Rod Worth Minimizers (RWM), AEC Dkts 50-237, 50-249 50-254, and 50-265

Dear Mr. Ziemann:

Regulatory File Cy.

Attached is a report which discusses the additional information concerning the RWM requested in your letter dated May 2, 1973.

Based on the information it seems premature and unwarranted to change the Technical Specifications concerning RWM operability. Since completing the planned improvements to the RWM discussed in the report to D. J. Skovholt dated August 3, 1972, the RWM's have monitored successfully 16 of 21 startups at Quad-Cities and 8 of 13 startups at Dresden. As indicated, further modifications to the RWM systems are planned which should be completed by April, 1974. Until these further modifications are completed and demonstrated the Technical Specifications should continue to allow use of a second operator as a substitute if a RWM is unavailable. It is requested that any further discussion of Technical Specification changes be delayed until April, 1974.

Your question concerning the feasibility of upgrading the RWM to operate with a Technical Specification requiring a control rod scram if the RWM is not operable at less than 10% power was puzzling to us. The purpose of the RWM is to monitor the operator's selection of control rods for withdrawal and to prevent withdrawal of a high worth rod that if dropped the full withdrawal stroke could result in fuel damage. A scram in the event this monitoring system is unavailable does not seem related to the purpose of the RWM system. Such a scram would provide no additional assurance against rod withdrawal errors, since a RWM inoperative signal already blocks further rod movement. If you want to discuss this matter further contact me.

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One signed original and 39 copies of this report are submitted.

Very truly yours,

J. S. Abel
Nuclear Licensing Administrator -
Boiling Water Reactors

1. Results of evaluations scheduled for completion by 9/1/72

Two evaluations were scheduled for completion by 9/1/72 concerning the problem of abnormal rod position inputs to the RWM (the most prevalent cause of RWM inoperability): (a) investigation of the feasibility of a modification to allow manual insertion of rod position from the main control room, and (b) further investigation to determine the source of abnormal rod identification signals.

The modification to allow manual insertion of rod position from the main control room has been developed; implementation is expected by 4/1/74.

The problem of spurious abnormal rod identification has been diagnosed as a relay race problem. The Rod Position Information System (RPIS) is a high speed solid state system. Relays are used as an interface between the operator's rod select push-buttons and the RPIS. This relay race results in incorrect data to the RWM for short periods of time.

A program modification was implemented whereby the RWM computers now require the same RPIS data on two successive scans at 15 milli second intervals before the data is used by the RWM. This helps to eliminate the problem, but a final solution is still being studied. The General Electric Company is currently working on a permanent hardware "fix" to solve the problem.

2. Results of feasibility study of providing backup RWM capability

The fact that both Dresden and Quad Cities have two RWM per plant raised the question of ... "Why not "crosstie" the RWM in order to achieve quasi redundancy?"

A computer swith-over system could be designed which would provide RWM backup for the RWM central processor units only. This backup would not extend to the individual RWM Input/Output (IØ) cabinets, output buffer, or displays. There are about 200 wires between each main frame and its I/Ø cabinet which have to be switched. The problem with this scheme is that it would not appreciably improve the RWM System reliability.

Experience indicates that erroneous signals and other difficulties in the RPIS have been the major contributor to problems of RWM availability. The corrective action taken to eliminate these erroneous signals were outlined above and in the previous RWM report to the AEC (transmittal letter to D. J. Skovholt (AEC) from L. D. Butterfield (C.E. Co.) dated 8/3/72). These modifications are all designed to either reduce the erroneous inputs or allow the operator to cope with them.

Another consideration concerning availability of the RWM central processor units is relevant. The adequate site stock of RWM replacement parts should help to maintain a high availability for hardware. The only advantage that RWM switchover capability would afford is the saving of trouble shooting and parts replacement time in the event that a computer hardware problem developed during operation at less than 10% power.

Based on the above facts, it's apparent that there is little to be gained by interconnecting the RWM to achieve a backup scheme.

3. Description of modifications and effects on availability

The following modifications have been made to the RWM programs:

1. The program no longer applies insert and withdraw rod blocks during the control rod scan which is initiated on decreasing reactor power at the 10% power level.

2. The program no longer assumes a rod position of 48 (full out), during full core scan on a rod that is between notches and selected and driving.

3. Digital filtering for the reactor power set points to the RWM was increased to remove fluctuations.

4. The RWM operators display is now updated every five seconds (vs. every 60 secs) above the low power set point and below the low power alarm point.

5. When the plant operator attempts to latch a sequence, the RWM prints an error message identifying any out of sequence control rod.

6. Low power level set points and alarm points which input to the RWM have been adjusted such that the RWM now uses corrected steam flow as the primary input.

7. There is only one (1) rod withdrawal sequence. This should assure the ability of reaching 10 percent power before reaching the end of the sequence. If another sequence is to be used for reactor startup, the first sequence is removed entirely from the computer memory and replaced with the new sequence.

8. The program logic has been modified to assure that the computer re-latches at the proper point in the sequence after a rod drift error or execution of the diagnostic routine. This reduces the number of times the RWM must be reinitialized.

9. The program logic has been changed to delay stepping to a higher group until a rod has been pulled in that group. This will insure that an operator will not get trapped at the end of a rod group. He is now allowed to insert in sequence rods immediately from any point in a sequence without being blocked.

10. The logic has been changed to allow the computer to latch in with one (1) withdrawal error. This is consistent with operating restrictions.

11. The substitute rod position logic has also been changed. The RWM now assumes a position of 48 for a rod with bad position information. If this is not tolerable, a substitute position can be entered through the computer console.

These modifications have improved the performance of the RWM systems substantially, although the systems still have to be monitored closely during start up. The RWMs have successfully monitored 16 of 21 start ups at Quad Cities and 8 of 13 at Dresden.

The following modifications are planned. Implementation should be completed before 4/1/74.

1. Installation of thumbwheels and a pushbutton on the operators' panel to allow the entry of the substitute rod positions from the control room instead of the computer room.

2. The rod block capability of the RWM will be automatically bypassed above the low power alarm point. The intent of this is to allow the RWM to be left in the "normal" mode at all times. Hardware failures will be alarmed when they occur allowing time for repair before the system is really needed.

3. If the rod pattern is not compatible with the withdraw sequence, the sequence latch procedure will initiate the display of the following information in addition to applying blocks:

   a). The highest possible group that could be latched with less than 3 insert errors.

   b). The identification of the first withdraw error and first insert error.

   c). An indicator labeled "Out of Sequence".

4. Display error messages including state of system at operator's panel indicating with digital lights rod identification and coded RWM error. Items 3 & 4 give additional information to facilitate restarting the RWM in the event of an inop.

5. A rod drift alarm will not require system reinitialization but will initiate a control rod scan at all power levels. The computer will automatically clear rod blocks a: soon as the errors is cleared without operator intervention to the RWM system.

These planned modifications should further improve the usefulness and reliability of the RWM system.

4. Impact of a technical specification change requiring operability of the RWM on a startup for a specified number of control rod withdrawals

Based on the current availability status of the RWM, it's apparent that such a change would delay plant startups. Such a requirement appears unduly "harsh", especially at this time in the program designed to correct the RWM availability problem. Further, as already pointed out in previous reports and discussions on this subject, it is felt that a second qualified observer is a satisfactory subsitute for the RWM in performing the intended function of verifying proper control rod withdrawal according to the specified withdrawal sequence.

5. Feasibility and further RWM upgrading required to operate with a tech. spec. requiring an inop RWM scram function at less than 10% power

The question of involving a RWM inop scram function appears to be excessive and not related to the seriousness of such inoperability. The existing rod block from a RWM inop already accomplishes the desired function of preventing erroneous rod movements from creating high rod worths. In the process of performing this interlock function of preventing movement of an incorrect control rod, the RWM frequently interprets inadequate or incorrect control rod drive position information as requiring a rod block. If the output function is changed from rod block to scram, the temporary unavailability of the RWM or any spurious trip would cause a scram, whereas rod block is the desired objective. Some of the modifications completed or planned decrease the incidence of spurious trips, but the majority are designed to aid the operator in clearing the trips and will not necessarily eliminate them.

Therefore, the present technical specification requirement of a second, qualified observer monitoring rod movement at less than 10% power, when the RWM is inoperable, coupled with the current program of improving reliability, appears to be the most sensible and realistic approach.