

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	}	
SACRAMENTO MUNICIPAL UTILITY DISTRICT		Docket No. 50-312
Rancho Seco Nuclear Generating Station		

EXEMPTION

I.

The Sacramento Municipal Utility District (the licensee), is the holder of Facility Operating License No. DPR-54 which authorizes the operation of the nuclear power reactor known as Rancho Seco Nuclear Generating Station (the facility) at steady state reactor power levels not in excess of 2772 megawatts thermal (rated power). The facility consists of a Babcock and Wilcox Company (B&W) designed pressurized water reactor (PWR) located at the licensee's site in Sacramento County, California.

II.

In accordance with the requirements of the Commission's Emergency Core Cooling System (ECCS) Acceptance Criteria, 10 CFR 50.46, the licensee submitted on July 8, 1975, an ECCS evaluation for the facility. The ECCS performance submitted by the licensee was based upon an ECCS Evaluation Model developed by B&W, the designer of the Nuclear Steam Supply System for this facility. The B&W ECCS Evaluation Model had been previously

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found to conform to the requirements of the Commission's ECCS Acceptance Criteria, 10 CFR Part 50.46 and Appendix K. The evaluation indicated that with the limits set forth in the facility's Technical Specifications, the ECCS cooling performance for the facility would conform with the criteria contained in 10 CFR 50.46(b) which govern calculated peak clad temperature, maximum cladding oxidation, maximum hydrogen generation, coolable geometry and long-term cooling.

On April 12, 1978, B&W informed the Commission that it had determined that in the event of a small break Loss of Coolant Accident (LOCA) on the discharge side of a reactor coolant pump, high pressure injection (HPI) flow to the core could be reduced somewhat. Subsequent calculations indicated that in such a case the calculated peak clad temperature might exceed 2200F.

Previous small break analyses for B&W 177 fuel assembly (FA) lowered loop plants had identified the limiting small break to be in the suction line of the reactor coolant pump. Recent analyses have shown that the discharge line break is more limiting than the suction line break.

The Rancho Seco Nuclear Generating Station has an ECCS configuration which consists of two HPI trains. Each train has a HPI pump and the train injects into two of the four reactor coolant system (RCS) cold legs on the discharge side of the RCS pump. (There is also a third HPI pump installed.) The two parallel HPI trains are connected but are kept isolated by manual valves (known as the crossover valves) that are

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normally closed. Upon receiving a safety injection signal the HPI pumps are started and valves in the four injection lines are opened. Assuming loss of offsite power and the worst single failure (failure of diesel to start) only one HPI pump would be available and two of the four injection valves would fail to open.

If a small break is postulated to occur in the RCS piping between the RCS pump discharge and the reactor vessel, the high pressure injection flow injected into this line (about half of the output of one high pressure pump) could flow out the break. Therefore, for the worst combination of break location and single failure, only one-half of the flow rate of a single high pressure ECCS pump would contribute to maintaining the coolant inventory in the reactor vessel. This situation had not been previously analyzed and B&W had indicated that the limits specified in 10 CFR 50.46 may be exceeded.

Following discovery of this problem, B&W stated that they had analyzed a spectrum of small breaks in the pump discharge line and had determined that to meet the limits of 10 CFR 50.46, operator action was required to open the two manually operated crossover valves and to manually align the two motor driven isolation valves which had failed to open. This would allow the flow from the one HPI pump to feed all four reactor

coolant legs. B&W assumed that 30% of the flow would be lost through the break and 70% would refill the core. By letters dated April 14 and 21, 1978, supplemented by discussions with the staff, the licensee committed to provide for the necessary operator actions within the required time frame. That is, in the event of a small break and a limiting single failure, manual action would be taken to begin opening these valves within five minutes and have them fully opened and an adequate flow split obtained within 10 minutes after initiation of the event. To facilitate this operation, the licensee committed to maintain one of the series-connected, manually operated crossover valves normally open. The analyses performed by B&W assumed that the flow split was established at 600 seconds by operator action. We therefore concluded that the modeling of operator action used in the analyses was a reasonable approximation of the operator action that actually will be taken, provided specific procedures were prepared and followed to assure such action.

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By letter dated July 18, 1978, B&W submitted a summary of analyses of this event. This summary described the methods used and the results obtained for small breaks in the pump discharge piping for a reactor power of 2772 Mwt, which is the rated power level of Rancho Seco. The results provided in this summary were obtained using the B&W ECCS Evaluation Model with two modifications. These modifications, which involve use of a two node inner vessel simulation and phase distributional multipliers for bubble rise in all control volumes within the reactor vessel, were described in a B&W letter to the staff, dated May 26, 1978, and have been reviewed and approved by the staff.

By letter dated July 18, 1978, the licensee stated that he had reviewed the B&W submittal of July 18, 1978, and had found the conclusions acceptable and applicable to Rancho Seco. Based on this review, the licensee requested authorization to operate Rancho Seco at 100% full power (2772 Mwt).* In a submittal dated July 7, 1978, the licensee also confirmed that procedures for operator action consistent with the assumptions of the B&W analyses had been implemented, that drills had been conducted which verified that the required operations could readily be completed in less time than assumed in the B&W analyses and that all five operating shifts had been trained in the procedures. Representatives of the Commission's regional office state that they have verified the licensee's implementation of the procedures and have

* In a previous licensing action related to this matter the maximum power level of Rancho Seco had been limited to 2080 Mwt by the Commission's Order for Modification of License dated April 26, 1978.

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inspected the licensee's training records to verify that training in the procedures was conducted. Based on the above, we concluded that the procedures implemented by the licensee relative to operator action in the event of a small break are acceptable. In addition, in his letter dated April 21, 1978, the licensee committed to submit by July 21, 1978, a proposal for any long-term modification (to eliminate the need for prompt operator action) considered appropriate.

Regarding the licensee's request for authorization to operate the facility at full power (2772 Mwt), we reviewed the B&W submittal of July 18, 1978, which presented the results of analyses performed for reactor coolant pump discharge line break sizes 0.15, 0.10, 0.085, 0.07, 0.055 and 0.04 ft² at a reactor power level of 2772 Mwt. Based on these results, B&W stated that with operator action consistent with that modeled in the analyses, a 0.07 ft² discharge line break is the most limiting case. In this case, core uncover occurs for about 410 seconds and the conservatively calculated peak clad temperature is approximately 1092°F. This temperature is well below the limit specified in 10 CFR 50.46(b).

Based on our review of these analyses, we found that the calculations supported the conclusion that 0.07 ft² discharge line break was the most limiting case. The analyses submitted used a simplified input to the FOM code for the distribution of steam sources which the licensee described as conservative. However, these analyses did not provide adequate justification that this approach was clearly conservative. Accordingly, we could not conclude that operation of Rancho Seco at 2772 Mwt would be fully in conformance with 10 CFR 50.46. On the other hand, for operation of this facility at power levels up to 2772 Mwt, the ECCS performance calculations for limiting small break did indicate that this break had a very substantial margin on peak clad temperature below the limits of 10 CFR 50.46(b) if operator action consistent with that assumed in the analyses was properly taken. Therefore, because of this very substantial margin on peak clad temperature, the NRC staff concluded that operation of Rancho Seco at power levels of up to 2772 Mwt in accordance with the operating procedures previously identified would not endanger life or property or the common defense and security. The license conditions previously imposed by Order of April 26, 1978, were therefore modified to: (1) require submission of a reevaluation of ECCS cooling performance wholly in conformance with 10 CFR 50.46., except for the credit for completion of operator action within 10 minutes after initiation of the event; (2) limit the maximum steady

state reactor core power level to 2772 Mwt; (3) require operation in accordance with procedures described in the licensee's letters of April 14, 1978, as supplemented by letters dated April 21 and July 7, 1978 (except that the maximum time for completion of operator action was 10 minutes); and (4) require submission as soon as possible of a description and safety evaluation of a proposed plant modification which would eliminate reliance on prompt operator action. These conditions were added to the Rancho Seco license by Order for modification of License dated July 21, 1978. Since that time, B&W has provided in their letter of August 11, 1978 additional information concerning the simplified input used in the FOAM code portion of the ECCS performance analyses submitted July 18, 1978. The staff has reviewed this additional information and on the basis of its review has concluded that the small break LOCA analyses which used this simplified FOAM code input method are acceptably conservative and in conformance with the performance criteria of 10 CFR 50.46 and Appendix K to Part 50. As noted previously, however, these analyses assume completion of the local operator action as described in the licensee's letters of April 14, 21 and July 7, 1978, within ten minutes following the initiation of the event.

The original concern in this matter derived from an unexpected but nevertheless inadequate assessment of a spectrum of breaks. This deviation from 10 CFR 50.46 has been ameliorated on a temporary basis by the actions discussed herein. However, continued reliance on

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prompt operator action to perform the required steps to assure plant safety over a period of years into the future is undesirable and should be remedied as promptly as possible. To this extent, the original defect still remains until modifications are made to eliminate reliance on prompt operator actions. To remedy this defect the licensee, in accordance with license Condition 4 of the present Order, submitted on July 20, 1978, a description and safety evaluation of a proposed plant modification which would eliminate reliance on the prompt operator action noted above. Additional information concerning the proposed modification has been supplied by the licensee's letters of October 9, November 22 and December 4, 1978. In addition, in his letters of November 22 and December 4, 1978, the licensee committed to complete implementation of this proposed modification prior to Rancho Seco operation in Cycle 4. Justification for this implementation schedule was provided in the licensee's letter of December 4, 1978.

The licensee, in his letter of November 22, 1978, also requested an exemption from the provisions of 10 CFR 50.46 until such modifications were implemented.

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With respect to this request for an exemption, we note that the conclusions drawn in our Order of July 21, 1978 remain valid and have been further supported by our subsequent conclusions regarding the acceptability of the simplified input used in the FOAM code. Accordingly, we conclude that operation of Rancho Seco at power levels up to 2772 Mwt in accordance with the referenced procedures for operator action until modifications are completed to achieve full compliance with 10 CFR 50.46 will not endanger life or property or the common defense and security.

We have reviewed the modification proposed by the licensee to eliminate reliance on prompt operator action. This modification consists of replacement of the AC motors presently installed on the valve operators for the four high pressure injection valves and the reactor coolant normal makeup valve, with similarly qualified DC motors. Because Rancho Seco has four Class 1 battery banks, the proposed change allows the injection and makeup valve operators to be powered from reliable power sources different from those used for the high pressure injection pumps. Accordingly, a single failure would not disable both a pump and its associated injection valves. The licensee has presented a single failure analysis which demonstrates that in the presence of a small break LOCA, no single failure combined with a loss of offsite power would prevent supply of an adequate total flow of cooling water. The licensee will also provide modifications

which will limit the degree of opening of the injection valves upon receipt of a high pressure injection signal. This is being done to assure a proper flow split between the four injection lines and to prevent pump runout. The licensee has committed to perform tests to verify that these criteria are met. The licensee has also provided a battery loading analysis which adequately demonstrates the ability of the battery banks to accommodate this additional load. Therefore, based on our review of the licensee's submittal we conclude that upon installation of the modification, as proposed, and upon completion of testing to verify attainment of the flow split assumed in the B&W analysis of July 18, 1978, the emergency core cooling system will fully conform to the requirements of 10 CFR 50.46.

Thus, while the ECCS for Rancho Seco does not fully comply with our requirements, appropriate actions have been taken to remedy the defect in a timely manner, and to mitigate the consequences of a small break LOCA, should such an accident occur prior to implementation of acceptable modifications. As a condition of granting an exemption, adherence to prescribed operator actions and implementation of the proposed modifications prior to operation in Cycle 4 are being made conditions of the facility operating license. These conditions will remain in force only for the interval of time about one year until the proposed modifications of the ECCS are completed. The public interest is served by issuing this exemption for Rancho Seco in that in the absence of an exemption, shutdown of the facility would be required. Loss of this large block of generating capacity could adversely affect electric system reliability and thus possibly adversely affect the public.

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III.

Copies of the following documents are available for inspection at the Commission's Public Document Room at 1717 H Street, Washington, D.C. 20555, and are being placed in the Commission's local public document room at the Sacramento City-County Library, Sacramento, California.

- (1) Letters from J. J. Mattimoe to R. W. Reid, Chief, Operating Reactors Branch #4, dated April 17 and 21, 1978.
- (2) Order for Modification of License, Docket No. 50-312, dated July 21, 1978.
- (3) Letters from J. H. Taylor to S. A. Varga, Chief, Light Water Reactors Branch #4, dated May 26, July 18 and August 11, 1978.
- (4) Letters from J. J. Mattimoe to R. W. Reid, Chief, Operating Reactors Branch #4, dated July 7 and 18, October 7, November 22 and December 4, 1978.

IV.

WHEREFORE, in accordance with the Commission's regulations as set forth in 10 CFR 50.12, the licensee is hereby granted an exemption from the provisions of 10 CFR Part 50, Paragraph 50.46(a). With respect to Rancho Seco this exemption supersedes the Order for Modification of License dated July 21, 1978, and the license is hereby conditioned as follows:

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- (1) Until implementation of the modifications defined in (2) below, the facility shall be operated in accordance with the procedures for operator action described in the licensee's letter dated April 14, 1978 as supplemented by letters dated April 21 and July 7, 1978, except that the maximum time for completion of operator action shall be 10 minutes after initiation of the event, and
- (2) Authorization to operate the facility in the absence of implementation of the modifications to eliminate reliance on prompt operator action, as described in the licensee's letters of July 20, October 9, and November 22, 1978 is limited to Cycle 3.

FOR THE NUCLEAR REGULATORY COMMISSION

Victor Stello, Jr., Director
Division of Operating Reactors
Office of Nuclear Reactor Regulation

Dated at Bethesda, Maryland,
this 15th day of December 1978.