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*NRC Research and/or Technical Assistance Report*  
TECHNICAL SPECIFICATIONS FOR REDUNDANT DECAY HEAT

REMOVAL CAPABILITY, H. B. ROBINSON STEAM ELECTRIC  
PLANT, UNIT NO. 2

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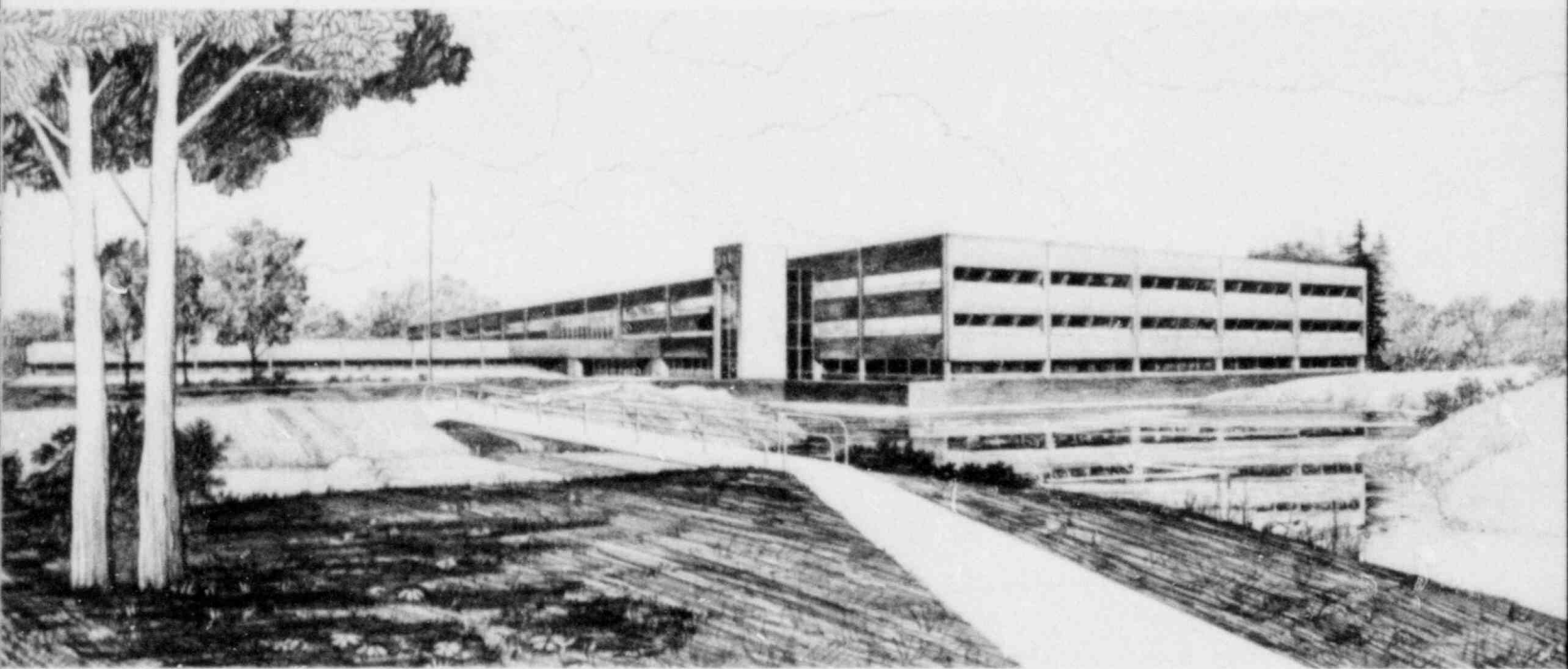
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INTERIM REPORT

TECHNICAL SPECIFICATIONS FOR REDUNDANT DECAY HEAT REMOVAL CAPABILITY

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

Docket No. 50-261

February 1982

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## ABSTRACT

This report reviews the H. B. Robinson Steam Electric Plant Unit No. 2 proposed technical specifications for redundancy in decay heat removal capability in all modes of operation.

## FOREWORD

This report is supplied as part of the "Selected Operating Reactors Issues Program (III)" being conducted for the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Division of Licensing by EG&G Idaho, Inc., Reliability and Statistics Branch.

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## TECHNICAL EVALUATION REPORT

### TECHNICAL SPECIFICATIONS FOR REDUNDANT DECAY HEAT REMOVAL CAPABILITY

#### H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

#### 1.0 INTRODUCTION

A number of events have occurred at operating PWR facilities where decay heat removal capability has been seriously degraded due to inadequate administrative controls during shutdown modes of operation. One of these events, described in IE Information Notice 80-20,<sup>1</sup> occurred at the Davis-Besse, Unit No. 1 plant on April 19, 1980. In IE Bulletin 80-12<sup>2</sup> dated May 9, 1980, licensees were requested to immediately implement administrative controls which would ensure that proper means are available to provide redundant methods of decay heat removal. While the function of the bulletin was to effect immediate action with regard to this problem, the NRC considered it necessary that an amendment of each license be made to provide for permanent long-term assurance that redundancy in decay heat removal capability will be maintained. By letter dated June 11, 1980,<sup>3</sup> all PWR licensees were requested to: 1) propose technical specification (TS) changes that provide for redundancy in decay heat removal capability in all modes of operation, 2) use the NRC model TS which provide an acceptable solution of the concern and include an appropriate safety analysis as basis, and 3) submit the proposed TS with the bases by October 11, 1980.

On September 26, 1980, Carolina Power and Light Company (CP&L) submitted proposed changes to their technical specifications for H. B. Robinson, Unit No. 2.<sup>4</sup> The following discussion evaluates the proposed TS and notes any differences existing between them and the model TS provided by the NRC (Appendix A). The requirements are compared for equivalent modes of operation.

#### 2.0 DISCUSSION

H. B. Robinson, Unit No. 2 is a three-loop Westinghouse PWR plant. The following sections of the Westinghouse Standard Technical Specifications<sup>5</sup> apply to this task:

- 3/4.4 Reactor Coolant System
- 3/4.4.1 Reactor Coolant Loops and Coolant Circulation
- 3/4.9 Refueling Operations
- 3/4.9.8 Residual Heat Removal and Coolant Circulation

H. B. Robinson's proposed TS varied from the NRC model TS (MTS) in the following requirements:

1. Limiting Condition 3.4.1.1. The proposed Robinson TS require that Power Operation with less than three loops in service is prohibited, which meets the NRC MTS. However, no action is given if the above requirement is failed to be maintained.
2. Limiting Condition 3.4.1.2. Robinson's TS require that at least two steam generators shall be OPERABLE whenever the average primary coolant temperature is above 350°F; also, whenever a reduction of the boron concentration is made, at least one reactor coolant pump or Residual Heat Removal (RHR) system shall be in operation. Robinson requires that the plant shall be placed in Cold Shutdown if any one component in a reactor coolant loop is inoperable for a specified time period while the plant is in Hot Shutdown (as defined by Robinson's TS). The time period ranges from 4 to 24 hours for the specific component plus 48 hours, after which the specified action is required. There is no specified time period given in which the plant has to be in Cold Shutdown after the action is initialized.

The NRC MTS require that at least two coolant loops shall be OPERABLE and at least one loop be in operation; with less than the above, restore the required loops to OPERABLE status within 72 hours or have  $T_{avg}$  below 350°F within the next 72 hours.

3. Mode 4. H. B. Robinson's proposed TS define Hot Shutdown as when the reactor is subcritical and  $T_{avg}$  is  $\geq 540^\circ\text{F}$ . The NRC MTS equivalent mode, Hot Standby, is when  $T_{avg}$  is  $\geq 350^\circ$ . The NRC MTS Hot Shutdown (Mode 4) is defined when  $T_{avg}$  is between

200°F and 350°F. Robinson did not have a defined condition that corresponds to the NRC MTS Hot Shutdown and so did not include coverage of Limiting Condition 3.4.1.3 for Hot Shutdown (NRC Mode 4).

4. Limiting Condition 3.4.1.3. In Cold Shutdown both RHR loops must be OPERABLE. If an RHR loop becomes inoperable, the proposed Robinson TS states "within 24 hours verify the existence of a method to add make-up water to the reactor coolant system."<sup>4</sup> The NRC MTS also requires at least one loop to be in operation. The action requirement given by the NRC is if no coolant loop is in operation suspend all operations involving a reduction in boron concentration of the Reactor Coolant System and immediately initiate corrective action to return the required coolant loop to operation.
5. Limiting Condition 3.9.8.2. When the water level is less than 23 feet above the top of the irradiated fuel assemblies, the proposed Robinson TS require one RHR loop to be in operation. The NRC MTS require two independent RHR loops to be OPERABLE. If all of the specified Limiting Conditions are not met, Robinson requires refueling of the reactor to cease, no operations shall be made to increase the reactivity of the core and work shall be initiated to correct the conditions. The NRC MTS action requirement is if less than two RHR loops are OPERABLE, immediately initiate corrective action to restore the loops to OPERABLE status.
6. Surveillance Requirements. The proposed H. B. Robinson TS do not include any surveillance requirements in their TS. The justification is given in their September 26, 1980 letter that NRC MTS do not conform with the format of Robinson TS and surveillance requirements are considered routine operator functions which have been and will continue to be controlled and documented at the Robinson plant through administrative methods (Operator's Logs, Checklists, Shift Turnover Checklists and Operating Work Procedures).<sup>4</sup>



### 3.0 CONCLUSIONS

The proposed Robinson TS varied from the NRC MTS in almost all areas. During Startup and Power Operation no action was given if the required conditions were not met. During Hot Standby (as defined by NRC) action was different between the NRC MTS and Robinson's TS. Robinson did not have a classification that corresponded to the NRC Hot Shutdown so these Limiting Conditions were not covered. In Cold Shutdown the Limiting Conditions and therefore the action requirements are different. During Refueling when the water level is below 23 feet above the top of the irradiated fuel assemblies within the reactor pressure vessel, Robinson had different limiting conditions. All surveillance requirements in the NRC MTS were not covered as Robinson's TS do not include them according to their format.

### 4.0 REFERENCES

1. NRC IE Information Notice 80-20, May 8, 1980.
2. NRC IE Bulletin 80-12, May 9, 1980.
3. NRC letter, D. G. Eisenhut, To All Operating Pressurized Water Reactors (PWR's) dated June 11, 1980.
4. CP&L letter, E. E. Utley to NRC, Steven A. Varga, dated September 26, 1980.
5. Standard Technical Specifications for Westinghouse Pressurized Water Reactors, NUREG-0452, Rev. 3, Fall 1980.

APPENDIX A

MODEL TECHNICAL SPECIFICATIONS FOR REDUNDANT DECAY  
HEAT REMOVAL FOR WESTINGHOUSE PRESSURIZED WATER REACTORS (PWR's)

### 3/4.4 REACTOR COOLANT SYSTEM

#### 3/4.4.1 REACTOR COOLANT LOOPS AND COOLANT CIRCULATION

##### STARTUP AND POWER OPERATION

##### LIMITING CONDITION FOR OPERATION

---

3.4.1.1 All reactor coolant loops shall be in operation.

APPLICABILITY: MODES 1 and 2.\*

ACTION:

With less than the above required reactor coolant loops in operation, be in at least HOT STANDBY within 1 hour.

##### SURVEILLANCE REQUIREMENT

---

4.4.1.1 The above required reactor coolant loops shall be verified to be in operation and circulating reactor coolant at least once per 12 hours.

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\* See Special Test Exception 3.10.4.

## REACTOR COOLANT SYSTEM

### HOT STANDBY

#### LIMITING CONDITION FOR OPERATION

---

- 3.4.1.2 a. At least two of the reactor coolant loops listed below shall be OPERABLE:
1. Reactor Coolant Loop (A) and its associated steam generator and reactor coolant pump,
  2. Reactor Coolant Loop (B) and its associated steam generator and reactor coolant pump,
  3. Reactor Coolant Loop (C) and its associated steam generator and reactor coolant pump,
  4. Reactor Coolant Loop (D) and its associated steam generator and reactor coolant pump.
- b. At least one of the above coolant loops shall be in operation.\*

APPLICABILITY: MODE 3

#### ACTION:

- a. With less than the above required reactor coolant loops OPERABLE, restore the required loops to OPERABLE status within 72 hours or be in HOT SHUTDOWN within the next 12 hours.

---

\* All reactor coolant pumps may be de-energized for up to 1 hour provided (1) no operations are permitted that would cause dilution of the reactor coolant system boron concentration, and (2) core outlet temperature is maintained at least 10°F below saturation temperature.

## REACTOR COOLANT SYSTEM

- b. With no reactor coolant loop in operation, suspend all operations involving a reduction in boron concentration of the Reactor Coolant System and immediately initiate corrective action to return the required coolant loop to operation.

## SURVEILLANCE REQUIREMENT

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4.4.1.2.1 At least the above required reactor coolant pumps, if not in operation, shall be determined to be OPERABLE once per 7 days by verifying correct breaker alignments and indicated power availability.

4.4.1.2.2 At least one cooling loop shall be verified to be in operation and circulating reactor coolant at least once per 12 hours.

## REACTOR COOLANT SYSTEM

### SHUTDOWN

#### LIMITING CONDITION FOR OPERATION

---

- 3.4.1.3 a. At least two of the coolant loops listed below shall be OPERABLE:
1. Reactor Coolant Loop (A) and its associated steam generator and reactor coolant pump,\*
  2. Reactor Coolant Loop (B) and its associated steam generator and reactor coolant pump,\*
  3. Reactor Coolant Loop (C) and its associated steam generator and reactor coolant pump,\*
  4. Reactor Coolant Loop (D) and its associated steam generator and reactor coolant pump,\*
  5. Residual Heat Removal Loop (A),\*\*
  6. Residual Heat Removal Loop (B).\*\*
- b. At least one of the above coolant loops shall be in operation.\*\*\*

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\* A reactor coolant pump shall not be started with one or more of the RCS cold leg temperatures less than or equal to (275)<sup>0</sup>F unless 1) the pressurizer water volume is less than \_\_\_\_ cubic feet or 2) the secondary water temperature of each steam generator is less than \_\_\_\_ <sup>0</sup>F above each of the RCS cold leg temperatures.

\*\* The normal or emergency power source may be inoperable in MODE 5.

\*\*\* All reactor coolant pumps and decay heat removal pumps may be de-energized for up to 1 hour provided 1) no operations are permitted that would cause dilution of the reactor coolant system boron concentration, and 2) core outlet temperature is maintained at least 10<sup>0</sup>F below saturation temperature.

## REACTOR COOLANT SYSTEM

APPLICABILITY: MODES 4 and 5.

### ACTION:

- a. With less than the above required loops OPERABLE, immediately initiate corrective action to return the required loops to OPERABLE status as soon as possible; be in COLD SHUTDOWN within 20 hours.
- b. With no coolant loop in operation, suspend all operations involving a reduction in boron concentration of the Reactor Coolant System and immediately initiate corrective action to return the required coolant loop to operation.

### SURVEILLANCE REQUIREMENT

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4.4.1.3.1 The required residual heat removal loop(s) shall be determined OPERABLE per Specification 4.0.5.

4.4.1.3.2 The required reactor coolant pump(s), if not in operation, shall be determined to be OPERABLE once per 7 days by verifying correct breaker alignments and indicated power availability.

4.4.1.3.3 The required steam generator(s) shall be determined OPERABLE by verifying secondary side level to be greater than or equal to ( )% at least once per 12 hours.

4.4.1.3.4 At least one coolant loop shall be verified to be in operation and circulating reactor coolant at least once per 12 hours.

## REFUELING OPERATIONS

### 3/4.9.8 RESIDUAL HEAT REMOVAL AND COOLANT CIRCULATION

#### ALL WATER LEVELS

#### LIMITING CONDITION FOR OPERATION

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3.9.8.1 At least one residual heat removal (RHR) loop shall be in operation.

APPLICABILITY: MODE 6

ACTION:

- a. With less than one residual heat removal loop in operation, except as provided in b. below, suspend all operations involving an increase in the reactor decay heat load or a reduction in boron concentration of the Reactor Coolant System. Close all containment penetrations providing direct access from the containment atmosphere to the outside atmosphere within 4 hours.
- b. The residual heat removal loop may be removed from operation for up to 1 hour per 8 hour period during the performance of CORE ALTERATIONS in the vicinity of the reactor pressure vessel (hot) legs.
- c. The provisions of Specification 3.0.3 are not applicable.

#### SURVEILLANCE REQUIREMENT

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4.9.8.1 At least one residual heat removal loop shall be verified to be in operation and circulating reactor coolant at a flow rate of greater than or equal to (2800) gpm at least once per 4 hours.



## REFUELING OPERATIONS

### LOW WATER LEVEL

#### LIMITING CONDITION FOR OPERATION

---

3.9.8.2 Two independent Residual Heat Removal (RHR) loops shall be OPERABLE.\*

APPLICABILITY: MODE 6 when the water level above the top of the irradiated fuel assemblies seated within the reactor pressure vessel is less than 23 feet.

#### ACTION:

- a. With less than the required RHR loops OPERABLE, immediately initiate corrective action to return the required RHR loops to OPERABLE status as soon as possible.
- b. The provisions of Specification 3.0.3 are not applicable.

#### SURVEILLANCE REQUIREMENT

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4.9.8.2 The required Residual Heat Removal loops shall be determined OPERABLE per Specification 4.0.5.

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\* The normal or emergency power source may be inoperable for each RHR loop.

### 3/4.4 REACTOR COOLANT SYSTEM

#### BASES

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#### 3/4.4.1 REACTOR COOLANT LOOPS AND COOLANT CIRCULATION

The plant is designed to operate with all reactor coolant loops in operation, and maintain DNBR above 1.30 during all normal operations and anticipated transients. In MODES 1 and 2 with one reactor coolant loop not in operation this specification requires that the plant be in at least HOT STANDBY within 1 hour.

In MODE 3, a single reactor coolant loop provides sufficient heat removal capability for removing decay heat; however, single failure considerations require that two loops be OPERABLE.

In MODES 4 and 5, a single reactor coolant loop or RHR loop provides sufficient heat removal capability for removing decay heat; but single failure considerations require that at least two loops be OPERABLE. Thus, if the reactor coolant loops are not OPERABLE, this specification requires two RHR loops to be OPERABLE.

The operation of one Reactor Coolant Pump or one RHR pump provides adequate flow to ensure mixing, prevent stratification and produce gradual reactivity changes during boron concentration reductions in the Reactor Coolant System. The reactivity change rate associated with boron reduction will, therefore, be within the capability of operator recognition and control.

The restrictions on starting a Reactor Coolant Pump with one or more RCS cold legs less than or equal to (275)<sup>0</sup>F are provided to prevent RCS pressure transients, caused by energy additions from the secondary system, which could exceed the limits of Appendix G to 10 CFR Part 50. The RCS will be protected against overpressure transients and will not exceed the limits of Appendix G by either (1) restricting the water volume in the pressurizer and thereby providing a volume for the primary coolant to expand into, or (2) by restricting starting of the RCPs to when the secondary water temperature of each steam generator is less than ( )<sup>0</sup>F above each of the RCS cold leg temperatures.

## REFUELING OPERATIONS

### BASES

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#### 3/4.9.8 RESIDUAL HEAT REMOVAL AND COOLANT CIRCULATION

The requirement that at least one residual heat removal (RHR) loop be in operation ensures that (1) sufficient cooling capacity is available to remove decay heat and maintain the water in the reactor pressure vessel below 140 F as required during the REFUELING MODE, and (2) sufficient coolant circulation is maintained through the reactor core to minimize the effect of a boron dilution incident and prevent boron stratification.

The requirement to have two RHR loops OPERABLE when there is less than 23 feet of water above the core ensures that a single failure of the operating RHR loop will not result in a complete loss of residual heat removal capability. With the reactor vessel head removed and 23 feet of water above the core, a large heat sink is available for core cooling. Thus, in the event of a failure of the operating RHR loop, adequate time is provided to initiate emergency procedures to cool the core.