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TECHNICAL SPECIFICATIONS FOR REDUNDANT DECAY HEAT REMOVAL CAPABILITY, ST. LUCIE, UNIT NO. 1

NRC Research and/or Technical Assistance Report

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PRELIMINARY

U.S. Department of Energy
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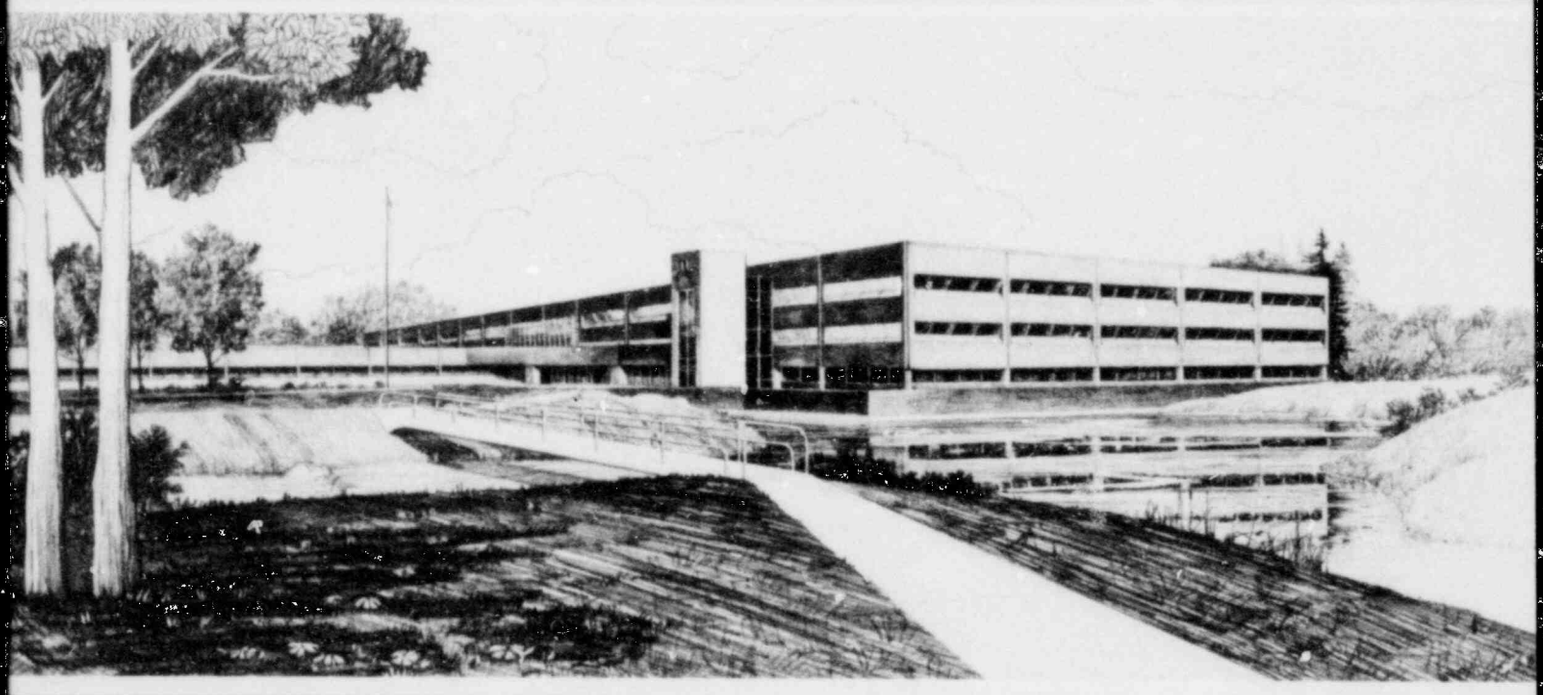

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Prepared for the
U.S. Nuclear Regulatory Commission
Under DOE Contract No. DE-AC07-76ID01570
FIN No. A6429

EG&G Idaho

EG&G Idaho, Inc.

FORM EG&G-398
(Rev. 11-81)

INTERIM REPORT

Accession No. _____

Report No. EGG-EA-5745

Contract Program or Project Title:

Selected Operating Reactor Issues Program (III)

Subject of this Document:

Technical Specifications for Redundant Decay Heat Removal Capability, St. Lucie, Unit No. 1

Type of Document:

Technical Evaluation Report

Author(s):

J. A. Steverson

Date of Document:

January 1982

Responsible NRC/DOE Individual and NRC/DOE Office or Division:

J. N. Donohew, Division of Licensing, NRC

This document was prepared primarily for preliminary or internal use. It has not received full review and approval. Since there may be substantive changes, this document should not be considered final.

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Prepared for the
U.S. Nuclear Regulatory Commission
Washington, D.C.
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INTERIM REPORT

TECHNICAL EVALUATION REPORT

TECHNICAL SPECIFICATIONS FOR REDUNDANT DECAY HEAT REMOVAL CAPABILITY

ST. LUCIE, UNIT NO. 1

Docket No. 50-335

January 1982

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Draft 12/30/81
TAC No. 42118

ABSTRACT

This report reviews the St. Lucie, Unit No. 1, technical specifications for redundancy in decay heat removal capability for all modes of operation.

FOREWORD

This report is supplied as part of the "Selected Operating Reactor 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.

The U.S. Nuclear Regulatory Commission funded the work under the authorization, B&R 20 19 02 06, FIN No. A6429.

TECHNICAL EVALUATION REPORT

TECHNICAL SPECIFICATIONS FOR REDUNDANT DECAY HEAT REMOVAL CAPABILITY

ST. LUCIE, UNIT NO. 1

1.0 INTRODUCTION

A number of events have occurred at operating Pressurized Water Reactor (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,[1] occurred at the Davis-Besse, Unit No. 1 plant on April 19, 1980. In IE Bulletin 80-12[2] 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,[3] 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 (Appendix A) which provide an acceptable solution of the concern and include appropriate safety analyses as bases, and 3) submit the proposed TS with the bases by October 11, 1980.

Florida Power & Light Co. (FP&L) submitted proposed revisions for decay heat removal to their St. Lucie TS on October 30, 1980.[4]

2.0 DISCUSSION

St. Lucie, Unit No. 1 is a two loop Combustion Engineering (CE) PWR plant. The following discussion evaluates the proposed TS submitted by FP&L for redundant decay heat removal as requested by the NRC. The proposed TS are compared to the model TS during equivalent operational modes. The following sections of the CE Standard Technical Specifications[5] apply to this task:

3/4.4 REACTOR COOLANT SYSTEM

3/4.4.1 COOLANT LOOPS AND COOLANT CIRCULATION

3/4.9 REFUELING OPERATIONS

3/4.9.8 SHUTDOWN COOLING AND COOLANT CIRCULATION

During startup and power operation, modes 1 and 2, the NRC model TS require that with less than four pumps operating, the plant be in HOT STANDBY within 1 hour. St. Lucie's proposed TS require that the plant be in HOT STANDBY within 6 hours with less than four pumps operating.

In mode 3, HOT STANDBY with less than two coolant loops OPERABLE, the NRC model TS require that the plant be in COLD SHUTDOWN within 30 hours if the loops are not restored to OPERABLE status within 72 hours. The proposed TS require that the plant be in HOT SHUTDOWN within the next 12 hours under the same conditions.

In mode 4, HOT SHUTDOWN, the NRC model TS require at least two reactor coolant loops to be OPERABLE. The model TS include an associated steam generator in each of Reactor Coolant Loops (A) and (B). The proposed TS do not specifically include the steam generator(s) as part of Reactor Coolant Loops (A) and (B). With less than the required loops OPERABLE and not restored within 72 hours, the proposed TS require that the plant be in COLD SHUTDOWN within 30 hours while the NRC model TS specify 20 hours.

3.0 CONCLUSION

The technical specifications proposed by St. Lucie, Unit 1 are in agreement with the NRC model TS with the following exceptions:

1. With less than four pumps operating in modes 1 and 2, the NRC model TS require the plant be in HOT STANDBY within 1 hour; the proposed TS specify 6 hours.

2. With less than two coolant loops OPERABLE in mode 3, the NRC model TS require the plant be in COLD SHUTDOWN within 30 hours; the proposed TS require that the plant be in HOT SHUTDOWN within 12 hours.

3. In mode 4, the proposed TS do not specifically include associated steam generators in Reactor Coolant Loops (A) and (B).

4. With less than the required loops OPERABLE in mode 4, the NRC model TS require that the plant be in COLD SHUTDOWN within 20 hours; the proposed TS specify 30 hours.

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. FP&L letter, R. Uhrig to NRC, D. G. Eisenhut, dated October 30, 1980.
5. Standard Technical Specifications for Combustion Engineering Pressurized Water Reactors, NUREG-0212, Rev. 1, Fall 1980.

APPENDIX A

MODEL TECHNICAL SPECIFICATIONS FOR REDUNDANT DECAY HEAT REMOVAL FOR COMBUSTION ENGINEERING PRESSURIZED WATER REACTORS

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 Both reactor coolant loops and both reactor coolant pumps in each loop shall be in operation.

APPLICABILITY: 1 and 2.*

ACTION:

With less than the above required reactor coolant pumps 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.

* See Special Test Exception 3.10.3.

REACTOR COOLANT SYSTEM

HOT STANDBY

LIMITING CONDITION FOR OPERATION

3.4.1.2 a. The reactor coolant loops listed below shall be OPERABLE:

1. Reactor Coolant Loop (A) and at least one associated reactor coolant pump,

2. Reactor Coolant Loop (B) and at least one associated reactor coolant pump,

b. At least one of the above Reactor 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.

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 loop to operation.

SURVEILLANCE REQUIREMENT

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.

* 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 $10^{o}F$ below saturation temperature.

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 at least one associated reactor coolant pump,

2. Reactor Coolant Loop (B) and its associated steam generator and at least one associated reactor coolant pump,

3. Shutdown Cooling Loop (A)#

4. Shutdown Cooling Loop (B)#

b. At least one of the above coolant loops shall be in operation.*

APPLICABILITY: MODES 4** and 5**

ACTION:

a. With less than the above required loops OPERABLE, immediately initiate corrective action to return the required coolant 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.

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* 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°F below saturation temperature.

** A reactor coolant pump shall not be started with one or more of the RCS cold leg temperatures less than or equal to (275)°F unless (1) the pressurizer water volume is less than 900 cubic feet or (2) the secondary water temperature of each steam generator is less than 46 °F above each of the RCS cold leg temperatures.

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

SURVEILLANCE REQUIREMENT

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 water 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

3.9.8.1 At least one shutdown loop shall be in operation.

APPLICABILITY: MODE 6

ACTION:

a. With less than one shutdown cooling 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 shutdown cooling 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

4.9.8.1 At least one shutdown cooling loop shall be verified to be in operation and circulating reactor coolant at a flow rate of greater than or equal to (3000) gpm at least once per 4 hours.

REFUELING OPERATIONS

LOW WATER LEVEL

LIMITING CONDITION FOR OPERATION

3.9.8.2 Two independent shutdown cooling 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 shutdown cooling loops OPERABLE, immediately initiate corrective action to return loops to OPERABLE status as soon as possible.

b. The provisions of Specification 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENT

4.9.8.2 The required shutdown cooling loops shall be determined OPERABLE per Specification 4.0.5.

* The normal or emergency power source may be inoperable for each shutdown cooling loop.

BASES

3/4.4.1 REACTOR COOLANT LOOPS AND COOLANT CIRCULATION

The plant is designed to operate with both reactor coolant loops and associated reactor coolant pumps in operation, and maintain DNBR above 1.30 during all normal operations and anticipated transients.

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 shutdown cooling 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 shutdown cooling loops to be OPERABLE.

The operation of one Reactor Coolant Pump or one shutdown cooling 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 reductions will, therefore, be within the capability of operator recognition and control.

The restrictions on starting a Reactor Coolant Pump during MODES 4 and 5 with one or more RCS cold legs less than or equal to (275)^{o}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 (46)^{o}F above each of the RCS cold leg temperatures.

3/4.9.8 COOLANT CIRCULATION

The requirement that at least one shutdown cooling 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 shutdown cooling loops OPERABLE when there is less than 23 feet of water above the core, ensures that a single failure of the operating shutdown cooling loop will not result in a complete loss of decay 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 shutdown cooling loop, adequate time is provided to initiate emergency procedures to cool the core.