

August 27, 1990

Docket Nos. 50-338  
and 50-339

DISTRIBUTION  
See attached sheet

Mr. W. L. Stewart  
Senior Vice President - Nuclear  
Virginia Electric and Power Company  
5000 Dominion Blvd.  
Glen Allen, Virginia 23060

Dear Mr. Stewart:

SUBJECT: NORTH ANNA UNITS 1 AND 2 - ISSUANCE OF AMENDMENTS RE: RESIDUAL  
HEAT REMOVAL FLOW RATES (TAC NOS. 76954 AND 76955)

The Commission has issued the enclosed Amendment Nos. 137 and 120 to Facility Operating License Nos. NPF-4 and NPF-7 for the North Anna Power Station, Units No. 1 and No. 2 (NA-1&2). The amendments revise the Technical Specifications (TS) in response to your letter dated June 8, 1990, as superseded June 13, 1990.

The amendments enhance RHR reliability by including a reduction in the minimum residual heat removal flow rates from 3000 gpm to 2000 gpm during reactor coolant system partial drainage (mid-loop) operation for which the temperature is maintained below 140°F and the reactor has been shut down for at least 100 hours.

A copy of the Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's biweekly Federal Register notice.

Sincerely,

Original signed by

Leon B. Engle, Project Manager  
Project Directorate II-2  
Division of Reactor Projects - I/II  
Office of Nuclear Reactor Regulation

Enclosures:

1. Amendment No. 137 to NPF-4
2. Amendment No. 120 to NPF-7
3. Safety Evaluation

cc w/enclosures:  
See next page

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Virginia Electric & Power Company

North Anna Power Station  
Units 1 and 2

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DATED: August 27, 1990

AMENDMENT NO. 137 TO FACILITY OPERATING LICENSE NO. NPF-4-NORTH ANNA UNIT 1  
AMENDMENT NO. 120 TO FACILITY OPERATING LICENSE NO. NPF-7-NORTH ANNA UNIT 2

**[REDACTED]**  
NRC & Local PDRs

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cc: Plant Service list



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

VIRGINIA ELECTRIC AND POWER COMPANY  
OLD DOMINION ELECTRIC COOPERATIVE  
DOCKET NO. 50-338  
NORTH ANNA POWER STATION, UNIT NO. 1  
AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 137  
License No. NPF-4

1. The Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment by Virginia Electric and Power Company et al., (the licensee) dated June 8, 1990, as superseded June 13, 1990, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;
  - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
  - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
  - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
  - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

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2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.D.(2) of Facility Operating License No. NPF-4 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No.137, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of issuance and shall be implemented within 30 days.

FOR THE NUCLEAR REGULATORY COMMISSION



Herbert N. Berkow, Director  
Project Directorate II-2  
Division of Reactor Projects - I/II  
Office of Nuclear Reactor Regulation

Attachment:  
Changes to the Technical  
Specifications

Date of Issuance: August 27, 1990

ATTACHMENT TO LICENSE AMENDMENT NO. 137

TO FACILITY OPERATING LICENSE NO. NPF-4

DOCKET NO. 50-338

Replace the following pages of the Appendix "A" Technical Specifications with the enclosed pages as indicated. The revised pages are identified by amendment number and contain vertical lines indicating the area of change. The corresponding overleaf pages are also provided to maintain document completeness.

Page

3/4 4-3a  
3/4 9-8  
3/4 9-8a  
B 3/4 4-1  
B 3/4 9-2

## REACTOR COOLANT SYSTEM

### SHUTDOWN

#### LIMITING CONDITION FOR OPERATION

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- 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. Residual Heat Removal Subsystem A,\*\*
  5. Residual Heat Removal Subsystem 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 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.

\*A reactor coolant pump shall not be started with one or more of the RCS cold leg temperatures less than or equal to 324°F unless the secondary water temperature of each steam generator is less than 50°F above each of the RCS cold leg temperatures.

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

\*\*\*All reactor coolant pumps and residual 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.

## REACTOR COOLANT SYSTEM

### SHUTDOWN

#### SURVEILLANCE REQUIREMENTS

- 4.4.1.3.1 The required RHR subsystems shall be demonstrated OPERABLE per Specification 4.7.9.2.
- 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 alignment 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 17% at least once per 12 hours.
- 4.4.1.3.4 At least once per 12 hours, verify at least one coolant loop to be in operation and circulating reactor coolant by:
- a. Verifying at least one Reactor Coolant Pump is in operation.
- or
- b. Verifying at least one RHR Loop is in operation and,
    - 1. if the RCS temperature  $>140^{\circ}$  F or the time since entry into MODE 3 is  $<100$  hours, circulating reactor coolant at a flow rate  $\geq 3000$  gpm.
- or
- 2. if the RCS temperature  $\leq 140^{\circ}$  F and the time since entry into MODE 3 is  $\geq 100$  hours, circulating reactor coolant at a flow rate  $\geq 2000$  gpm to remove decay heat.

## REFUELING OPERATIONS

### 3/4.9.8 RESIDUAL HEAT REMOVAL (RHR) AND COOLANT CIRCULATION

#### NORMAL WATER LEVEL

#### LIMITING CONDITIONS FOR OPERATION

3.9.8.1 At least one RHR loop shall be OPERABLE\* and at least one RHR loop shall be in operation.

**APPLICABILITY:** MODE 6 With the reactor vessel water level greater than or equal to 23 feet above the top of the reactor pressure vessel flange.

- ACTION:**
- a. With less than one RHR loop OPERABLE, immediately initiate corrective actions to return the required RHR loops to OPERABLE status as soon as possible.
  - b. With less than one RHR loop in operation, except as provided in c. 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.
  - c. The RHR 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.
  - d. The provisions of Specification 3.0.3 are not applicable.

#### SURVEILLANCE REQUIREMENTS

4.9.8.1.1 Verify the required RHR loop to be OPERABLE per Specification 4.0.5.

4.9.8.1.2 At least once per 4 hours, verify at least one RHR Loop is in operation and,

- a. if the RCS temperature  $>140^{\circ}$  F or the time since entry into MODE 3 is  $<100$  hours, circulating reactor coolant at a flow rate  $\geq 3000$  gpm.
- b. if the RCS temperature  $\leq 140^{\circ}$  F and the time since entry into MODE 3 is  $\geq 100$  hours, circulating reactor coolant at a flow rate  $\geq 2000$  gpm to remove decay.

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

## REFUELING OPERATIONS

### RESIDUAL HEAT REMOVAL (RHR) AND COOLANT CIRCULATION

#### LOW WATER LEVELS

#### LIMITING CONDITION FOR OPERATION

3.9.8.2 Two independent RHR loops shall be OPERABLE\* with at least one loop in operation.

**APPLICABILITY:** MODE 6 with the reactor vessel water level less than 23 feet above the top of the reactor pressure vessel flange.

- 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. With less than one RHR loop in operation, 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.
  - c. The provisions of Specification 3.0.3 are not applicable.

#### SURVEILLANCE REQUIREMENTS

4.9.8.2.1 Verify the required RHR loops to be OPERABLE per Specification 4.0.5.

4.9.8.2.2 At least once per 4 hours, verify at least one RHR Loop is in operation and,

- a. if the RCS temperature  $>140^{\circ}$  F or the time since entry into MODE 3 is  $<100$  hours, circulating reactor coolant at a flow rate  $\geq 3000$  gpm.
- b. if the RCS temperature  $\leq 140^{\circ}$  F and the time since entry into MODE 3 is  $\geq 100$  hours, circulating reactor coolant at a flow rate  $\geq 2000$  gpm to remove decay.

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

### 3/4.4 REACTOR COOLANT SYSTEM

#### BASES

#### 3/4.4.1 REACTOR COOLANT LOOPS

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.

After the reactor has shutdown and entered into MODE 3 for at least 100 hours, a minimum RHR system flow rate of 2000 gpm in MODE 5 is permitted, provided there is sufficient decay heat removal to maintain the RCS temperature less than or equal to 140°F. Since the decay heat power production rate decreases with time after reactor shutdown, the requirements for RHR system decay heat removal also decrease. Adequate decay heat removal is provided as long as the reactor has been shutdown for at least 100 hours after entry into MODE 3 and RHR flow is sufficient to maintain the RCS temperature less than or equal to 140°F. The reduced flow rate provides additional margin to vortexing at the RHR pump suction while in Mid Loop Operation. During a reduction in reactor coolant system boron concentration the Specification 3.1.1.3.1 requirement to maintain a 3000 gpm flow rate provides sufficient coolant circulation to minimize the effect of a boron dilution incident and to prevent boron stratification.

The restrictions on starting a Reactor Coolant Pump with one or more RCS cold legs less than or equal to 324°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 restricting starting of the RCPs to when the secondary water temperature of each steam generator is less than 50°F above each of the RCS cold leg temperatures.

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 requirement to maintain the boron concentration of an isolated loop greater than or equal to the boron concentration of the operating loops ensures that no reactivity addition to the core could occur during startup of an isolated loop. Verification of the boron concentration in an idle loop prior to opening the cold leg stop valve provides a reassurance of the adequacy of the boron concentration in the isolated loop. Operating the isolated loop on recirculating flow for at least 90 minutes prior to opening its cold leg stop valve ensures adequate mixing of the coolant in this loop and prevents any reactivity effects due to boron concentration stratification.

Startup of an idle loop will inject cool water from the loop into the core. The reactivity transient resulting from this cool water injection is minimized by delaying isolated loop startup until its temperature is

### 3/4.4 REACTOR COOLANT SYSTEM

#### BASES

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within 20°F of the operating loops. Making the reactor subcritical prior to loop startup prevents any power spike which could result from this cool water induced reactivity transient.

#### 3/4.4.2 AND 3/4.4.3 SAFETY VALVES

The pressurizer code safety valves operate to prevent the RCS from being pressurized above its Safety Limit of 2735 psig. Each safety valve is designed to relieve 380,000 lbs per hour of saturated steam at the valve set point. The relief capacity of a single safety valve is adequate to relieve any overpressure condition which could occur during shutdown. In the event that no safety valves are OPERABLE, an operating RHR loop, connected to the RCS, provides overpressure relief capability and will prevent RCS overpressurization.

During operation, all pressurizer code safety valves must be OPERABLE to prevent the RCS from being pressurized above its safety limit of 2735 psig. The combined relief capacity of all of these valves is greater than the maximum surge rate resulting from a complete loss of load assuming no reactor trip until the first Reactor Protection System trip set point is reached (i.e., no credit is taken for a direct reactor trip on the loss of load) and also assuming no operation of the power operated relief valves or steam dump valves.

Demonstration of the safety valves' lift settings will occur only during shutdown and will be performed in accordance with the provisions of Section XI of the ASME Boiler and Pressure Code.

The power operated relief valves and steam bubble function to relieve RCS pressure during all design transients up to and including the design step load decrease with steam dump. Operation of the power operated relief valves minimizes the undesirable opening of the spring-loaded pressurizer code safety valves. Each PORV has a remotely operated block valve to provide a positive shutoff capability should a relief valve become inoperable.

#### 3/4.4.4 PRESSURIZER

The limit on the maximum water volume in the pressurizer assures that the parameter is maintained within the normal steady state envelope of operation assumed in the SAR. The limit is consistent with the initial SAR assumptions. The 12 hour periodic surveillance is sufficient to ensure that the parameter is restored to within its limit following expected transient operation. The maximum water volume also ensures that a steam bubble is formed and thus the RCS is not a hydraulically solid system.

## 3/4.9 REFUELING OPERATIONS

### BASES

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#### 3/4.9.1 BORON CONCENTRATION

The limitations on reactivity conditions during REFUELING ensure that: 1) the reactor will remain subcritical during CORE ALTERATIONS, and 2) a uniform boron concentration is maintained for reactivity control in the water volume having direct access to the reactor vessel. These limitations are consistent with the initial conditions assumed for the boron dilution incident in the accident analyses. The value of 0.95 or less for  $K_{eff}$  includes a 1%  $\Delta k/k$  conservative allowance for uncertainties. Similarly, the boron concentration of 2300 ppm or greater includes a conservative uncertainty allowance of 50 ppm boron.

#### 3/4.9.2 INSTRUMENTATION

The OPERABILITY of the source range neutron flux monitors ensures that redundant monitoring capability is available to detect changes in the reactivity condition of the core.

#### 3/4.9.3 DECAY TIME

The minimum requirement for reactor subcriticality prior to movement of irradiated fuel assemblies in the reactor pressure vessel ensures that sufficient time has elapsed to allow the radioactive decay of the short lived fission products. This decay time is consistent with the assumptions used in the accident analyses.

#### 3/4.9.4 CONTAINMENT BUILDING PENETRATIONS

The requirements on containment building penetration closure and OPERABILITY ensure that a release of radioactive material within containment will be restricted from leakage to the environment. The OPERABILITY and closure restrictions are sufficient to restrict radioactive material release from a fuel element rupture based upon a lack of containment pressurization potential while in the REFUELING MODE.

#### 3/4.9.5 COMMUNICATIONS

The requirement for communication capability ensures that refueling station personnel can be promptly informed of significant changes in the facility status or core reactivity conditions during CORE ALTERATIONS.

## REFUELING OPERATIONS

### BASES

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#### 3/4.9.6 MANIPULATOR CRANE OPERABILITY

The OPERABILITY requirements for the manipulator cranes ensure that: 1) manipulator cranes will be used for movement of control rods and fuel assemblies; 2) each crane has sufficient load capacity to lift a control rod or fuel assembly, and 3) the core internals and pressure vessel are protected from excessive lifting force in the event they are inadvertently engaged during lifting operations.

#### 3/4.9.7 CRANE TRAVEL - SPENT FUEL PIT

The restriction on movement of loads in excess of the nominal weight of a fuel and control rod assembly and associated handling tool over other fuel assemblies in the storage pool ensures that in the event this load is dropped, 1) the activity release will be limited to that contained in a single fuel assembly, and 2) any possible distortion of fuel in the storage racks will not result in a critical array. This assumption is consistent with the activity release assumed in the accident analyses.

#### 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.

After the reactor has shutdown and entered into MODE 3 for at least 100 hours, a minimum RHR system flow rate of 2000 gpm in MODE 6 is permitted, provided there is sufficient decay heat removal to maintain the RCS temperature less than or equal to 140°F. Since the decay heat power production rate decreases with time after reactor shutdown, the requirements for RHR system decay heat removal also decrease. Adequate decay heat removal is provided as long as the reactor has been shutdown for at least 100 hours after entry into MODE 3 and RHR flow is sufficient to maintain the RCS temperature less than or equal to 140°F. The reduced flow rate provides additional margin to vortexing at the RHR pump suction while in Mid Loop Operation. During a reduction in reactor coolant system boron concentration the Specification 3.1.1.3.1 requirement to maintain a 3000 gpm flow rate provides sufficient coolant circulation to minimize the effect of a boron dilution incident and to prevent boron stratification.

The requirement to have two RHR loops OPERABLE when there is less than 23 feet of water above the reactor pressure vessel flange 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 reactor pressure vessel flange, 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.

#### 3/9.9 CONTAINMENT PURGE AND EXHAUST ISOLATION SYSTEM

The OPERABILITY of this system ensures that the containment vent and purge penetrations will be automatically isolated upon detection of high radiation levels within the containment. The OPERABILITY of this system is required to restrict the release of radioactive material from the containment atmosphere to the environment.



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

VIRGINIA ELECTRIC AND POWER COMPANY

OLD DOMINION ELECTRIC COOPERATIVE

DOCKET NO. 50-339

NORTH ANNA POWER STATION, UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 120  
License No. NPF-7

1. The Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment by Virginia Electric and Power Company et al., (the licensee) dated June 8, 1990, as superseded June 13, 1990, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;
  - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
  - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
  - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
  - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

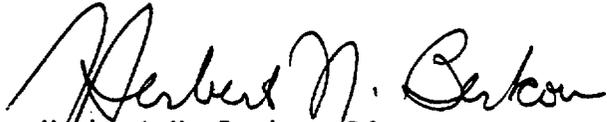
2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Facility Operating License No. NPF-7 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 120, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of issuance and shall be implemented within 30 days.

FOR THE NUCLEAR REGULATORY COMMISSION



Herbert N. Berkow, Director  
Project Directorate II-2  
Division of Reactor Projects - I/II  
Office of Nuclear Reactor Regulation

Attachment:  
Changes to the Technical  
Specifications

Date of Issuance: August 27, 1990

ATTACHMENT TO LICENSE AMENDMENT NO. 120

TO FACILITY OPERATING LICENSE NO. NPF-7

DOCKET NO. 50-339

Replace the following pages of the Appendix "A" Technical Specifications with the enclosed pages as indicated. The revised pages are identified by amendment number and contain vertical lines indicating the area of change. The corresponding overleaf pages are also provided to maintain document completeness.

Page

III

3/4 1-4

3/4 1-4a

3/4 4-3a

3/4 9-9

3/4 9-9a

B 3/4 4-1

B 3/4 9-2

INDEX

SAFETY LIMITS AND LIMITING SAFETY SYSTEM SETTINGS

---

<u>SECTION</u>	<u>Page</u>
<u>2.1 SAFETY LIMITS</u>	
Reactor Core.....	2-1
Reactor Coolant System Pressure.....	2-1
<u>2.2 LIMITING SAFETY SYSTEM SETTINGS</u>	
Reactor Trip Setpoints.....	2-5

BASES

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<u>SECTION</u>	<u>Page</u>
<u>2.1 SAFETY LIMITS</u>	
Reactor Core.....	B 2-1
Reactor Coolant System Pressure.....	B 2-2
<u>2.2 LIMITING SAFETY SYSTEM SETTINGS</u>	
Reactor Trip Setpoints.....	B 2-3

## INDEX

### LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

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<u>SECTION</u>	<u>Page</u>
<u>3/4.0 APPLICABILITY</u> .....	3/4 0-1
<u>3/4.1 REACTIVITY CONTROL SYSTEMS</u>	
3/4.1.1 BORATION CONTROL	
Shutdown Margin - $T_{avg} > 200^{\circ} F$ .....	3/4 1-1
Shutdown Margin - $T_{avg} \leq 200^{\circ} F$ .....	3/4 1-3
Boron Dilution - Reactor Coolant Flow.....	3/4 1-4
Boron Dilution - Valve Position.....	3/4 1-4a
Moderator Temperature Coefficient.....	3/4 1-5
Minimum Temperature for Criticality.....	3/4 1-7
3/4.1.2 BORATION SYSTEMS	
Flow Paths - Shutdown.....	3/4 1-8
Flow Paths - Operating.....	3/4 1-9
Charging Pump - Shutdown.....	3/4 1-11
Charging Pumps - Operating.....	3/4 1-12
Borated Water Sources - Shutdown.....	3/4 1-13
Borated Water Sources - Operating.....	3/4 1-14
3/4.1.3 MOVABLE CONTROL ASSEMBLIES	
Group Height.....	3/4 1-16
Position Indicator Channels - Operating.....	3/4 1-19
Position Indicator Channels - Shutdown.....	3/4 1-20
Rod Drop Time.....	3/4 1-21
Shutdown Rod Insertion Limit .....	3/4 1-22
Control Rod Insertion Limits.....	3/4 1-23

## REACTIVITY CONTROL SYSTEMS

SHUTDOWN MARGIN -  $T_{avg}$  LESS THAN OR EQUAL TO 200°F

### SURVEILLANCE REQUIREMENTS

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3.1.1.2 The SHUTDOWN MARGIN shall be greater than or equal to 1.77% delta k/k.

APPLICABILITY: MODE 5.

ACTION:

With the SHUTDOWN MARGIN less than 1.77% delta k/k, immediately initiate and continue boration at greater than or equal to 10 gpm of a solution containing greater than or equal to 12,950 ppm boron or equivalent until the required SHUTDOWN MARGIN is restored.

### SURVEILLANCE REQUIREMENTS

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4.1.1.2 The SHUTDOWN MARGIN shall be determined to be greater than or equal to 1.77% delta k/k:

- a. Within one hour after detection of an inoperable control rod(s) and at least once per 12 hours thereafter while the rod(s) is inoperable. If the inoperable control rod is immovable or untrippable, the SHUTDOWN MARGIN shall be increased by an amount at least equal to the withdrawn worth of the immovable or untrippable control rod(s).
- b. At least once per 24 hours by consideration of the following factors:
  1. Reactor coolant system boron concentration,
  2. Control rod position,
  3. Reactor coolant system average temperature,
  4. Fuel burnup based on gross thermal energy generation,
  5. Xenon concentration, and
  6. Samarium concentration.

## REACTIVITY CONTROL SYSTEM

### 3/4.1.1.3 BORON DILUTION

#### REACTOR COOLANT FLOW

### LIMITING CONDITIONS FOR OPERATION

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- 3.1.1.3.1 The flow rate of reactor coolant through the reactor coolant system shall be  $\geq 3000$  gpm whenever a reduction in Reactor Coolant System boron concentration is being made.

**APPLICABILITY:** All MODES

**ACTION:** With the flow rate of reactor coolant through the reactor coolant system  $< 3000$  gpm, immediately suspend all operations involving a reduction in boron concentration of the Reactor Coolant System.

### SURVEILLANCE REQUIREMENTS

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- 4.1.1.3.1 The flow of reactor coolant through the reactor coolant system shall be determined to be  $\geq 3000$  gpm within one hour prior to the start of and at least once per hour during a reduction in the Reactor Coolant System boron concentration by either:
- a. Verifying at least one reactor coolant pump is in operation,
  - or
  - b. Verifying that at least one RHR pump is in operation and supplying  $\geq 3000$  gpm through the reactor coolant system.

REACTIVITY CONTROL SYSTEM

BORON DILUTION

VALVE POSITION

LIMITING CONDITION FOR OPERATION

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3.1.1.3.2 The following valves shall be locked, sealed or otherwise secured in the closed position except during planned boron dilution or makeup activities:

- a. 2-CH-140 or
- b. 2-CH-160, 2-CH-156, FCV-2114B and FCV-2113B.

APPLICABILITY: MODES 3, 4, 5, and 6.

ACTION:

With the above valves not locked, sealed or otherwise secured in the closed position: 1) suspend all operations involving positive reactivity changes or CORE ALTERATIONS, 2) lock, seal or otherwise secure the valves in the closed position within 15 minutes, and 3) verify that the SHUTDOWN MARGIN is greater than or equal to 1.77% delta k/k within 60 minutes.

SURVEILLANCE REQUIREMENTS

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4.1.1.3.2 The above listed valves shall be verified to be locked, sealed or otherwise secured in the closed position within 15 minutes after a planned boron dilution or makeup activity.

## REACTOR COOLANT SYSTEM

### SHUTDOWN

#### SURVEILLANCE REQUIREMENTS

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4.4.1.3.1 The required RHR subsystems shall be demonstrated OPERABLE PER SPECIFICATION 4.7.9.2.

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 17% at least once per 12 hours.

4.4.1.3.4 At least once per 12 hours, verify at least one coolant loop to be in operation and circulating reactor coolant by:

a. Verifying at least one Reactor Coolant Pump is in operation.

or

b. Verifying at least one RHR Loop is in operation and,

1. if the RCS temperature  $> 140^{\circ}\text{F}$  or the time since entry into MODE 3 is  $< 100$  hours, circulating reactor coolant at a flow rate  $\geq 3000$  gpm,

or

2. if the RCS temperature  $\leq 140^{\circ}\text{F}$  and the time since entry into MODE 3 is  $\geq 100$  hours, circulating reactor coolant at a flow rate  $\geq 2000$  gpm to remove decay heat.

## REACTOR COOLANT SYSTEM

### ISOLATED LOOP

#### LIMITING CONDITION FOR OPERATION

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3.4.1.2 The boron concentration of an isolated loop shall be maintained greater than or equal to the boron concentration of the operating loops, unless the loop has been drained for maintenance.

APPLICABILITY: MODES 1, 2, 3, 4 and 5.

ACTION:

With the requirements of the above specification not satisfied, do not open the isolated loop's stop valves; either increase the boron concentration of the isolated loop to within the limits within 4 hours or be in at least HOT STANDBY within the next 6 hours with the unisolated portion of the RCS borated to a SHUTDOWN MARGIN equivalent to at least 1.77%  $\Delta k/k$  at 200°F.

#### SURVEILLANCE REQUIREMENTS

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4.4.1.2 The boron concentration of an isolated loop shall be determined to be greater than or equal to the boron concentration of the operating loops at least once per 24 hours and within 30 minutes prior to opening either the hot leg or cold leg stop valves of an isolated loop.

## REFUELING OPERATIONS

### 3/4.9.8 RESIDUAL HEAT REMOVAL (RHR) AND COOLANT CIRCULATION

#### NORMAL WATER LEVEL

#### LIMITING CONDITION FOR OPERATION

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3.9.8.1 At least one RHR loop shall be OPERABLE\* and at least one RHR loop shall be in operation.

**APPLICABILITY:** MODE 6 With the reactor vessel water level greater than or equal to 23 feet above the top of the reactor pressure vessel flange.

- ACTION:**
- a. With less than one RHR loop OPERABLE, immediately initiate corrective actions to return the required RHR loops to OPERABLE status as soon as possible.
  - b. With less than one RHR loop in operation, except as provided in c. 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.
  - c. The RHR 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.
  - d. The provisions of Specification 3.0.3 are not applicable.

#### SURVEILLANCE REQUIREMENTS

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4.9.8.1.1 Verify the required RHR loop to be OPERABLE per Specification 4.0.5.

4.9.8.1.2 At least once per 4 hours, verify at least one RHR Loop is in operation and,

- a. if the RCS temperature  $>140^{\circ}$  F or the time since entry into MODE 3 is  $<100$  hours, circulating reactor coolant at a flow rate  $\geq 3000$  gpm.
- b. if the RCS temperature  $\leq 140^{\circ}$  F and the time since entry into MODE 3 is  $\geq 100$  hours, circulating reactor coolant at a flow rate  $\geq 2000$  gpm to remove decay heat.

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

## REFUELING OPERATIONS

### RESIDUAL HEAT REMOVAL (RHR) AND COOLANT CIRCULATION

#### LOW WATER LEVELS

#### LIMITING CONDITION FOR OPERATION

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3.9.8.2 Two independent RHR loops shall be OPERABLE\* with at least one loop in operation.

**APPLICABILITY:** MODE 6 with the reactor vessel water level less than 23 feet above the top of the reactor pressure vessel flange.

- 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. With less than one RHR loop in operation, 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.
  - c. The provisions of Specification 3.0.3 are not applicable.

#### SURVEILLANCE REQUIREMENTS

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4.9.8.2.1 Verify the required RHR loops to be OPERABLE per Specification 4.0.5.

4.9.8.2.2 At least once per 4 hours, verify at least one RHR Loop is in operation and,

- a. if the RCS temperature  $>140^{\circ}$  F or the time since entry into MODE 3 is  $<100$  hours, circulating reactor coolant at a flow rate  $\geq 3000$  gpm.
- b. if the RCS temperature  $\leq 140^{\circ}$  F and the time since entry into MODE 3 is  $\geq 100$  hours, circulating reactor coolant at a flow rate  $\geq 2000$  gpm to remove decay heat.

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

REFUELING OPERATIONS

CONTAINMENT PURGE AND EXHAUST ISOLATION SYSTEM

LIMITING CONDITION FOR OPERATION

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3.9.9 The Containment Purge and Exhaust isolation system shall be OPERABLE.

APPLICABILITY: MODE 6.

ACTION:

With the Containment Purge and Exhaust isolation system inoperable, close each of the Purge and Exhaust penetrations providing direct access from the containment atmosphere to the outside atmosphere.

The provisions of Specification 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

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4.9.9 The Containment Purge and Exhaust isolation system shall be demonstrated OPERABLE within 100 hours prior to the start of and at least once per 7 days during CORE ALTERATIONS by verifying that containment Purge and Exhaust isolation occurs on manual initiation and on a high radiation test signal from the containment gaseous and particulate radiation monitoring instrumentation channels.

### 3/4.4 REACTOR COOLANT SYSTEM

#### BASES

#### 3/4.4.1 REACTOR COOLANT LOOPS

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.

After the reactor has shutdown and entered into MODE 3 for at least 100 hours, a minimum RHR system flow rate of 2000 gpm in MODE 5 is permitted, provided there is sufficient decay heat removal to maintain the RCS temperature less than or equal to 140°F. Since the decay heat power production rate decreases with time after reactor shutdown, the requirements for RHR system decay heat removal also decrease. Adequate decay heat removal is provided as long as the reactor has been shutdown for at least 100 hours after entry into MODE 3 and RHR flow is sufficient to maintain the RCS temperature less than or equal to 140°F. The reduced flow rate provides additional margin to vortexing at the RHR pump suction while in Mid Loop Operation. During a reduction in reactor coolant system boron concentration the Specification 3.1.1.3.1 requirement to maintain a 3000 gpm flow rate provides sufficient coolant circulation to minimize the effect of a boron dilution incident and to prevent boron stratification.

The restrictions on starting a Reactor Coolant Pump with one or more RCS cold legs less than or equal to 340°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 from the RCPs to when the secondary water temperature of each steam generator is less than 50°F above each of the RCS cold leg temperatures.

The requirement to maintain the boron concentration of an isolated loop greater than or equal to the boron concentration of the operating loops ensures that no reactivity addition to the core could occur during startup of an isolated loop. Verification of the boron concentration in an idle loop prior to opening the cold leg stop valve provides a reassurance of the adequacy of the boron concentration in the isolated loop. Operating the isolated loop on recirculating flow for at least 90 minutes prior to opening its cold leg stop valve ensures adequate mixing of the coolant in this loop and prevents any reactivity effects due to boron concentration stratification.

Startup of an idle loop will inject cool water from the loop into the core. The reactivity transient resulting from this cool water injection is minimized by delaying isolated loop startup until its temperature is within 20°F of the operating loops. Making the reactor subcritical prior to loop startup prevents any power spike which could result from this cool water induced reactivity transient.

## REACTOR COOLANT SYSTEM

### BASES

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#### 3/4.4.2 and 3/4.4.3 SAFETY AND RELIEF VALVES

The pressurizer code safety valves operate to prevent the RCS from being pressurized above its Safety Limit of 2735 psig. Each safety valve is designed to relieve 380,000 lbs per hour of saturated steam at the valve set point. The relief capacity of a single safety valve is adequate to relieve any overpressure condition which could occur during shutdown. In the event that no safety valves are OPERABLE, an operating RHR loop, connected to the RCS, provides overpressure relief capability and will prevent RCS overpressurization.

During operation, all pressurizer code safety valves must be OPERABLE to prevent the RCS from being pressurized above its safety limit of 2735 psig. The combined relief capacity of all of these valves is greater than the maximum surge rate resulting from a complete loss of load assuming no reactor trip until the first Reactor Protective System trip set point is reached (i.e., no credit is taken for a direct reactor trip on the loss of load) and also assuming no operation of the power operated relief valves or steam dump valves.

Demonstration of the safety valves' lift settings will occur only during shutdown and will be performed in accordance with the provisions of Section XI of the ASME Boiler and Pressure Code.

The power operated relief valves (PORVs) and steam bubble function to relieve RCS pressure during all design transients up to and including the design step load decrease with steam dump. Operation of the PORVs minimizes the undesirable opening of the spring-loaded pressurizer code safety valves. Each PORV has a remotely operated block valve to provide a positive shutoff capability should a relief valve become inoperable.

#### 3/4.4.4 PRESSURIZER

The limit on the maximum water volume in the pressurizer assures that the parameter is maintained within the normal steady state envelope of operation assumed in the SAR. The limit is consistent with the initial SAR assumptions. The 12-hour periodic surveillance is sufficient to ensure that the parameter is restored to within its limit following expected transient operation. The maximum water volume also ensures that a steam bubble is formed and thus the RCS is not a hydraulically solid system. The requirement that a minimum number of pressurizer heaters be OPERABLE ensures that the plant will be able to establish natural circulation.

## 3/4.9 REFUELING OPERATIONS

### BASES

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#### 3/4.9.1 BORON CONCENTRATION

The limitations on reactivity conditions during REFUELING ensure that: 1) the reactor will remain subcritical during CORE ALTERATIONS, and 2) a uniform boron concentration is maintained for reactivity control in the water volume having direct access to the reactor vessel. These limitations are consistent with the initial conditions assumed for the boron dilution incident in the accident analyses. The value of 0.95 or less for  $K_{eff}$  includes a 1%  $\Delta k/k$  conservative allowance for uncertainties. Similarly, the boron concentration of 2300 ppm or greater includes a conservative uncertainty allowance of 50 ppm boron.

#### 3/4.9.2 INSTRUMENTATION

The OPERABILITY of the source range neutron flux monitors ensures that redundant monitoring capability is available to detect changes in the reactivity condition of the core.

#### 3/4.9.3 DECAY TIME

The minimum requirement for reactor subcriticality prior to movement of irradiated fuel assemblies in the reactor pressure vessel ensures that sufficient time has elapsed to allow the radioactive decay of the short lived fission products. This decay time is consistent with the assumptions used in the accident analyses.

#### 3/4.9.4 CONTAINMENT BUILDING PENETRATIONS

The requirements on containment building penetration closure and OPERABILITY ensure that a release of radioactive material within containment will be restricted from leakage to the environment. The OPERABILITY and closure restrictions are sufficient to restrict radioactive material release from a fuel element rupture based upon the lack of containment pressurization potential while in the REFUELING MODE.

#### 3/4.9.5 COMMUNICATIONS

The requirement for communications capability ensures that refueling station personnel can be promptly informed of significant changes in the facility status or core reactivity conditions during CORE ALTERATIONS.

## REFUELING OPERATIONS

### BASES

#### 3/4.9.6 MANIPULATOR CRANE OPERABILITY

The OPERABILITY requirements for the manipulator cranes ensure that: 1) manipulator cranes will be used for movement of control rods and fuel assemblies, 2) each crane has sufficient load capacity to lift a control rod or fuel assembly, and 3) the core internals and pressure vessel are protected from excessive lifting force in the event they are inadvertently engaged during lifting operations.

#### 3/4.9.7 CRANE TRAVEL - SPENT FUEL PIT

The restriction on movement of loads in excess of the nominal weight that of a fuel and control rod assemblies and associated handling tool over other fuel assemblies in the storage pool ensures that in the event this load is dropped, 1) the activity release will be limited to that contained in a single fuel assembly, and 2) any possible distortion of fuel in the storage racks will not result in a critical array. This assumption is consistent with the activity release assumed in the accident.

#### 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.

After the reactor has shutdown and entered into MODE 3 for at least 100 hours, a minimum RHR system flow rate of 2000 gpm in MODE 6 is permitted, provided there is sufficient decay heat removal to maintain the RCS temperature less than or equal to 140°F. Since the decay heat power production rate decreases with time after reactor shutdown, the requirements for RHR system decay heat removal also decrease. Adequate decay heat removal is provided as long as the reactor has been shutdown for at least 100 hours after entry into MODE 3 and RHR flow is sufficient to maintain the RCS temperature less than or equal to 140°F. The reduced flow rate provides additional margin to vortexing at the RHR pump suction while in Mid Loop Operation. During a reduction in reactor coolant system boron concentration the Specification 3.1.1.3.1 requirement to maintain a 3000 gpm flow rate provides sufficient coolant circulation to minimize the effect of a boron dilution incident and to prevent boron stratification.

The requirement to have two RHR loops OPERABLE when there is less than 23 feet of water above the reactor pressure vessel flange 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 reactor pressure vessel flange, 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.

#### 3/4.9.9 CONTAINMENT PURGE AND EXHAUST ISOLATION SYSTEM

The OPERABILITY of this system ensures that the containment vent and purge penetrations will be automatically isolated upon detection of high radiation levels within the containment. The OPERABILITY of this system is required to restrict the release of radioactive material from the containment atmosphere to the environment.



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NOS. 137 AND 120 TO

FACILITY OPERATING LICENSE NOS. NPF-4 AND NPF-7

VIRGINIA ELECTRIC AND POWER COMPANY

OLD DOMINION ELECTRIC COOPERATIVE

NORTH ANNA POWER STATION, UNITS NO. 1 AND NO. 2

DOCKET NOS. 50-338 AND 50-339

INTRODUCTION

By letter dated June 8, 1990, as superseded June 13, 1990, the Virginia Electric and Power Company (the licensee) proposed changes to the Technical Specifications (TS) for the North Anna Power Station, Units No. 1 and No. 2 (NA-1&2). The changes will reduce the minimum residual heat removal (RHR) flow rate from 3000 gpm to 2000 gpm during reactor coolant system (RCS) partial drainage (mid-loop) operation for which the temperature is maintained below 140°F and the reactor has been shut down for at least 100 hours. The 100 hour requirement is consistent with the typical time from power operation to mid-loop operation. At the currently required flow rate of 3000 gpm, the RHR system is more susceptible to vortex formation at the RHR pump suction piping during RCS partial drainage operation. Vortexing can cause RHR system air entrainment and pump cavitation and subsequent loss of RHR system heat removal capability. The changes will increase the margin to safety operate RHR pumps and also increase plant operational flexibility.

DISCUSSION

Mid-loop operation (operation with the RCS partially drained) is necessary for required inspection and maintenance of RCS components such as reactor coolant pumps and steam generators. As indicated in NUREG-1269, reduced flow rates provide greater margin against vortex formation and can help preclude an inadvertent loss of decay heat removal capability due to air entrainment and cavitation of the RHR pumps. A Westinghouse Owners' Group (WOG) project evaluated the effects of system geometry, RHR flow rate and water level within the RCS hot leg piping, in order to predict the onset of detrimental vortexing. For the NA-1/2 RCS configuration (at a 2000 gpm RHR flow rate), the WOG evaluation predicts that vortexing begins at an RCS hot leg water level of about 0.25 inch above reactor vessel nozzle centerline. Since the normal RCS hot leg water level at NA-1&2 during mid-loop operation is 10 inches above reactor vessel nozzle center, the proposed minimum RHR flow rate of 2000 gpm provides adequate operational flexibility and margin to vortexing for normal plant mid-loop operation.

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As the time after plant shutdown increases, decay heat removal and thus the RHR flow rate requirements are reduced. The licensee performed an energy balance calculation utilizing a decay heat power curve based upon ANSI/ANS-5.1-1979. The analysis indicated that at 100 hours after reactor shutdown the proposed minimum RHR flow rate provides sufficient heat removal capability to maintain the RCS temperature below 140°F as required for refueling (Mode 6) operation. In addition, a minimum RHR flow rate is required to prevent flow stratification and localized variations in boron concentration in the RCS. The analysis showed the proposed minimum flow of 2000 gpm would provide the necessary turbulence in the RCS cold leg to ensure adequate boron mixing. Also, the functional performance of the mechanical equipment in the RHR system trains from the RCS hot leg piping to the RCS cold leg piping was evaluated. This evaluation confirmed that the minimum RHR flow through any one RHR pump discharge check valve was sufficient to keep the check valve fully open.

The TS changes in the proposed amendments are itemized below:

- (1) Addition of TS 3/4.1.1.3.1 to the NA-2 TS -- The addition of this TS requires that a minimum RCS flow of 3000 gpm be maintained whenever a reduction in the RCS boron concentration is being made. This specification provides assurance that adequate boron mixing will be maintained when the RCS boron concentration is being changed. The proposed specification is consistent with the existing NA-1 TS and Standard TS and is acceptable.
- (2) Renumbering of TS 3/4.1.1.3 to 3/4.1.1.3.2 for the NA-2 TS -- The change will enhance consistency between the NA-1&2 TS. The change is an administrative change, and is acceptable.
- (3) TS 4.4.1.3.4, 3/4.9.8.1 and 3/4.9.8.2 (NA-1&2) -- The proposed changes revise the current minimum RHR system flow rate of 3000 gpm to 2000 gpm during mid-loop operation when the RCS temperature is maintained below 140°F and the reactor has been shut down for at least 100 hours. The proposed changes are consistent with the licensee's analysis as discussed above, and are therefore acceptable.
- (4) TS 4.4.1.3.1 (operability requirements per TS 4.7.9.2) -- The current TS requires the RHR system to be "Operable per Specification 4.0.5." The TS is changed to be "Operable per Specification 4.7.9.2." Since Specification 4.7.9.2 includes the operability requirements for Specification 4.0.5, the change does not effect the plant operation, is an administrative change, and is acceptable.
- (5) TS 3/4.9.8.1 (applicable to "Normal Water Levels") -- The LCO (Limiting Condition for Operation) for this specification is changed to read "At least one RHR loop shall be OPERABLE and at least one RHR loop shall be in operation." The revised TS is a more conservative requirement in that it now requires at least one RHR loop to be operable, in addition to operation of at least one RHR loop. The staff finds this change to be acceptable.

- (6) TS 3/4.9.8.2 (applicable to "Low Water Level") -- The TS is revised from "Two independent RHR loops shall be OPERABLE" by adding "with at least one loop in operation" to the LCO. The change imposes a more restricted operating condition and the proposed TS is consistent with the Standard TS, and is therefore acceptable.

#### EVALUATION

The staff has reviewed the proposed TS changes which include a reduction in the RHR flow rate during mid-loop operation when the RCS temperature is maintained below 140°F and the reactor has been shut down for at least 100 hours. The staff finds these changes are consistent with the position of NRC GL 88-17 and supported by the licensee's analysis. Therefore, the staff finds the changes to be acceptable.

#### ENVIRONMENTAL CONSIDERATION

These amendments involve a change to a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes surveillance requirements. We have determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that these amendments involve no significant hazards consideration and there has been no public comment on such finding. Accordingly, these amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of these amendments.

#### CONCLUSION

We have concluded, based on the considerations discussed above, that (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (2) such activities will be conducted in compliance with the Commission's regulations, and the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

Date: August 27, 1990

#### Principal Contributors:

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