October 9, 1987

Docket Nos.: STN 50-528,
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Mr. E. E. Van Brunt, Jr.
Executive Vice President
Arizona Nuclear Power Project
Post Office Box 52034
Phoenix, Arizona 85072-2034

Dear Mr. Van Brunt:

SUBJECT: ISSUANCE OF AMENDMENT NO. 23 TO FACILITY OPERATING LICENSE NO. NPF-41 AND AMENDMENT NO. 13 TO FACILITY OPERATING LICENSE NO. NPF-51, FOR THE PALO VERDE NUCLEAR GENERATING STATION, UNITS 1 AND 2, RESPECTIVELY (TAC NOS. 64676 AND 64677)

The Commission has issued the subject Amendments, which are enclosed, to the Facility Operating Licenses for Palo Verde Nuclear Generating Station, Units 1 and 2. The Amendments consist of changes to the Technical Specifications (Appendix A to each license) in response to your application transmitted by letter dated January 23, 1987, as supplemented by letters dated April 23, June 8, July 17 and October 1, 1987. In response to your request in the October 1, 1987 letter, the processing of these same changes for Palo Verde, Unit 3 will be completed prior to the unit achieving 100% power.

The Amendments revise the Technical Specifications for each of the two Palo Verde Units, as follows. The Shutdown Margin requirements in Specifications 3.1.1.1 and 3.1.1.2 have been revised to reflect a temperature dependent margin with any rod withdrawn and a margin of 1% delta k/k when all full-length CEAs are fully inserted; the trip setpoints and notations in Tables 2.2-1 and 3.3-1 have been revised accordingly. Specification 3.1.2.3 and the five tables in Specification 3.1.2.7 have been revised to permit operation of more than one charging pump while in Mode 5. A new Special Test Exception (Specification 3.10.9) has been added to allow operability testing of the control element drive mechanism system during pre-startup testing without the need for alternating between Specifications 3.1.1.1 and 3.1.1.2. Related administrative changes have been made to several other portions of the Technical Specifications, e.g., revised table of contents, revised bases section, added definition of $K_{N-1}$, and renumbered pages and sections, resulting from the above changes.

A copy of the related Safety Evaluation is also enclosed. A Notice of Issuance will be included in the Commission's next regular bi-weekly Federal Register notice.

Sincerely,

Original signed by:
E. A. Licitra

E. A. Licitra, Senior Project Manager
Project Directorate V
Division of Reactor Projects - III, IV, V and Special Projects

Enclosures:

1. Amendment No. 23 to NPF-41
2. Amendment No. 13 to NPF-51
3. Safety Evaluation

cc: See next page

*See previous concurrence

| | | | | |
|---|---|---|---|---|
| *DRSP/PDV | DRSP/PDV EAL | *NRR/SRXB | *OGC | DRSP/PDV |
| JLee | EALicitra:cd | MWHodges | | GWKnighton |
| 9/23/87 | 10/9/87 | 9/25/87 | 10/5/87 | 10/9/87 |

Mr. E. E. Van Brunt, Jr.
Arizona Nuclear Power Project

Palo Verde

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

ARIZONA PUBLIC SERVICE COMPANY, ET AL.

DOCKET NO. STN 50-528

PALO VERDE NUCLEAR GENERATING STATION, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 23
License No. NPF-41

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment, dated January 23, 1987, as supplemented by letters dated April 23, June 8, July 17 and October 1, 1987, by the Arizona Public Service Company (APS) on behalf of itself and the Salt River Project Agricultural Improvement and Power District, El Paso Electric Company, Southern California Edison Company, Public Service Company of New Mexico, Los Angeles Department of Water and Power, and Southern California Public Power Authority (licensees), complies with the standards and requirements of the Atomic Energy act of 1954, as amended (the Act) and the Commission's 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 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 enclosure to this license amendment, and Paragraph 2.C.(2) of Facility Operating License No. NPF-41 is hereby amended to read as follows:

   (2) <u>Technical Specifications and Environmental Protection Plan</u>

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 23, and the Environmental Protection Plan contained in Appendix B, are hereby incorporated into this license. APS shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This license amendment is effective as of the date of issuance. The changes in the Technical Specifications are to become effective within 30 days of issuance of the amendment. In the period between issuance of the amendment and the effective date of the new Technical Specifications, the licensees shall adhere to the Technical Specifications existing at the time. The period of time during changeover shall be minimized.

FOR THE NUCLEAR REGULATORY COMMISSION

George W. Knighton

George W. Knighton, Director
Project Directorate V
Division of Reactor Projects - III, IV, V and Special Projects
Office of Nuclear Reactor Regulation

Enclosure:
Changes to the Technical Specifications

Date of Issuance: October 9, 1987

October 9, 1987

ENCLOSURE TO LICENSE AMENDMENT

AMENDMENT NO. 23 TO FACILITY OPERATING LICENSE NO. NPF-41

DOCKET NO. STN 50-528

Replace the following pages of the Appendix A Technical Specifications with the enclosed pages. The revised pages are identified by Amendment number and contain vertical lines indicating the areas of change. Also to be replaced are the following overleaf pages to the amended pages.

| Amendment Pages | Overleaf Pages |
|---|---|
| I | -- |
| II | -- |
| IV | III |
| IX | -- |
| X | -- |
| XIII | -- |
| XIV | -- |
| XIX | XX |
| 1-4 | 1-3 |
| 1-5 | -- |
| 1-6 | -- |
| 1-7 | 1-8 |
| 2-4 | 2-3 |
| 2-5 | 2-6 |
| 3/4 1-1 | -- |
| 3/4 1-2 | -- |
| 3/4 1-2a | -- |
| 3/4 1-3 | 3/4 1-4 |
| 3/4 1-8 | 3/4 1-7 |
| 3/4 1-9 | -- |
| 3/4 1-10 | -- |
| 3/4 1-13 | 3/4 1-14 |
| 3/4 1-16 | 3/4 1-15 |
| 3/4 1-17 | -- |
| 3/4 1-18 | -- |
| 3/4 1-19 | -- |
| 3/4 1-20 | -- |
| 3/4 3-5 | 3/4 3-6 |
| 3/4 10-1 | 3/4 10-2 |
| 3/4 10-9 | -- |
| 3/4 10-10 | -- |
| B 3/4 1-1 | -- |
| B 3/4 1-1a | -- |
| B 3/4 1-2 | -- |
| B 3/4 10-2 | B 3/4 10-1 |

# INDEX

DEFINITIONS

SECTION | PAGE

1.0 DEFINITIONS

DEFINITIONS

## INDEX

## SAFETY LIMITS AND LIMITING SAFETY SYSTEM SETTINGS



## BASES

LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

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LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

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BASES

LIST OF FIGURES

LIST OF TABLES

DOSE EQUIVALENT I-131

1.10 DOSE EQUIVALENT I-131 shall be that concentration of I-131 (microcuries/gram) which alone would produce the same thyroid dose as the quantity and isotopic mixture of I-131, I-132, I-133, I-134 and I-135 actually present. The thyroid dose conversion factors used for this calculation shall be those listed in Table III of TID-14844, "Calculation of Distance Factors for Power and Test Reactor Sites."

$\bar{E}$ - AVERAGE DISINTEGRATION ENERGY

1.11 $\bar{E}$ shall be the average (weighted in proportion to the concentration of each radionuclide in the reactor coolant at the time of sampling) of the sum of the average beta and gamma energies per disintegration (in MeV) for isotopes, other than iodines, with half-lives greater than 15 minutes, making up at least 95% of the total noniodine activity in the coolant.

ENGINEERED SAFETY FEATURES RESPONSE TIME

1.12 The ENGINEERED SAFETY FEATURES RESPONSE TIME shall be that time interval from when the monitored parameter exceeds its ESF actuation setpoint at the channel sensor until the ESF equipment is capable of performing its safety function (i.e., the valves travel to their required positions, pump discharge pressures reach their required values, etc.). Times shall include diesel generator starting and sequence loading delays where applicable.

FREQUENCY NOTATION

1.13 The FREQUENCY NOTATION specified for the performance of Surveillance Requirements shall correspond to the intervals defined in Table 1.1.

GASEOUS RADWASTE SYSTEM

1.14 A GASEOUS RADWASTE SYSTEM shall be any system designed and installed to reduce radioactive gaseous effluents by collecting primary coolant system offgases from the primary system and providing for delay or holdup for the purpose of reducing the total radioactivity prior to release to the environment.

IDENTIFIED LEAKAGE

1.15 IDENTIFIED LEAKAGE shall be:

a. Leakage into closed systems, other than reactor coolant pump controlled bleed-off flow, such as pump seal or valve packing leaks that are captured and conducted to a sump or collecting tank, or

b. Leakage into the containment atmosphere from sources that are both specifically located and known either not to interfere with the operation of leakage detection systems or not to be PRESSURE BOUNDARY LEAKAGE, or

c. Reactor Coolant System leakage through a steam generator to the secondary system.

$K_{N-1}$

1.16 $K_{N-1}$ is the k effective calculated by considering the actual CEA configuration and assuming that the fully or partially inserted full-length CEA of the highest worth is fully withdrawn.

MEMBER(S) OF THE PUBLIC

1.17 MEMBER(S) OF THE PUBLIC shall include all persons who are not occupationally associated with the plant. This category does not include employees of the licensee, its contractors, or vendors. Also excluded from this category are persons who enter the site to service equipment or to make deliveries. This category does include persons who use portions of the site for recreational, occupational, or other purposes not associated with the plant.

OFFSITE DOSE CALCULATION MANUAL (ODCM)

1.18 The OFFSITE DOSE CALCULATION MANUAL shall contain the current methodology and parameters used in the calculation of offsite doses due to radioactive gaseous and liquid effluents, in the calculation of gaseous and liquid effluent monitoring alarm/trip setpoints, and in the conduct of the environmental radiological monitoring program.

OPERABLE - OPERABILITY

1.19 A system, subsystem, train, component, or device shall be OPERABLE or have OPERABILITY when it is capable of performing its specified function(s), and when all necessary attendant instrumentation, controls, electrical power, cooling or seal water, lubrication or other auxiliary equipment that are required for the system, subsystem, train, component, or device to perform its function(s) are also capable of performing their related support function(s).

OPERATIONAL MODE - MODE

1.20 An OPERATIONAL MODE (i.e. MODE) shall correspond to any one inclusive combination of core reactivity condition, power level, and cold leg reactor coolant temperature specified in Table 1.2.

PHYSICS TESTS

1.21 PHYSICS TESTS shall be those tests performed to measure the fundamental nuclear characteristics of the reactor core and related instrumentation and (1) described in Chapter 14.0 of the FSAR, (2) authorized under the provisions of 10 CFR 50.59, or (3) otherwise approved by the Commission.

PLANAR RADIAL PEAKING FACTOR - $F_{xy}$

1.22 The PLANAR RADIAL PEAKING FACTOR is the ratio of the peak to plane average power density of the individual fuel rods in a given horizontal plane, excluding the effects of azimuthal tilt.

PRESSURE BOUNDARY LEAKAGE

1.23 PRESSURE BOUNDARY LEAKAGE shall be leakage (except steam generator tube leakage) through a nonisolable fault in a Reactor Coolant System component body, pipe wall, or vessel wall.

PROCESS CONTROL PROGRAM (PCP)

1.24 The PROCESS CONTROL PROGRAM shall contain the provisions to assure that the SOLIDIFICATION of wet radioactive wastes results in a waste form with properties that meet the requirements of 10 CFR Part 61 and of low level radioactive waste disposal sites. The PCP shall identify process parameters influencing SOLIDIFICATION such as pH, oil content, $H_2O$ content, solids content, ratio of solidification agent to waste and/or necessary additives for each type of anticipated waste, and the acceptable boundary conditions for the process parameters shall be identified for each waste type, based on laboratory scale and full-scale testing or experience. The PCP shall also include an identification of conditions that must be satisfied, based on full-scale testing, to assure that dewatering of bead resins, powdered resins, and filter sludges will result in volumes of free water, at the time of disposal, within the limits of 10 CFR Part 61 and of low level radioactive waste disposal sites.

PURGE - PURGING

1.25 PURGE or PURGING shall be the controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration, or other operating condition, in such a manner that replacement air or gas is required to purify the confinement.

RATED THERMAL POWER

1.26 RATED THERMAL POWER shall be a total reactor core heat transfer rate to the reactor coolant of 3800 MWt.

REACTOR TRIP SYSTEM RESPONSE TIME

1.27 The REACTOR TRIP SYSTEM RESPONSE TIME shall be the time interval from when the monitored parameter exceeds its trip setpoint at the channel sensor until electrical power is interrupted to the CEA drive mechanism.

REPORTABLE EVENT

1.28 A REPORTABLE EVENT shall be any of those conditions specified in Section 50.73 to 10 CFR Part 50.

SHUTDOWN MARGIN

1.29 SHUTDOWN MARGIN shall be the instantaneous amount of reactivity by which the reactor is subcritical or would be subcritical from its present condition assuming:

a. No change in part-length control element assembly position, and

b. All full-length control element assemblies (shutdown and regulating) are fully inserted except for the single assembly of highest reactivity worth which is assumed to be fully withdrawn.

SITE BOUNDARY

1.30 The SITE BOUNDARY shall be that line beyond which the land is neither owned, nor leased, nor otherwise controlled by the licensee.

SOFTWARE

1.31 The digital computer SOFTWARE for the reactor protection system shall be the program codes including their associated data, documentation, and procedures.

SOLIDIFICATION

1.32 SOLIDIFICATION shall be the conversion of radioactive wastes from liquid systems to a homogeneous (uniformly distributed), monolithic, immobilized solid with definite volume and shape, bounded by a stable surface of distinct outline on all sides (free-standing).

SOURCE CHECK

1.33 A SOURCE CHECK shall be the qualitative assessment of channel response when the channel sensor is exposed to a source of increased radioactivity.

STAGGERED TEST BASIS

1.34 A STAGGERED TEST BASIS shall consist of:

a. A test schedule for n systems, subsystems, trains, or other designated components obtained by dividing the specified test interval into n equal subintervals, and

b. The testing of one system, subsystem, train, or other designated component at the beginning of each subinterval.

THERMAL POWER

1.35 THERMAL POWER shall be the total reactor core heat transfer rate to the reactor coolant.

UNIDENTIFIED LEAKAGE

1.36 UNIDENTIFIED LEAKAGE shall be all leakage which does not constitute either IDENTIFIED LEAKAGE or reactor coolant pump controlled bleed-off flow.

UNRESTRICTED AREA

1.37 An UNRESTRICTED AREA shall be any area at or beyond the SITE BOUNDARY access to which is not controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials, or any area within the SITE BOUNDARY used for residential quarters or for industrial, commercial, institutional, and/or recreational purposes.

VENTILATION EXHAUST TREATMENT SYSTEM

1.38 A VENTILATION EXHAUST TREATMENT SYSTEM shall be any system designed and installed to reduce gaseous radioiodine or radioactive material in particulate form in effluents by passing ventilation or vent exhaust gases through charcoal adsorbers and/or HEPA filters for the purpose of removing iodines or particulates from the gaseous exhaust stream prior to the release to the environment. Such a system is not considered to have any effect on noble gas effluents. Engineered Safety Feature (ESF) atmospheric cleanup systems are not considered to be VENTILATION EXHAUST TREATMENT SYSTEM components.

VENTING

1.39 VENTING shall be the controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration, or other operating condition, in such a manner that replacement air or gas is not provided or required during VENTING. Vent, used in system names, does not imply a VENTING process.

TABLE 1.1

FREQUENCY NOTATION

| NOTATION | FREQUENCY |
| --- | --- |
| S | At least once per 12 hours. |
| D | At least once per 24 hours. |
| W | At least once per 7 days. |
| 4/M | At least 4 times per month at intervals no greater than 9 days and a minimum of 48 times per year. |
| M | At least once per 31 days. |
| Q | At least once per 92 days. |
| SA | At least once per 184 days. |
| R | At least once per 18 months. |
| P | Completed prior to each release. |
| S/U | Prior to each reactor startup. |
| N.A. | Not applicable. |

## TABLE 2.2-1

## REACTOR PROTECTIVE INSTRUMENTATION TRIP SETPOINT LIMITS

| FUNCTIONAL UNIT | TRIP SETPOINT | ALLOWABLE VALUES |
|---|---|---|
| I. TRIP GENERATION | | |
| A. Process | | |
| 1. Pressurizer Pressure - High | ≤ 2383 psia | ≤ 2388 psia |
| 2. Pressurizer Pressure - Low | ≥ 1837 psia (2) | ≥ 1822 psia (2) |
| 3. Steam Generator Level - Low | ≥ 44.2% (4) | ≥ 43.7% (4) |
| 4. Steam Generator Level - High | ≤ 91.0% (9) | ≤ 91.5% (9) |
| 5. Steam Generator Pressure - Low | ≥ 919 psia (3) | ≥ 912 psia (3) |
| 6. Containment Pressure - High | ≤ 3.0 psig | ≤ 3.2 psig |
| 7. Reactor Coolant Flow - Low | | |
| a. Rate | ≤ 0.115 psi/sec (6)(7) | ≤ 0.118 psi/sec (6)(7) |
| b. Floor | ≥ 11.9 psid (6)(7) | ≥ 11.7 psid(6)(7) |
| c. Band | ≤ 10.0 psid (6)(7) | ≤ 10.2 psid (6)(7) |
| 8. Local Power Density - High | ≤ 21.0 kW/ft (5) | ≤ 21.0 kW/ft (5) |
| 9. DNBR - Low | ≥ 1.231 (5) | ≥ 1.231 (5) |
| B. Excore Neutron Flux | | |
| 1. Variable Overpower Trip | | |
| a. Rate | ≤ 10.6%/min of RATED THERMAL POWER (8) | ≤ 11.0%/min of RATED THERMAL POWER (8) |
| b. Ceiling | ≤ 110.0% of RATED THERMAL POWER (8) | ≤ 111.0% of RATED THERMAL POWER (8) |
| c. Band | ≤ 9.8% of RATED THERMAL POWER (8) | ≤ 10.0% of RATED THERMAL POWER (8) |

TABLE 2.2-1 (Continued)

REACTOR PROTECTIVE INSTRUMENTATION TRIP SETPOINT LIMITS

| FUNCTIONAL UNIT | TRIP SETPOINT | ALLOWABLE VALUES |
|---|---|---|
| 2. Logarithmic Power Level - High (1) | | |
| a. Startup and Operating | ≤ 0.010% of RATED THERMAL POWER | ≤ 0.011% of RATED THERMAL POWER |
| b. Shutdown | ≤ 0.010% of RATED THERMAL POWER | ≤ 0.011% of RATED THERMAL POWER |
| C. Core Protection Calculator System | | |
| 1. CEA Calculators | Not Applicable | Not Applicable |
| 2. Core Protection Calculators | Not Applicable | Not Applicable |
| D. Supplementary Protection System | | |
| Pressurizer Pressure - High | ≤ 2409 psia | ≤ 2414 psia |
| II. RPS LOGIC | | |
| A. Matrix Logic | Not Applicable | Not Applicable |
| B. Initiation Logic | Not Applicable | Not Applicable |
| III. RPS ACTUATION DEVICES | | |
| A. Reactor Trip Breakers | Not Applicable | Not Applicable |
| B. Manual Trip | Not Applicable | Not Applicable |

## TABLE 2.2-1 (Continued)

## REACTOR PROTECTIVE INSTRUMENTATION TRIP SETPOINT LIMITS

### TABLE NOTATIONS

(1) Trip may be manually bypassed above $10^{-4}$% of RATED THERMAL POWER; bypass shall be automatically removed when THERMAL POWER is less than or equal to $10^{-4}$% of RATED THERMAL POWER.

(2) In MODES 3-4, value may be decreased manually, to a minimum of 100 psia, as pressurizer pressure is reduced, provided the margin between the pressurizer pressure and this value is maintained at less than or equal to 400 psi; the setpoint shall be increased automatically as pressurizer pressure is increased until the trip setpoint is reached. Trip may be manually bypassed below 400 psia; bypass shall be automatically removed whenever pressurizer pressure is greater than or equal to 500 psia.

(3) In MODES 3-4, value may be decreased manually as steam generator pressure is reduced, provided the margin between the steam generator pressure and this value is maintained at less than or equal to 200 psi; the setpoint shall be increased automatically as steam generator pressure is increased until the trip setpoint is reached.

(4) % of the distance between steam generator upper and lower level wide range instrument nozzles.

(5) As stored within the Core Protection Calculator (CPC). Calculation of the trip setpoint includes measurement, calculational and processor uncertainties, and dynamic allowances. Trip may be manually bypassed below $10^{-4}$% of RATED THERMAL POWER; bypass shall be automatically removed when THERMAL POWER is greater than or equal to $10^{-4}$% of RATED THERMAL POWER.

The approved DNBR limit is 1.231 which includes a partial rod bow penalty compensation. If the fuel burnup exceeds that for which an increased rod bow penalty is required, the DNBR limit shall be adjusted. In this case a DNBR trip setpoint of 1.231 is allowed provided that the difference is compensated by an increase in the CPC addressable constant BERR1 as follows:

$$BERR1_{new} = BERR1_{old} \left[1 + \frac{RB - RB_o}{100} \times \frac{d\ (\%\ POL)}{d\ (\%\ DNBR)}\right]$$

where $BERR1_{old}$ is the uncompensated value of BERR1; RB is the fuel rod bow penalty in % DNBR; $RB_o$ is the fuel rod bow penalty in % DNBR already accounted for in the DNBR limit; POL is the power operating limit; and d (% POL)/d (% DNBR) is the absolute value of the most adverse derivative of POL with respect to DNBR.

TABLE 2.2-1 (Continued)

REACTOR PROTECTIVE INSTRUMENTATION TRIP SETPOINT LIMITS

TABLE NOTATIONS (Continued)

(6) RATE is the maximum rate of decrease of the trip setpoint. There are no restrictions on the rate at which the setpoint can increase.
FLOOR is the minimum value of the trip setpoint.
BAND is the amount by which the trip setpoint is below the input signal unless limited by Rate or Floor.
Setpoints are based on steam generator differential pressure.

(7) The setpoint may be altered to disable trip function during testing pursuant to Specification 3.10.3.

(8) RATE is the maximum rate of increase of the trip setpoint. (The rate at which the setpoint can decrease is no slower than five percent per second.)
CEILING is the maximum value of the trip setpoint.
BAND is the amount by which the trip setpoint is above the steady state input signal unless limited by the rate or the ceiling.

(9) % of the distance between steam generator upper and lower level narrow range instrument nozzles.

## 3/4.1 REACTIVITY CONTROL SYSTEMS

### 3/4.1.1 BORATION CONTROL

#### SHUTDOWN MARGIN - ALL CEAs FULLY INSERTED

#### LIMITING CONDITION FOR OPERATION

3.1.1.1 The SHUTDOWN MARGIN shall be greater than or equal to 1.0% delta k/k.

APPLICABILITY: MODES 3, 4*, and 5* with all full-length CEAs fully inserted.

ACTION:

With the SHUTDOWN MARGIN less than 1.0% delta k/k, immediately initiate and continue boration at greater than or equal to 26 gpm to reactor coolant system of a solution containing greater than or equal to 4000 ppm boron or equivalent until the required SHUTDOWN MARGIN is restored.

#### SURVEILLANCE REQUIREMENTS

4.1.1.1.1 The SHUTDOWN MARGIN shall be determined to be greater than or equal to 1.0% delta k/k at least once per 24 hours by consideration of at least the following factors:

1. Reactor Coolant System boron concentration,
2. CEA position,
3. Reactor Coolant System average temperature,
4. Fuel burnup based on gross thermal energy generation,
5. Xenon concentration, and
6. Samarium concentration.

4.1.1.1.2 The overall core reactivity balance shall be compared to predicted values to demonstrate agreement within ± 1.0% delta k/k at least once per 31 Effective Full Power Days (EFPD). This comparison shall consider at least those factors stated in Specification 4.1.1.1.1, above. The predicted reactivity values shall be adjusted (normalized) to correspond to the actual core conditions prior to exceeding a fuel burnup of 60 EFPD after each fuel loading.

* See Special Test Exception 3.10.9.

SHUTDOWN MARGIN - $K_{N-1}$ - ANY CEA WITHDRAWN

LIMITING CONDITION FOR OPERATION

3.1.1.2

a. The SHUTDOWN MARGIN shall be greater than or equal to that shown in Figure 3.1-1A, and

b. For $T_{cold}$ less than or equal to 500°F, $K_{N-1}$ shall be less than 0.99.

APPLICABILITY: MODES 1, 2*, 3*, 4*, and 5* with any full-length CEA fully or partially withdrawn.

ACTION:

a. With the SHUTDOWN MARGIN less than that in Figure 3.1-1A, immediately initiate and continue boration at greater than or equal to 26 gpm to the reactor coolant system of a solution containing greater than or equal to 4000 ppm boron or equivalent until the required SHUTDOWN MARGIN is restored, and

b. With $T_{cold}$ less than or equal to 500°F and $K_{N-1}$ greater than or equal to 0.99, immediately vary CEA positions and/or initiate and continue boration at greater than or equal to 26 gpm to the reactor coolant system of a solution containing greater than or equal to 4000 ppm boron or equivalent until the required $K_{N-1}$ is restored.

SURVEILLANCE REQUIREMENTS

4.1.1.2.1 With any full-length CEA fully or partially withdrawn, the SHUTDOWN MARGIN shall be determined to be greater than or equal to that in Figure 3.1.1A:

a. Within 1 hour after detection of an inoperable CEA(s) and at least once per 12 hours thereafter while the CEA(s) is inoperable. If the inoperable CEA is immovable as a result of excessive friction or mechanical interference or known to be untrippable, the above required SHUTDOWN MARGIN shall be increased by an amount at least equal to the withdrawn worth of the immovable or untrippable CEA(s).

* See Special Test Exceptions 3.10.1 and 3.10.9

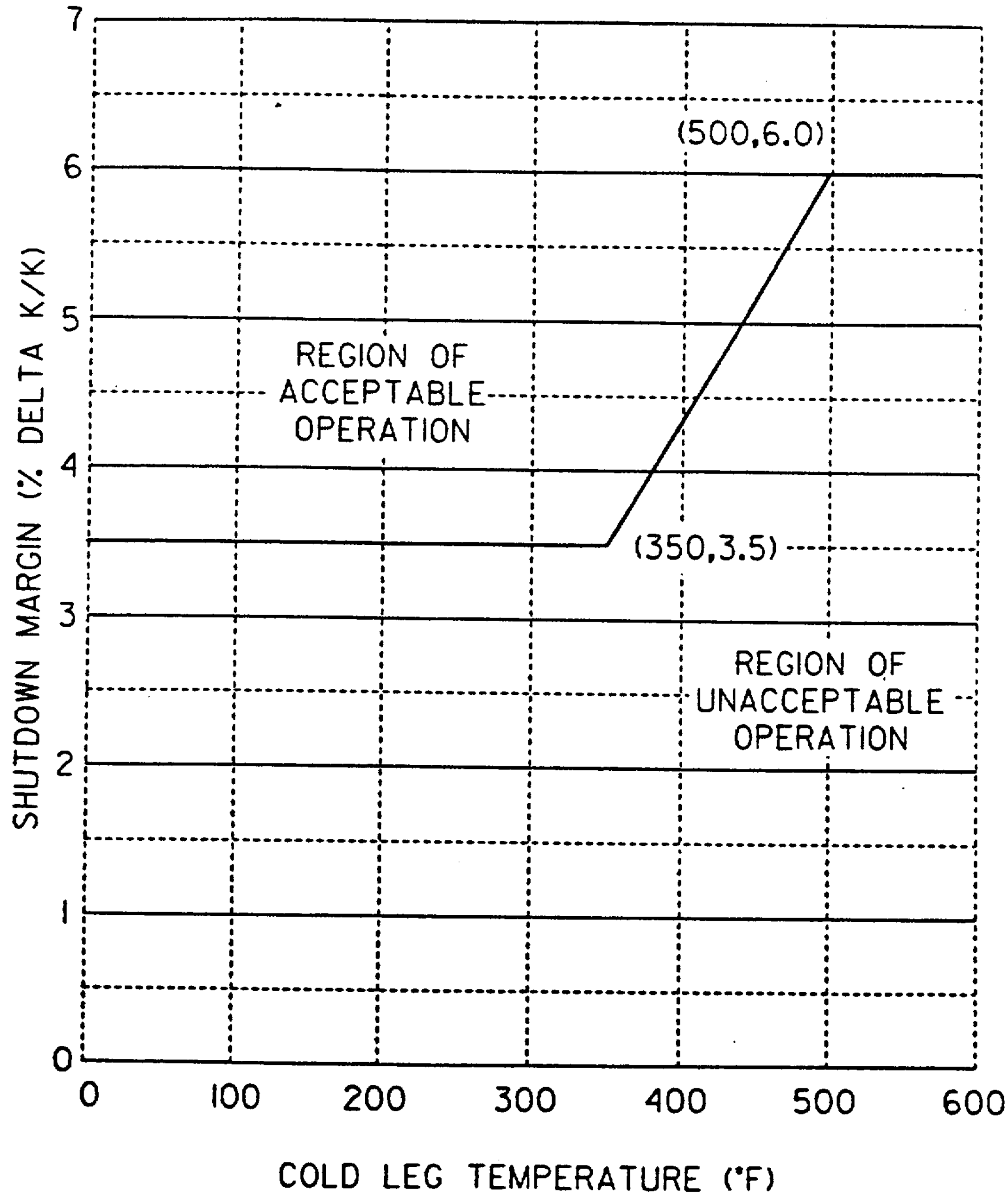


FIGURE 3.1-1A

SHUTDOWN MARGIN VERSUS COLD LEG TEMPERATURE

SURVEILLANCE REQUIREMENTS (Continued)

b. When in MODE 1 or MODE 2 with $k_{eff}$ greater than or equal to 1.0, at least once per 12 hours by verifying that CEA group withdrawal is within the Transient Insertion Limits of Specification 3.1.3.6.

c. When in MODE 2 with $k_{eff}$ less than 1.0, within 4 hours prior to achieving reactor criticality by verifying that the predicted critical CEA position is within the limits of Specification 3.1.3.6.

d. Prior to initial operation above 5% RATED THERMAL POWER after each fuel loading, by consideration of the factors of e. below, with the CEA groups at the Transient Insertion Limits of Specification 3.1.3.6.

e. When in MODE 3, 4, or 5, at least once per 24 hours by consideration of at least the following factors:

    1. Reactor Coolant System boron concentration,
    2. CEA position,
    3. Reactor Coolant System average temperature,
    4. Fuel burnup based on gross thermal energy generation,
    5. Xenon concentration, and
    6. Samarium concentration.

4.1.1.2.2 When in MODE 3, 4, or 5, with any full-length CEA fully or partially withdrawn, and $T_{cold}$ less than or equal to 500°F, $K_{N-1}$ shall be determined to be less than 0.99 at least once per 24 hours by consideration of at least the following factors:

1. Reactor Coolant System boron concentration,
2. CEA position,
3. Reactor Coolant System average temperature,
4. Fuel burnup based on gross thermal energy generation,
5. Xenon concentration, and
6. Samarium concentration

4.1.1.2.3 The overall core reactivity balance shall be compared to predicted values to demonstrate agreement within ± 1.0% delta k/k at least once per 31 Effective Full Power Days (EFPD). This comparison shall consider at least those factors stated in Specification 4.1.1.2.1.e or 4.1.1.2.2. The predicted reactivity values shall be adjusted (normalized) to correspond to the actual core conditions prior to exceeding a fuel burnup of 60 EFPD after each fuel loading.

## MODERATOR TEMPERATURE COEFFICIENT

### LIMITING CONDITION FOR OPERATION

3.1.1.3 The moderator temperature coefficient (MTC) shall be within the area of Acceptable Operation shown on Figure 3.1-1.

APPLICABILITY: MODES 1 and 2*#

ACTION:

With the moderator temperature coefficient outside the area of Acceptable Operation shown on Figure 3.1-1, be in at least HOT STANDBY within 6 hours.

### SURVEILLANCE REQUIREMENTS

4.1.1.3.1 The MTC shall be determined to be within its limits by confirmatory measurements. MTC measured values shall be extrapolated and/or compensated to permit direct comparison with the above limits.

4.1.1.3.2 The MTC shall be determined at the following frequencies and THERMAL POWER conditions during each fuel cycle:

a. Prior to initial operation above 5% of RATED THERMAL POWER, after each fuel loading.

b. At any THERMAL POWER, within 7 EFPD after reaching a core average exposure of 40 EFPD burnup into the current cycle.

c. At any THERMAL POWER, within 7 EFPD after reaching a core average exposure equivalent to two-thirds of the expected current cycle end-of-cycle core average burnup.

---

*With Keff greater than or equal to 1.0.

#See Special Test Exception 3.10.2.

## 3/4.1.2 BORATION SYSTEMS

### FLOW PATHS - SHUTDOWN

### LIMITING CONDITION FOR OPERATION

3.1.2.1 As a minimum, one of the following boron injection flow paths shall be OPERABLE:

a. If only the spent fuel pool in Specification 3.1.2.5a. is OPERABLE, a flow path from the spent fuel pool via a gravity feed connection and a charging pump to the Reactor Coolant System.

b. If only the refueling water tank in Specification 3.1.2.5b. is OPERABLE, a flow path from the refueling water tank via either a charging pump, a high pressure safety injection pump, or a low pressure safety injection pump to the Reactor Coolant System.

APPLICABILITY: MODES 5 and 6.

ACTION:

With none of the above flow paths OPERABLE, suspend all operations involving CORE ALTERATIONS or positive reactivity changes.

### SURVEILLANCE REQUIREMENTS

4.1.2.1 At least one of the above required flow paths shall be demonstrated OPERABLE at least once per 31 days by verifying that each valve (manual, power-operated, or automatic) in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct position.

## FLOW PATHS - OPERATING

### LIMITING CONDITION FOR OPERATION

3.1.2.2 At least two of the following three boron injection flow paths shall be OPERABLE:

a. A gravity feed flow path from either the refueling water tank or the spent fuel pool through CH-536 (RWT Gravity Feed Isolation Valve) and a charging pump to the Reactor Coolant System,

b. A gravity feed flow path from the refueling water tank through CH-327 (RWT Gravity Feed/Safety Injection System Isolation Valve) and a charging pump to the Reactor Coolant System,

c. A flow path from either the refueling water tank or the spent fuel pool through CH-164 (Boric Acid Filter Bypass Valve), utilizing gravity feed and a charging pump to the Reactor Coolant System.

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

ACTION:

With only one of the above required boron injection flow paths to the Reactor Coolant System OPERABLE, restore at least two boron injection flow paths to the Reactor Coolant System to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours; restore at least two flow paths to OPERABLE status within the next 7 days or be in COLD SHUTDOWN within the next 30 hours.

### SURVEILLANCE REQUIREMENTS

4.1.2.2.1 At least two of the above required flow paths shall be demonstrated OPERABLE:

a. At least once per 31 days by verifying that each valve (manual, power-operated, or automatic) in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct position.

b. At least once per 18 months when the Reactor Coolant System is at normal operating pressure by verifying that the flow path required by Specification 3.1.2.2 delivers at least 26 gpm for 1 charging pump and 68 gpm for two charging pumps to the Reactor Coolant System.

4.1.2.2.2 The provisions of Specification 4.0.4 are not applicable for entry into Mode 3 or Mode 4 to perform the surveillance testing of Specification 4.1.2.2.1.b provided the testing is performed within 24 hours after achieving normal operating pressure in the reactor coolant system.

## CHARGING PUMPS - SHUTDOWN

### LIMITING CONDITION FOR OPERATION

3.1.2.3 At least one charging pump or one high pressure safety injection pump or one low pressure safety injection pump in the boron injection flow path required OPERABLE pursuant to Specification 3.1.2.1 shall be OPERABLE and capable of being powered from an OPERABLE emergency power source.

APPLICABILITY: MODES 5 and 6.

ACTION:

With no charging pump or high pressure safety injection pump or low pressure safety injection pump OPERABLE or capable of being powered from an OPERABLE emergency power source, suspend all operations involving CORE ALTERATIONS or positive reactivity changes.

### SURVEILLANCE REQUIREMENTS

4.1.2.3 No additional Surveillance Requirements other than those required by Specification 4.0.5.

## CHARGING PUMPS - OPERATING

### LIMITING CONDITION FOR OPERATION

3.1.2.4 At least two charging pumps shall be OPERABLE.

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

ACTION:

With only one charging pump OPERABLE, restore at least two charging pumps to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours; restore at least two charging pumps to OPERABLE status within the next 7 days or be in COLD SHUTDOWN within the next 30 hours.

### SURVEILLANCE REQUIREMENTS

4.1.2.4 No additional Surveillance Requirements other than those required by Specification 4.0.5.

## BORATED WATER SOURCES - OPERATING

### LIMITING CONDITION FOR OPERATION

3.1.2.6 Each of the following borated water sources shall be OPERABLE:

a. The spent fuel pool with:

1. A minimum borated water volume as specified in Figure 3.1-2, and
2. A boron concentration of between 4000 ppm and 4400 ppm boron, and
3. A solution temperature between 60°F and 180°F.

b. The refueling water tank with:

1. A minimum contained borated water volume as specified in Figure 3.1-2, and
2. A boron concentration of between 4000 and 4400 ppm of boron, and
3. A solution temperature between 60°F and 120°F.

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

ACTION:

a. With the above required spent fuel pool inoperable, restore the pool to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours; restore the above required spent fuel pool to OPERABLE status within the next 7 days or be in COLD SHUTDOWN within the next 30 hours.

b. With the refueling water tank inoperable, restore the tank to OPERABLE status within 1 hour or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

### SURVEILLANCE REQUIREMENTS

4.1.2.6 Each of the above required borated water sources shall be demonstrated OPERABLE:

a. At least once per 7 days by:

1. Verifying the boron concentration in the water, and
2. Verifying the contained borated water volume of the water source.

b. At least once per 24 hours by verifying the refueling water tank temperature when the outside air temperature is outside the 60°F to 120°F range.

c. At least once per 24 hours by verifying the spent fuel pool temperature when irradiated fuel is present in the pool.

*See Special Test Exception 3.10.7.

BORON DILUTION ALARMS

LIMITING CONDITION FOR OPERATION

3.1.2.7 Both startup channel high neutron flux alarms shall be OPERABLE.

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

ACTION:

a. With one startup channel high neutron flux alarm inoperable:

   1. Determine the RCS boron concentration when entering MODE 3, 4, 5, or 6 or at the time the alarm is determined to be inoperable. From that time, the RCS boron concentration shall be determined at the applicable monitoring frequency in Tables 3.1-1 through 3.1-5 by either boronometer or RCS sampling.**

b. With both startup channel high neutron flux alarms inoperable:

   1. Determine the RCS boron concentration by either boronmeter and RCS sampling** or by independent collection and analysis of two RCS samples when entering Mode 3, 4, or 5 or at the time both alarms are determined to be inoperable. From that time, the RCS boron concentration shall be determined at the applicable monitoring frequency in Tables 3.1-1 through 3.1-5, as applicable, by either boronmeter and RCS sampling** or by collection and analysis of two independent RCS samples. If redundant determination of RCS boron concentration cannot be accomplished immediately, suspend all operations involving CORE ALTERATIONS or positive reactivity changes until the method for determining and confirming RCS boron concentration is restored.

   2. When in MODE 5 with the RCS level below the centerline of the hotleg or MODE 6, suspend all operations involving CORE ALTERATIONS or positive reactivity changes until at least one startup channel high neutron flux alarm is restored to OPERABLE status.

c. The provisions of Specification 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.1.2.7 Each startup channel high neutron flux alarm shall be demonstrated OPERABLE by performance of:

---

*Within 1 hour after the neutron flux is within the startup range following a reactor shutdown.

**With one or more reactor coolant pumps (RCP) operating the sample should be obtained from the hot leg. With no RCP operating, the sample should be obtained from the discharge line of the low pressure safety injection (LPSI) pump operating in the shutdown cooling mode.

SURVEILLANCE REQUIREMENTS (Continued)

a. A CHANNEL CHECK:

1. At least once per 12 hours.

2. When initially setting setpoints at the following times:

   a) One hour after a reactor trip.
   b) After a controlled reactor shutdown: Within 1 hour after the neutron flux is within the startup range in MODE 3.

b. A CHANNEL FUNCTIONAL TEST every 31 days of cumulative operation during shutdown.

## TABLE 3.1-1

## REQUIRED MONITORING FREQUENCIES FOR BACKUP BORON DILUTION DETECTION AS A FUNCTION OF OPERATING CHARGING PUMPS AND PLANT OPERATIONAL MODES FOR $K_{eff} \geq 0.98$

| OPERATIONAL MODE | Number of Operating Charging Pumps | | | |
|---|---|---|---|---|
| | 0 | 1 | 2 | 3 |
| 3 | 12 hours | 1 hour | ONA | ONA |
| 4 not on SCS | 12 hours | 1 hour | ONA | ONA |
| 5 not on SCS | 8 hours | 1 hour | ONA | ONA |
| 4 & 5 on SCS | ONA | ONA | ONA | ONA |

Notes: SCS = Shutdown Cooling System
ONA = Operation not allowed

## TABLE 3.1-2

### REQUIRED MONITORING FREQUENCIES FOR BACKUP BORON DILUTION DETECTION AS A FUNCTION OF OPERATING CHARGING PUMPS AND PLANT OPERATIONAL MODES FOR $0.98 \geq K_{eff} \geq 0.97$

| OPERATIONAL MODE | Number of Operating Charging Pumps | | | |
|---|---|---|---|---|
| | 0 | 1 | 2 | 3 |
| 3 | 12 hours | 2.5 hours | 1 hour | 0.5 hours |
| 4 not on SCS | 12 hours | 2.5 hours | 1 hour | 0.5 hours |
| 5 not on SCS | 8 hours | 2.5 hours | 1 hour | 0.5 hours |
| 4 & 5 on SCS | 8 hours | 0.5 hours | ONA | ONA |

Notes: SCS = Shutdown Cooling System
ONA = Operation not allowed

## TABLE 3.1-3

## REQUIRED MONITORING FREQUENCIES FOR BACKUP BORON DILUTION DETECTION AS A FUNCTION OF OPERATING CHARGING PUMPS AND PLANT OPERATIONAL MODES FOR $0.97 > K_{eff} > 0.96$

| OPERATIONAL MODE | Number of Operating Charging Pumps | | | |
|---|---|---|---|---|
| | 0 | 1 | 2 | 3 |
| 3 | 12 hours | 3.5 hours | 1.5 hours | 1 hour |
| 4 not on SCS | 12 hours | 3.5 hours | 1.5 hours | 1 hour |
| 5 not on SCS | 8 hours | 3.5 hours | 1.5 hours | 1 hour |
| 4 & 5 on SCS | 8 hours | 1 hour | 0.5 hours | ONA |

Notes: SCS = Shutdown Cooling System
ONA = Operation not allowed

## TABLE 3.1-4

## REQUIRED MONITORING FREQUENCIES FOR BACKUP BORON DILUTION DETECTION AS A FUNCTION OF OPERATING CHARGING PUMPS AND PLANT OPERATIONAL MODES FOR $0.96 > K_{eff} \geq 0.95$

| OPERATIONAL MODE | Number of Operating Charging Pumps | | | |
|---|---|---|---|---|
| | 0 | 1 | 2 | 3 |
| 3 | 12 hours | 5 hours | 2 hours | 1 hour |
| 4 not on SCS | 12 hours | 5 hours | 2 hours | 1 hour |
| 5 not on SCS | 8 hours | 5 hours | 2 hours | 1 hour |
| 4 & 5 on SCS | 8 hours | 2 hours | 0.5 hours | ONA |

Notes: SCS = Shutdown Cooling System
ONA = Operation not allowed

## TABLE 3.1-5

## REQUIRED MONITORING FREQUENCIES FOR BACKUP BORON DILUTION DETECTION AS A FUNCTION OF OPERATING CHARGING PUMPS AND PLANT OPERATIONAL MODES FOR $K_{eff} \leq 0.95$

| OPERATIONAL MODE | Number of Operating Charging Pumps | | | |
|---|---|---|---|---|
| | 0 | 1 | 2 | 3 |
| 3 | 12 hours | 6 hours | 3 hours | 1.5 hours |
| 4 not on SCS | 12 hours | 6 hours | 3 hours | 1.5 hours |
| 5 not on SCS | 8 hours | 6 hours | 3 hours | 1.5 hours |
| 4 & 5 on SCS | 8 hours | 2 hours | 1 hour | 0.5 hours |
| 6 | 24 hours | 8 hours | 4 hours | 2 hours |

Note: SCS = Shutdown Cooling System

## TABLE 3.3-1 (Continued)

### TABLE NOTATIONS

*With the protective system trip breakers in the closed position, the CEA drive system capable of CEA withdrawal, and fuel in the reactor vessel.

#The provisions of Specification 3.0.4 are not applicable.

(a) Trip may be manually bypassed above $10^{-4}$% of RATED THERMAL POWER; bypass shall be automatically removed when THERMAL POWER is less than or equal to $10^{-4}$% of RATED THERMAL POWER.

(b) Trip may be manually bypassed below 400 psia; bypass shall be automatically removed whenever pressurizer pressure is greater than or equal to 500 psia.

(c) Trip may be manually bypassed below $10^{-4}$% of RATED THERMAL POWER; bypass shall be automatically removed when THERMAL POWER is greater than or equal to $10^{-4}$% of RATED THERMAL POWER.

(d) Trip may be bypassed during testing pursuant to Special Test Exception 3.10.3.

(e) See Special Test Exception 3.10.2.

(f) There are four channels, each of which is comprised of one of the four reactor trip breakers, arranged in a selective two-out-of-four configuration (i.e., one-out-of-two taken twice).

### ACTION STATEMENTS

ACTION 1 - With the number of channels OPERABLE one less than required by the Minimum Channels OPERABLE requirement, restore the inoperable channel to OPERABLE status within 48 hours or be in at least HOT STANDBY within the next 6 hours and/or open the protective system trip breakers.

ACTION 2 - With the number of channels OPERABLE one less than the Total Number of Channels, STARTUP and/or POWER OPERATION may continue provided the inoperable channel is placed in the bypassed or tripped condition within 1 hour. If the inoperable channel is bypassed, the desirability of maintaining this channel in the bypassed condition shall be reviewed in accordance with Specification 6.5.1.6.g. The channel shall be returned to OPERABLE status no later than during the next COLD SHUTDOWN.

## TABLE 3.3-1 (Continued)

## ACTION STATEMENTS

With a channel process measurement circuit that affects multiple functional units inoperable or in test, bypass or trip all associated functional units as listed below:

| Process Measurement Circuit | Functional Unit Bypassed/Tripped |
|---|---|
| 1. Linear Power (Subchannel or Linear) | Variable Overpower (RPS)<br>Local Power Density - High (RPS)<br>DNBR - Low (RPS) |
| 2. Pressurizer Pressure - High (Narrow Range) | Pressurizer Pressure - High (RPS)<br>Local Power Density - High (RPS)<br>DNBR - Low (RPS) |
| 3. Steam Generator Pressure - Low | Steam Generator Pressure - Low<br>Steam Generator Level 1-Low (ESF)<br>Steam Generator Level 2-Low (ESF) |
| 4. Steam Generator Level - Low (Wide Range) | Steam Generator Level - Low (RPS)<br>Steam Generator Level 1-Low (ESF)<br>Steam Generator Level 2-Low (ESF) |
| 5. Core Protection Calculator | Local Power Density - High (RPS)<br>DNBR - Low (RPS) |

ACTION 3 - With the number of channels OPERABLE one less than the Minimum Channels OPERABLE requirement, STARTUP and/or POWER OPERATION may continue provided the following conditions are satisfied:

a. Verify that one of the inoperable channels has been bypassed and place the other channel in the tripped condition within 1 hour, and

b. All functional units affected by the bypassed/tripped channel shall also be placed in the bypassed/tripped condition as listed below:

| Process Measurement Circuit | Functional Unit Bypassed/Tripped |
|---|---|
| 1. Linear Power (Subchannel or Linear) | Variable Overpower (RPS)<br>Local Power Density - High (RPS)<br>DNBR - Low (RPS) |
| 2. Pressurizer Pressure - High (Narrow Range) | Pressurizer Pressure - High (RPS)<br>Local Power Density - High (RPS)<br>DNBR - Low (RPS) |

## 3/4.10.1 SHUTDOWN MARGIN AND $K_{N-1}$ - CEA WORTH TESTS

### LIMITING CONDITION FOR OPERATION

3.10.1 The SHUTDOWN MARGIN and $K_{N-1}$ requirements of Specification 3.1.1.2 may be suspended for measurement of CEA worth and shutdown margin provided reactivity equivalent to at least the highest estimated CEA worth is available for trip insertion from OPERABLE CEA(s), or the reactor is subcritical by at least the reactivity equivalent of the highest CEA worth.

APPLICABILITY: MODES 2, 3* and 4*#.

ACTION:

a. With any full-length CEA not fully inserted and with less than the above reactivity equivalent available for trip insertion, immediately initiate and continue boration at greater than or equal to 26 gpm of a solution containing greater than or equal to 4000 ppm boron or its equivalent until the SHUTDOWN MARGIN and $K_{N-1}$ required by Specification 3.1.1.2 are restored.

b. With all full-length CEAs fully inserted and the reactor subcritical by less than the above reactivity equivalent, immediately initiate and continue boration at greater than or equal to 26 gpm of a solution containing greater than or equal to 4000 ppm boron or its equivalent until the SHUTDOWN MARGIN required by Specification 3.1.1.1 is restored.

### SURVEILLANCE REQUIREMENTS

4.10.1.1 The position of each full-length and part-length CEA required either partially or fully withdrawn shall be determined at least once per 2 hours.

4.10.1.2 Each CEA not fully inserted shall be demonstrated capable of full insertion when tripped from at least the 50% withdrawn position within 24 hours prior to reducing the SHUTDOWN MARGIN to less than the limits of Specification 3.1.1.1.

4.10.1.3 When in MODE 3 or MODE 4, the reactor shall be determined to be subcritical by at least the reactivity equivalent of the highest estimated CEA worth or the reactivity equivalent of the highest estimated CEA worth is available for trip insertion from OPERABLE CEAs at least once per 2 hours by consideration of at least the following factors:

a. Reactor Coolant System boron concentration,

b. CEA position,

c. Reactor Coolant System average temperature,

d. Fuel burnup based on gross thermal energy generation,

e. Xenon concentration, and

f. Samarium concentration.

---

*Operation in MODE 3 and MODE 4 shall be limited to 6 consecutive hours.

#Limited to low power PHYSICS TESTING at the 320°F plateau.

## 3/4.10.2 MODERATOR TEMPERATURE COEFFICIENT, GROUP HEIGHT, INSERTION, AND POWER DISTRIBUTION LIMITS

### LIMITING CONDITION FOR OPERATION

3.10.2 The moderator temperature coefficient, group height, insertion, and power distribution limits of Specifications 3.1.1.3, 3.1.3.1, 3.1.3.5, 3.1.3.6, 3.2.2, 3.2.3, 3.2.7, and the Minimum Channels OPERABLE requirement of I.C.1 (CEA Calculators) of Table 3.3-1 may be suspended during the performance of PHYSICS TESTS provided:

a. The THERMAL POWER is restricted to the test power plateau which shall not exceed 85% of RATED THERMAL POWER, and

b. The limits of Specification 3.2.1 are maintained and determined as specified in Specification 4.10.2.2 below.

APPLICABILITY: MODES 1 and 2.

ACTION:

With any of the limits of Specification 3.2.1 being exceeded while the requirements of Specifications 3.1.1.3, 3.1.3.1, 3.1.3.5, 3.1.3.6, 3.2.2, 3.2.3, 3.2.7, and the Minimum Channels OPERABLE requirement of I.C.1 (CEA Calculators) of Table 3.3-1 are suspended, either:

a. Reduce THERMAL POWER sufficiently to satisfy the requirements of Specification 3.2.1, or

b. Be in HOT STANDBY within 6 hours.

### SURVEILLANCE REQUIREMENTS

4.10.2.1 The THERMAL POWER shall be determined at least once per hour during PHYSICS TESTS in which the requirements of Specifications 3.1.1.3, 3.1.3.1, 3.1.3.5, 3.1.3.6, 3.2.2, 3.2.3, 3.2.7, or the Minimum Channels OPERABLE requirement of I.C.1 (CEA Calculators) of Table 3.3-1 are suspended and shall be verified to be within the test power plateau.

4.10.2.2 The linear heat rate shall be determined to be within the limits of Specification 3.2.1 by monitoring it continuously with the Incore Detector Monitoring System pursuant to the requirements of Specifications 4.2.1.3 and 3.3.3.2 during PHYSICS TESTS above 20% of RATED THERMAL POWER in which the requirements of Specifications 3.1.1.3, 3.1.3.1, 3.1.3.5, 3.1.3.6, 3.2.2, 3.2.3, 3.2.7, or the Minimum Channels OPERABLE requirement of I.C.1 (CEA Calculators) of Table 3.3-1 are suspended.

## 3/4.10.9 SHUTDOWN MARGIN AND $K_{N-1}$ - CEDMS TESTING

### LIMITING CONDITION FOR OPERATION

3.10.9 The SHUTDOWN MARGIN requirement of Specification 3.1.1.1 and the SHUTDOWN MARGIN and $K_{N-1}$ requirements of Specification 3.1.1.2 may be suspended for pre-startup tests to demonstrate the OPERABILITY of the control element drive mechanism system provided:

a. No more than one CEA is withdrawn at any time.

b. No CEA is withdrawn more than 7 inches.

c. The $K_{N-1}$ requirement of Specification 3.1.1.2 is met prior to the start of testing.

d. All other operations involving positive reactivity changes are suspended during the testing.

APPLICABILITY: MODES 4 and 5.

ACTION: With any of the above requirements not met, suspend testing and comply with the requirements of Specification 3.1.1.1 or 3.1.1.2, as applicable.

### SURVEILLANCE REQUIREMENTS

4.10.9 Surveillance Requirements 4.1.1.2.1.e and 4.1.1.2.2 shall be conducted within one hour prior to the start of testing, and at least once per 12 hours during testing.

SPECIAL TEST EXCEPTIONS

## 3/4.10.10 NATURAL CIRCULATION TESTING PROGRAM

### LIMITING CONDITION FOR OPERATION

3.10.10 The limitations of Specifications 3.4.1.2, 3.4.1.3, and 3.7.1.6 may be suspended during the performance of the Startup Natural Circulation Testing Program* provided:

a. Operations involving a reduction in boron concentration of the Reactor Coolant System are suspended.

b. Core outlet temperature is maintained at least 10°F below Saturation temperature.

c. A reactor coolant pump shall not be started with one or more of Reactor Coolant System cold leg temperatures less than or equal to 255°F during cooldown, or 295°F during heatup, unless the secondary water temperature (saturation temperature corresponding to steam generator pressure) of each steam generator is less than 100°F above each of the Reactor Coolant System cold leg temperatures.

APPLICABILITY: MODES 3 and 4 during Natural Circulation Testing.

ACTION:

With the Reactor Coolant System saturation margin less than 10°F, place at least one reactor coolant loop in operation, with at least one reactor coolant pump.

### SURVEILLANCE REQUIREMENTS

4.10.10.1 The saturation margin shall be determined to be within the above limits by continuous monitoring with the saturation margin monitors required by Table 3.3-10 or, by calculating the saturation margin at least once per 30 minutes.

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*Startup Natural Circulation Testing Program:

Natural Circulation Cooldown Test at 80% power.

## 3/4.1.1 BORATION CONTROL

### 3/4.1.1.1 and 3/4.1.1.2 SHUTDOWN MARGIN AND $K_{N-1}$

The function of SHUTDOWN MARGIN is to ensure that the reactor remains subcritical following a design basis accident or anticipated operational occurrence. The function of $K_{N-1}$ is to maintain sufficient subcriticality to preclude inadvertent criticality following ejection of a single control element assembly (CEA). During operation in MODES 1 and 2, with $k_{eff}$ greater than or equal to 1.0, the transient insertion limits of Specification 3.1.3.6 ensure that sufficient SHUTDOWN MARGIN is available.

SHUTDOWN MARGIN is the amount by which the core is subcritical, or would be subcritical immediately following a reactor trip, considering a single malfunction resulting in the highest worth CEA failing to insert. $K_{N-1}$ is a measure of the core's reactivity, considering a single malfunction resulting in the highest worth inserted CEA being ejected.

SHUTDOWN MARGIN requirements vary throughout the core life as a function of fuel depletion and reactor coolant system (RCS) cold leg temperature ($T_{cold}$). The most restrictive condition occurs at EOL, with $T_{cold}$ at no-load operating temperature, and is associated with a postulated steam line break accident and the resulting uncontrolled RCS cooldown. In the analysis of this accident, the specified SHUTDOWN MARGIN is required to control the reactivity transient and ensure that the fuel performance and offsite dose criteria are satisfied. As (initial) $T_{cold}$ decreases, the potential RCS cooldown and the resulting reactivity transient are less severe and, therefore, the required SHUTDOWN MARGIN also decreases. Below $T_{cold}$ of about 210°F, the inadvertent deboration event becomes limiting with respect to the SHUTDOWN MARGIN requirements. Below 210°F, the specified SHUTDOWN MARGIN ensures that sufficient time for operator actions exists between the initial indication of the deboration and the total loss of shutdown margin. Accordingly, with at least one CEA partially or fully withdrawn, the SHUTDOWN MARGIN requirements are based upon these limiting conditions.

Additional events considered in establishing requirements on SHUTDOWN MARGIN that are not limiting with respect to the Specification limits are single CEA withdrawal and startup of an inactive reactor coolant pump.

$K_{N-1}$ requirements vary with the amount of positive reactivity that would be introduced assuming the CEA with the highest inserted worth ejects from the core. In the analysis of the CEA ejection event, the $K_{N-1}$ requirement ensures that the radially averaged enthalpy acceptance criterion is satisfied, considering power redistribution effects. Above $T_{cold}$ of 500°F, Doppler reactivity feedback is sufficient to preclude the need for a specific $K_{N-1}$ requirement. With all CEAs fully inserted, $K_{N-1}$ and SHUTDOWN MARGIN requirements are equivalent in terms of minimum acceptable core boron concentration.

SHUTDOWN MARGIN AND $K_{N-1}$ (continued)

Other technical specifications that reference the Specifications on SHUTDOWN MARGIN or $K_{N-1}$ are: 3/4.1.2, BORATION SYSTEMS, 3/4.1.3, MOVABLE CONTROL ASSEMBLIES, 3/4.9.1, REFUELING OPERATIONS-BORON CONCENTRATION, 3/4.10.1, SHUTDOWN MARGIN AND $K_{N-1}$ - CEA WORTH TESTS, and 3/4.10.9, SHUTDOWN MARGIN AND $K_{N-1}$ - CEDMS TESTING.

3/4.1.1.3 MODERATOR TEMPERATURE COEFFICIENT (MTC)

The limitations on moderator temperature coefficient (MTC) are provided to ensure that the assumptions used in the accident and transient analysis remain valid through each fuel cycle. The surveillance requirements for measurement of the MTC during each fuel cycle are adequate to confirm the MTC value since this coefficient changes slowly due principally to the reduction in RCS boron concentration associated with fuel burnup. The confirmation that the measured MTC value is within its limit provides assurances that the coefficient will be maintained within acceptable values throughout each fuel cycle.

3/4.1.1.4 MINIMUM TEMPERATURE FOR CRITICALITY

This specification ensures that the reactor will not be made critical with the Reactor Coolant System cold leg temperature less than 552°F. This limitation is required to ensure (1) the moderator temperature coefficient is within its analyzed temperature range, (2) the protective instrumentation is within its normal operating range, and (3) consistency with the FSAR safety analysis.

## 3/4.1.2 BORATION SYSTEMS

The boron injection system ensures that negative reactivity control is available during each mode of facility operation. The components required to perform this function include (1) borated water sources, (2) charging pumps, (3) separate flow paths, and (4) an emergency power supply from OPERABLE diesel generators. The nominal capacity of each charging pump is 44 gpm at its discharge. Up to 16 gpm of this may be diverted to the volume control tank via the RCP control bleedoff. Instrument inaccuracies and pump performance uncertainties are limited to 2 gpm yielding the 26 gpm value.

With the RCS temperature above 210°F, a minimum of two separate and redundant boron injection systems are provided to ensure single functional capability in the event an assumed failure renders one of the systems inoperable. Allowable out-of-service periods ensure that minor component repair or corrective action may be completed without undue risk to overall facility safety from injection system failures during the repair period.

Each system is capable of providing boration equivalent to a SHUTDOWN MARGIN of 4% delta k/k after xenon decay and cooldown to 210°F. Therefore, the boration capacity of either system is more than sufficient to satisfy the SHUTDOWN MARGIN and/or $K_{N-1}$ requirements of the specifications. The maximum expected boration capability requirement occurs at EOL from full power equilibrium xenon conditions and requires 23,800 gallons of 4000 ppm borated water from either the refueling water tank or the spent fuel pool.

With the RCS temperature below 210°F one injection system is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the additional restrictions prohibiting CORE ALTERATIONS and positive reactivity changes in the event the single injection system becomes inoperable. The restrictions of one and only one operable charging pump whenever reactor coolant level is below the bottom of the pressurizer is based on the assumptions used in the analysis of the boron dilution event.

Each system is capable of providing boration equivalent to a SHUTDOWN MARGIN of 4% delta k/k. Therefore, the boration capacity of the system required below 210°F is more than sufficient to satisfy the shutdown margin and/or $K_{N-1}$ requirements of the specifications. This condition requires 9,700 gallons of 4000 ppm borated water from either the refueling water tank or the spent fuel pool.

## 3/4.10.1 SHUTDOWN MARGIN

This special test exception provides that a minimum amount of CEA worth is immediately available for reactivity control when tests are performed for CEAs worth measurement. This special test exception is required to permit the periodic verification of the actual versus predicted core reactivity condition occurring as a result of fuel burnup or fuel cycling operations. Although testing will be initiated from MODE 2, temporary entry into MODE 3 is necessary during some CEA worth measurements. A reasonable recovery time is available for return to MODE 2 in order to continue PHYSICS TESTING.

## 3/4.10.2 MODERATOR TEMPERATURE COEFFICIENT, GROUP HEIGHT, INSERTION, AND POWER DISTRIBUTION LIMITS

This special test exception permits individual CEAs to be positioned outside of their normal group heights and insertion limits during the performance of such PHYSICS TESTS as those required to (1) measure CEA worth, (2) determine the reactor stability index and damping factor under xenon oscillation conditions, (3) determine power distributions for non-normal CEA configurations, (4) measure rod shadowing factors, and (5) measure temperature and power coefficients. Special test exception permits MTC to exceed limits in Specification 3.1.1.3 during performance of PHYSICS TESTS.

## 3/4.10.3 REACTOR COOLANT LOOPS

This special test exception permits reactor criticality with less than four reactor coolant pumps in operation and is required to perform certain STARTUP and PHYSICS TESTS while at low THERMAL POWER levels.

## 3/4.10.4 CEA POSITION, REGULATING CEA INSERTION LIMITS AND REACTOR COOLANT COLD LEG TEMPERATURE

This special test exception permits the CEAs to be positioned beyond the insertion limits and reactor coolant cold leg temperature to be outside limits during PHYSICS TESTS required to determine the isothermal temperature coefficient and power coefficient.

## 3/4.10.5 MINIMUM TEMPERATURE AND PRESSURE FOR CRITICALITY

This special test exception permits reactor criticality at low THERMAL POWER levels with $T_{cold}$ below the minimum critical temperature and pressure during PHYSICS TESTS which are required to verify the low temperature physics predictions and to ensure the adequacy of design codes for reduced temperature conditions. The Low Power Physics Testing Program at low temperature (300°F) and a pressure of 500 psia is used to perform the following tests:

1. Biological shielding survey test
2. Isothermal temperature coefficient tests
3. CEA group tests
4. Boron worth tests
5. Critical configuration boron concentration

## 3/4.10.6 SAFETY INJECTION TANKS

This special test exception permits testing the low pressure safety injection system check valves. The pressure in the injection header must be reduced below the head of the low pressure injection pump in order to get flow through the check valves. The safety injection tank (SIT) isolation valve must be closed in order to accomplish this. The SIT isolation valve is still capable of automatic operation in the event of an SIAS; therefore, system capability should not be affected.

## 3/4.10.7 SPENT FUEL POOL LEVEL

This special test exception permits loading of the initial core with the spent fuel pool dry.

## 3/4.10.8 SAFETY INJECTION TANK PRESSURE

This special test exception allows the performance of PHYSICS TESTS at low pressure/low temperature (600 psig, 320°F) conditions which are required to verify the low temperature physics predictions and to ensure the adequacy of design codes for reduced temperature conditions.

## 3/4.10.9 SHUTDOWN MARGIN AND $K_{N-1}$ - CEDMS TESTING

This special test exception allows the performance of control element drive mechanism tests prior to startup, without the operator having to be concerned as to whether Specification 3.1.1.1 or 3.1.1.2 is applicable as CEAs are moved. The logarithmic power level-high trip provides additional protection against inadvertent criticality during this test.

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

ARIZONA PUBLIC SERVICE COMPANY, ET AL.

DOCKET NO. STN 50-529

PALO VERDE NUCLEAR GENERATING STATION, UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 13
License No. NPF-51

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment, dated January 23, 1987, as supplemented by letters dated April 23, June 8, July 17 and October 1, 1987, by the Arizona Public Service Company (APS) on behalf of itself and the Salt River Project Agricultural Improvement and Power District, El Paso Electric Company, Southern California Edison Company, Public Service Company of New Mexico, Los Angeles Department of Water and Power, and Southern California Public Power Authority (licensees), complies with the standards and requirements of the Atomic Energy act of 1954, as amended (the Act) and the Commission's 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 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 enclosure to this license amendment, and Paragraph 2.C.(2) of Facility Operating License No. NPF-51 is hereby amended to read as follows:

   (2) Technical Specifications and Environmental Protection Plan

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 13, and the Environmental Protection Plan contained in Appendix B, are hereby incorporated into this license. APS shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This license amendment is effective as of the date of issuance. The changes in the Technical Specifications are to become effective within 30 days of issuance of the amendment. In the period between issuance of the amendment and the effective date of the new Technical Specifications, the licensees shall adhere to the Technical Specifications existing at the time. The period of time during changeover shall be minimized.

FOR THE NUCLEAR REGULATORY COMMISSION

George W. Knighton

George W. Knighton, Director
Project Directorate V
Division of Reactor Projects - III, IV, V and Special Projects
Office of Nuclear Reactor Regulation

Enclosure:
Changes to the Technical Specifications

Date of Issuance: October 9, 1987

October 9, 1987

ENCLOSURE TO LICENSE AMENDMENT

AMENDMENT NO. 13 TO FACILITY OPERATING LICENSE NO. NPF-51

DOCKET NO. STN 50-529

Replace the following pages of the Appendix A Technical Specifications with the enclosed pages. The revised pages are identified by Amendment number and contain vertical lines indicating the areas of change. Also to be replaced are the following overleaf pages to the amended pages.

| Amendment Pages | Overleaf Pages |
|---|---|
| I | -- |
| II | -- |
| IV | III |
| IX | -- |
| X | -- |
| XIII | -- |
| XIV | -- |
| XIX | XX |
| 1-4 | 1-3 |
| 1-5 | -- |
| 1-6 | -- |
| 1-7 | 1-8 |
| 2-4 | 2-3 |
| 2-5 | 2-6 |
| 3/4 1-1 | -- |
| 3/4 1-2 | -- |
| 3/4 1-2a | -- |
| 3/4 1-3 | 3/4 1-4 |
| 3/4 1-8 | 3/4 1-7 |
| 3/4 1-9 | -- |
| 3/4 1-10 | -- |
| 3/4 1-13 | 3/4 1-14 |
| 3/4 1-16 | 3/4 1-15 |
| 3/4 1-17 | -- |
| 3/4 1-18 | -- |
| 3/4 1-19 | -- |
| 3/4 1-20 | -- |
| 3/4 3-5 | 3/4 3-6 |
| 3/4 10-1 | 3/4 10-2 |
| 3/4 10-9 | -- |
| B 3/4 1-1 | -- |
| B 3/4 1-1a | -- |
| B 3/4 1-2 | -- |
| B 3/4 10-2 | B 3/4 10-1 |

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## LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

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DOSE EQUIVALENT I-131

1.10 DOSE EQUIVALENT I-131 shall be that concentration of I-131 (microcuries/gram) which alone would produce the same thyroid dose as the quantity and isotopic mixture of I-131, I-132, I-133, I-134 and I-135 actually present. The thyroid dose conversion factors used for this calculation shall be those listed in Table III of TID-14844, "Calculation of Distance Factors for Power and Test Reactor Sites."

$\bar{E}$ - AVERAGE DISINTEGRATION ENERGY

1.11 $\bar{E}$ shall be the average (weighted in proportion to the concentration of each radionuclide in the reactor coolant at the time of sampling) of the sum of the average beta and gamma energies per disintegration (in MeV) for isotopes, other than iodines, with half-lives greater than 15 minutes, making up at least 95% of the total noniodine activity in the coolant.

ENGINEERED SAFETY FEATURES RESPONSE TIME

1.12 The ENGINEERED SAFETY FEATURES RESPONSE TIME shall be that time interval from when the monitored parameter exceeds its ESF actuation setpoint at the channel sensor until the ESF equipment is capable of performing its safety function (i.e., the valves travel to their required positions, pump discharge pressures reach their required values, etc.). Times shall include diesel generator starting and sequence loading delays where applicable.

FREQUENCY NOTATION

1.13 The FREQUENCY NOTATION specified for the performance of Surveillance Requirements shall correspond to the intervals defined in Table 1.1.

GASEOUS RADWASTE SYSTEM

1.14 A GASEOUS RADWASTE SYSTEM shall be any system designed and installed to reduce radioactive gaseous effluents by collecting primary coolant system offgases from the primary system and providing for delay or holdup for the purpose of reducing the total radioactivity prior to release to the environment.

IDENTIFIED LEAKAGE

1.15 IDENTIFIED LEAKAGE shall be:

a. Leakage into closed systems, other than reactor coolant pump controlled bleed-off flow, such as pump seal or valve packing leaks that are captured and conducted to a sump or collecting tank, or

b. Leakage into the containment atmosphere from sources that are both specifically located and known either not to interfere with the operation of leakage detection systems or not to be PRESSURE BOUNDARY LEAKAGE, or

c. Reactor Coolant System leakage through a steam generator to the secondary system.

KN-1

1.16 $K_{N-1}$ is the k effective calculated by considering the actual CEA configuration and assuming that the fully or partially inserted full-length CEA of the highest inserted worth is fully withdrawn.

MEMBER(S) OF THE PUBLIC

1.17 MEMBER(S) OF THE PUBLIC shall include all persons who are not occupationally associated with the plant. This category does not include employees of the licensee, its contractors, or vendors. Also excluded from this category are persons who enter the site to service equipment or to make deliveries. This category does include persons who use portions of the site for recreational, occupational, or other purposes not associated with the plant.

OFFSITE DOSE CALCULATION MANUAL (ODCM)

1.18 The OFFSITE DOSE CALCULATION MANUAL shall contain the current methodology and parameters used in the calculation of offsite doses due to radioactive gaseous and liquid effluents, in the calculation of gaseous and liquid effluent monitoring alarm/trip setpoints, and in the conduct of the environmental radiological monitoring program.

OPERABLE - OPERABILITY

1.19 A system, subsystem, train, component, or device shall be OPERABLE or have OPERABILITY when it is capable of performing its specified function(s), and when all necessary attendant instrumentation, controls, electrical power, cooling or seal water, lubrication or other auxiliary equipment that are required for the system, subsystem, train, component, or device to perform its function(s) are also capable of performing their related support function(s).

OPERATIONAL MODE - MODE

1.20 An OPERATIONAL MODE (i.e. MODE) shall correspond to any one inclusive combination of core reactivity condition, power level, and cold leg reactor coolant temperature specified in Table 1.2.

PHYSICS TESTS

1.21 PHYSICS TESTS shall be those tests performed to measure the fundamental nuclear characteristics of the reactor core and related instrumentation and (1) described in Chapter 14.0 of the FSAR, (2) authorized under the provisions of 10 CFR 50.59, or (3) otherwise approved by the Commission.

PLANAR RADIAL PEAKING FACTOR - $F_{xy}$

1.22 The PLANAR RADIAL PEAKING FACTOR is the ratio of the peak to plane average power density of the individual fuel rods in a given horizontal plane, excluding the effects of azimuthal tilt.

PRESSURE BOUNDARY LEAKAGE

1.23 PRESSURE BOUNDARY LEAKAGE shall be leakage (except steam generator tube leakage) through a nonisolable fault in a Reactor Coolant System component body, pipe wall, or vessel wall.

PROCESS CONTROL PROGRAM (PCP)

1.24 The PROCESS CONTROL PROGRAM shall contain the provisions to assure that the SOLIDIFICATION of wet radioactive wastes results in a waste form with properties that meet the requirements of 10 CFR Part 61 and of low level radioactive waste disposal sites. The PCP shall identify process parameters influencing SOLIDIFICATION such as pH, oil content, $H_2O$ content, solids content, ratio of solidification agent to waste and/or necessary additives for each type of anticipated waste, and the acceptable boundary conditions for the process parameters shall be identified for each waste type, based on laboratory scale and full-scale testing or experience. The PCP shall also include an identification of conditions that must be satisfied, based on full-scale testing, to assure that dewatering of bead resins, powdered resins, and filter sludges will result in volumes of free water, at the time of disposal, within the limits of 10 CFR Part 61 and of low level radioactive waste disposal sites.

PURGE - PURGING

1.25 PURGE or PURGING shall be the controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration, or other operating condition, in such a manner that replacement air or gas is required to purify the confinement.

RATED THERMAL POWER

1.26 RATED THERMAL POWER shall be a total reactor core heat transfer rate to the reactor coolant of 3800 MWt.

REACTOR TRIP SYSTEM RESPONSE TIME

1.27 The REACTOR TRIP SYSTEM RESPONSE TIME shall be the time interval from when the monitored parameter exceeds its trip setpoint at the channel sensor until electrical power is interrupted to the CEA drive mechanism.

REPORTABLE EVENT

1.28 A REPORTABLE EVENT shall be any of those conditions specified in Sections 50.72 and 50.73 to 10 CFR Part 50.

SHUTDOWN MARGIN

1.29 SHUTDOWN MARGIN shall be the instantaneous amount of reactivity by which the reactor is subcritical or would be subcritical from its present condition assuming:

a. No change in part-length control element assembly position, and

b. All full-length control element assemblies (shutdown and regulating) are fully inserted except for the single assembly of highest reactivity worth which is assumed to be fully withdrawn.

SITE BOUNDARY

1.30 The SITE BOUNDARY shall be that line beyond which the land is neither owned, nor leased, nor otherwise controlled by the licensee.

SOFTWARE

1.31 The digital computer SOFTWARE for the reactor protection system shall be the program codes including their associated data, documentation, and procedures.

SOLIDIFICATION

1.32 SOLIDIFICATION shall be the conversion of radioactive wastes from liquid systems to a homogeneous (uniformly distributed), monolithic, immobilized solid with definite volume and shape, bounded by a stable surface of distinct outline on all sides (free-standing).

SOURCE CHECK

1.33 A SOURCE CHECK shall be the qualitative assessment of channel response when the channel sensor is exposed to a source of increased radioactivity.

STAGGERED TEST BASIS

1.34 A STAGGERED TEST BASIS shall consist of:

a. A test schedule for n systems, subsystems, trains, or other designated components obtained by dividing the specified test interval into n equal subintervals, and

b. The testing of one system, subsystem, train, or other designated component at the beginning of each subinterval.

THERMAL POWER

1.35 THERMAL POWER shall be the total reactor core heat transfer rate to the reactor coolant.

UNIDENTIFIED LEAKAGE

1.36 UNIDENTIFIED LEAKAGE shall be all leakage which does not constitute either IDENTIFIED LEAKAGE or reactor coolant pump controlled bleed-off flow.

UNRESTRICTED AREA

1.37 An UNRESTRICTED AREA shall be any area at or beyond the SITE BOUNDARY access to which is not controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials, or any area within the SITE BOUNDARY used for residential quarters or for industrial, commercial, institutional, and/or recreational purposes.

VENTILATION EXHAUST TREATMENT SYSTEM

1.38 A VENTILATION EXHAUST TREATMENT SYSTEM shall be any system designed and installed to reduce gaseous radioiodine or radioactive material in particulate form in effluents by passing ventilation or vent exhaust gases through charcoal adsorbers and/or HEPA filters for the purpose of removing iodines or particulates from the gaseous exhaust stream prior to the release to the environment. Such a system is not considered to have any effect on noble gas effluents. Engineered Safety Feature (ESF) atmospheric cleanup systems are not considered to be VENTILATION EXHAUST TREATMENT SYSTEM components.

VENTING

1.39 VENTING shall be the controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration, or other operating condition, in such a manner that replacement air or gas is not provided or required during VENTING. Vent, used in system names, does not imply a VENTING process.

## TABLE 1.1

## FREQUENCY NOTATION

| NOTATION | FREQUENCY |
|---|---|
| S | At least once per 12 hours. |
| D | At least once per 24 hours. |
| W | At least once per 7 days. |
| 4/M | At least 4 times per month at intervals no greater than 9 days and a minimum of 48 times per year. |
| M | At least once per 31 days. |
| Q | At least once per 92 days. |
| SA | At least once per 184 days. |
| R | At least once per 18 months. |
| P | Completed prior to each release. |
| S/U | Prior to each reactor startup. |
| N.A. | Not applicable. |

## TABLE 2.2-1

## REACTOR PROTECTIVE INSTRUMENTATION TRIP SETPOINT LIMITS

| FUNCTIONAL UNIT | TRIP SETPOINT | ALLOWABLE VALUES |
|---|---|---|
| I. TRIP GENERATION | | |
| A. Process | | |
| 1. Pressurizer Pressure - High | ≤ 2383 psia | ≤ 2388 psia |
| 2. Pressurizer Pressure - Low | ≥ 1837 psia (2) | ≥ 1822 psia (2) |
| 3. Steam Generator Level - Low | ≥ 44.2% (4) | ≥ 43.7% (4) |
| 4. Steam Generator Level - High | ≤ 91.0% (9) | ≤ 91.5% (9) |
| 5. Steam Generator Pressure - Low | ≥ 919 psia (3) | ≥ 912 psia (3) |
| 6. Containment Pressure - High | ≤ 3.0 psig | ≤ 3.2 psig |
| 7. Reactor Coolant Flow - Low | | |
| a. Rate | ≤ 0.115 psi/sec (6)(7) | ≤ 0.118 psi/sec (6)(7) |
| b. Floor | ≥ 11.9 psid (6)(7) | ≥ 11.7 psid(6)(7) |
| c. Band | ≤ 10.0 psid (6)(7) | ≤ 10.2 psid (6)(7) |
| 8. Local Power Density - High | ≤ 21.0 kW/ft (5) | ≤ 21.0 kW/ft (5) |
| 9. DNBR - Low | ≥ 1.231 (5) | ≥ 1.231 (5) |
| B. Excore Neutron Flux | | |
| 1. Variable Overpower Trip | | |
| a. Rate | ≤ 10.6%/min of RATED THERMAL POWER (8) | ≤ 11.0%/min of RATED THERMAL POWER (8) |
| b. Ceiling | ≤ 110.0% of RATED THERMAL POWER (8) | ≤ 111.0% of RATED THERMAL POWER (8) |
| c. Band | ≤ 9.8% of RATED THERMAL POWER (8) | ≤ 10.0% of RATED THERMAL POWER (8) |

TABLE 2.2-1 (Continued)

REACTOR PROTECTIVE INSTRUMENTATION TRIP SETPOINT LIMITS

| FUNCTIONAL UNIT | TRIP SETPOINT | ALLOWABLE VALUES |
|---|---|---|
| 2. Logarithmic Power Level - High (1) | | |
| a. Startup and Operating | ≤ 0.010% of RATED THERMAL POWER | ≤ 0.011% of RATED THERMAL POWER |
| b. Shutdown | ≤ 0.010% of RATED THERMAL POWER | ≤ 0.011% of RATED THERMAL POWER |
| C. Core Protection Calculator System | | |
| 1. CEA Calculators | Not Applicable | Not Applicable |
| 2. Core Protection Calculators | Not Applicable | Not Applicable |
| D. Supplementary Protection System | | |
| Pressurizer Pressure - High | ≤ 2409 psia | ≤ 2414 psia |
| II. RPS LOGIC | | |
| A. Matrix Logic | Not Applicable | Not Applicable |
| B. Initiation Logic | Not Applicable | Not Applicable |
| III. RPS ACTUATION DEVICES | | |
| A. Reactor Trip Breakers | Not Applicable | Not Applicable |
| B. Manual Trip | Not Applicable | Not Applicable |

## TABLE NOTATIONS

(1) Trip may be manually bypassed above $10^{-4}$% of RATED THERMAL POWER; bypass shall be automatically removed when THERMAL POWER is less than or equal to $10^{-4}$% of RATED THERMAL POWER.

(2) In MODES 3-4, value may be decreased manually, to a minimum of 100 psia, as pressurizer pressure is reduced, provided the margin between the pressurizer pressure and this value is maintained at less than or equal to 400 psi; the setpoint shall be increased automatically as pressurizer pressure is increased until the trip setpoint is reached. Trip may be manually bypassed below 400 psia; bypass shall be automatically removed whenever pressurizer pressure is greater than or equal to 500 psia.

(3) In MODES 3-4, value may be decreased manually as steam generator pressure is reduced, provided the margin between the steam generator pressure and this value is maintained at less than or equal to 200 psi; the setpoint shall be increased automatically as steam generator pressure is increased until the trip setpoint is reached.

(4) % of the distance between steam generator upper and lower level wide range instrument nozzles.

(5) As stored within the Core Protection Calculator (CPC). Calculation of the trip setpoint includes measurement, calculational and processor uncertainties, and dynamic allowances. Trip may be manually bypassed below $10^{-4}$% of RATED THERMAL POWER; bypass shall be automatically removed when THERMAL POWER is greater than or equal to $10^{-4}$% of RATED THERMAL POWER.

The approved DNBR limit is 1.231 which includes a partial rod bow penalty compensation. If the fuel burnup exceeds that for which an increased rod bow penalty is required, the DNBR limit shall be adjusted. In this case a DNBR trip setpoint of 1.231 is allowed provided that the difference is compensated by an increase in the CPC addressable constant BERR1 as follows:

$$BERR1_{new} = BERR1_{old} \left[1 + \frac{RB - RB_o}{100} \times \frac{d\ (\%\ POL)}{d\ (\%\ DNBR)}\right]$$

where $BERR1_{old}$ is the uncompensated value of BERR1; RB is the fuel rod bow penalty in % DNBR; $RB_o$ is the fuel rod bow penalty in % DNBR already accounted for in the DNBR limit; POL is the power operating limit; and d (% POL)/d (% DNBR) is the absolute value of the most adverse derivative of POL with respect to DNBR.

TABLE 2.2-1 (Continued)

REACTOR PROTECTIVE INSTRUMENTATION TRIP SETPOINT LIMITS

TABLE NOTATIONS (Continued)

(6) RATE is the maximum rate of decrease of the trip setpoint. There are no restrictions on the rate at which the setpoint can increase.
FLOOR is the minimum value of the trip setpoint.
BAND is the amount by which the trip setpoint is below the input signal unless limited by Rate or Floor.
Setpoints are based on steam generator differential pressure.

(7) The setpoint may be altered to disable trip function during testing pursuant to Specification 3.10.3.

(8) RATE is the maximum rate of increase of the trip setpoint. (The rate at which the setpoint can decrease is no slower than five percent per second.)
CEILING is the maximum value of the trip setpoint.
BAND is the amount by which the trip setpoint is above the steady state input signal unless limited by the rate or the ceiling.

(9) % of the distance between steam generator upper and lower level narrow range instrument nozzles.

## 3/4.1 REACTIVITY CONTROL SYSTEMS

### 3/4.1.1 BORATION CONTROL

#### SHUTDOWN MARGIN - ALL CEAs FULLY INSERTED

#### LIMITING CONDITION FOR OPERATION

3.1.1.1 The SHUTDOWN MARGIN shall be greater than or equal to 1.0% delta k/k.

APPLICABILITY: MODES 3, 4* and 5* with all full-length CEAs fully inserted.

ACTION:

With the SHUTDOWN MARGIN less than 1.0% delta k/k, immediately initiate and continue boration at greater than or equal to 26 gpm to reactor coolant system of a solution containing greater than or equal to 4000 ppm boron or equivalent until the required SHUTDOWN MARGIN is restored.

#### SURVEILLANCE REQUIREMENTS

4.1.1.1.1 The SHUTDOWN MARGIN shall be determined to be greater than or equal to 1.0% delta k/k at least once per 24 hours by consideration of at least the following factors:

1. Reactor Coolant System boron concentration,
2. CEA position,
3. Reactor Coolant System average temperature,
4. Fuel burnup based on gross thermal energy generation,
5. Xenon concentration, and
6. Samarium concentration.

4.1.1.1.2 The overall core reactivity balance shall be compared to predicted values to demonstrate agreement within ± 1.0% delta k/k at least once per 31 Effective Full Power Days (EFPD). This comparison shall consider at least those factors stated in Specification 4.1.1.1.1, above. The predicted reactivity values shall be adjusted (normalized) to correspond to the actual core conditions prior to exceeding a fuel burnup of 60 EFPD after each fuel loading.

* See Special Test Exception 3.10.9.

SHUTDOWN MARGIN - $K_{N-1}$ - ANY CEA WITHDRAWN

LIMITING CONDITION FOR OPERATION

3.1.1.2

a. The SHUTDOWN MARGIN shall be greater than or equal to that shown in Figure 3.1-1A, and

b. For $T_{cold}$ less than or equal to 500°F, $K_{N-1}$ shall be less than 0.99.

APPLICABILITY: MODES 1, 2*, 3*, 4*, and 5* with any full-length CEA fully or partially withdrawn.

ACTION:

a. With the SHUTDOWN MARGIN less than that in Figure 3.1-1A, immediately initiate and continue boration at greater than or equal to 26 gpm to the reactor coolant system of a solution containing greater than or equal to 4000 ppm boron or equivalent until the required SHUTDOWN MARGIN Is restored, and

b. With $T_{cold}$ less than or equal to 500°F and $K_{N-1}$ greater than or equal to 0.99, immediately vary CEA positions and/or initiate and continue boration at greater than or equal to 26 gpm to the reactor coolant system of a solution containing greater than or equal to 4000 ppm boron or equivalent until the required $K_{N-1}$ is restored.

SURVEILLANCE REQUIREMENTS

4.1.1.2.1 With any full-length CEA fully or partially withdrawn, the SHUTDOWN MARGIN shall be determined to be greater than or equal to that in Figure 3.1.1A:

a. Within 1 hour after detection of an inoperable CEA(s) and at least once per 12 hours thereafter while the CEA(s) is inoperable. If the inoperable CEA is immovable as a result of excessive friction or mechanical interference or known to be untrippable, the above required SHUTDOWN MARGIN shall be increased by an amount at least equal to the withdrawn worth of the immovable or untrippable CEA(s).

* See Special Test Exceptions 3.10.1 and 3.10.9.

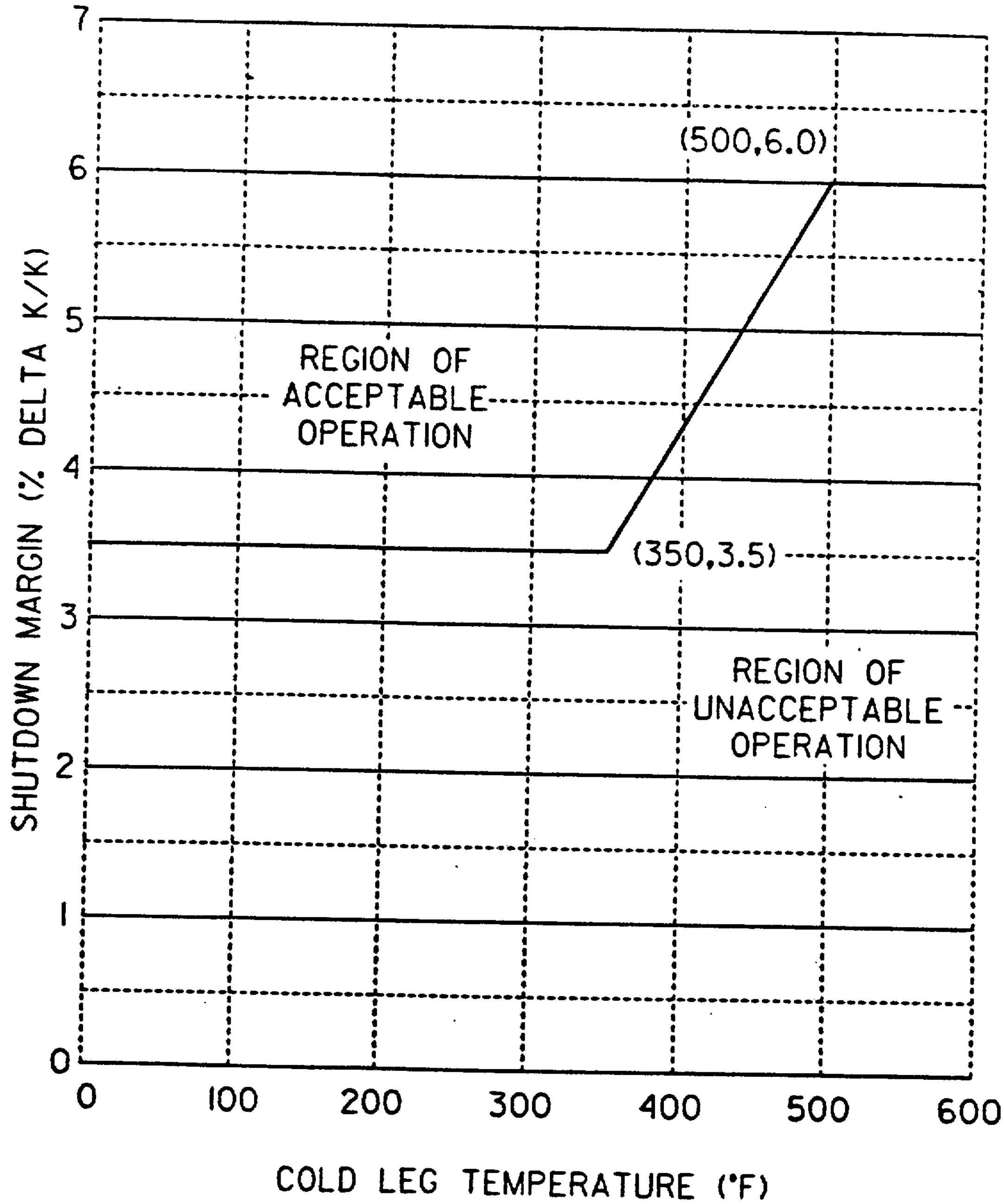


FIGURE 3.1-1A

SHUTDOWN MARGIN VERSUS COLD LEG TEMPERATURE

SURVEILLANCE REQUIREMENTS (Continued)

b. When in MODE 1 or MODE 2 with $k_{eff}$ greater than or equal to 1.0, at least once per 12 hours by verifying that CEA group withdrawal is within the Transient Insertion Limits of Specification 3.1.3.6.

c. When in MODE 2 with $k_{eff}$ less than 1.0, within 4 hours prior to achieving reactor criticality by verifying that predicted critical CEA position is within the limits of Specification 3.1.3.6.

d. Prior to initial operation above 5% RATED THERMAL POWER after each fuel loading, by consideration of the factors of e. below, with the CEA groups at the Transient Insertion Limits of Specification 3.1.3.6.

e. When in MODE 3, 4, or 5, at least once per 24 hours by consideration of at least the following factors:

1. Reactor Coolant System boron concentration,
2. CEA position
3. Reactor Coolant System average temperature,
4. Fuel burnup based on gross thermal energy generation,
5. Xenon concentration, and
6. Samarium concentration.

4.1.1.2.2 When in MODE 3, 4, or 5, with any full-length CEA fully or partially withdrawn, and $T_{cold}$ less than or equal to 500°F, $K_{N-1}$ shall be determined to be less than 0.99 at least once per 24 hours by consideration of at least the following factors.

1. Reactor Coolant System boron concentration,
2. CEA position,
3. Reactor Coolant System average temperature
4. Fuel burnup based on gross thermal energy generation.
5. Xenon concentration, and
6. Samarium concentration.

4.1.1.2.3 The overall core reactivity balance shall be compared to predicted values to demonstrate agreement within ± 1.0% delta k/k at least once per 31 Effective Full Power Days (EFPD). This comparison shall consider at least those factors stated in Specification 4.1.1.2.1.e or 4.1.1.2.2. The predicted reactivity values shall be adjusted (normalized) to correspond to the actual core conditions prior to exceeding a fuel burnup of 60 EFPD after each fuel loading.

## MODERATOR TEMPERATURE COEFFICIENT

### LIMITING CONDITION FOR OPERATION

3.1.1.3 The moderator temperature coefficient (MTC) shall be within the area of Acceptable Operation shown on Figure 3.1-1.

APPLICABILITY: MODES 1 and 2*#.

ACTION:

With the moderator temperature coefficient outside the area of Acceptable Operation shown on Figure 3.1-1, be in at least HOT STANDBY within 6 hours.

### SURVEILLANCE REQUIREMENTS

4.1.1.3.1 The MTC shall be determined to be within its limits by confirmatory measurements. MTC measured values shall be extrapolated and/or compensated to permit direct comparison with the above limits.

4.1.1.3.2 The MTC shall be determined at the following frequencies and THERMAL POWER conditions during each fuel cycle:

a. Prior to initial operation above 5% of RATED THERMAL POWER, after each fuel loading.

b. At any THERMAL POWER, within 7 EFPD after reaching a core average exposure of 40 EFPD burnup into the current cycle.

c. At any THERMAL POWER, within 7 EFPD after reaching a core average exposure equivalent to two-thirds of the expected current cycle end-of-cycle core average burnup.

---

*With Keff greater than or equal to 1.0.

#See Special Test Exception 3.10.2.

3/4.1.2 BORATION SYSTEMS

FLOW PATHS - SHUTDOWN

LIMITING CONDITION FOR OPERATION

3.1.2.1 As a minimum, one of the following boron injection flow paths shall be OPERABLE:

a. If only the spent fuel pool in Specification 3.1.2.5a. is OPERABLE, a flow path from the spent fuel pool via a gravity feed connection and a charging pump to the Reactor Coolant System.

b. If only the refueling water tank in Specification 3.1.2.5b. is OPERABLE, a flow path from the refueling water tank via either a charging pump, a high pressure safety injection pump, or a low pressure safety injection pump to the Reactor Coolant System.

APPLICABILITY: MODES 5 and 6.

ACTION:

With none of the above flow paths OPERABLE, suspend all operations involving CORE ALTERATIONS or positive reactivity changes.

SURVEILLANCE REQUIREMENTS

4.1.2.1 At least one of the above required flow paths shall be demonstrated OPERABLE at least once per 31 days by verifying that each valve (manual, power-operated, or automatic) in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct position.

## FLOW PATHS - OPERATING

## LIMITING CONDITION FOR OPERATION

3.1.2.2 At least two of the following three boron injection flow paths shall be OPERABLE:

a. A gravity feed flow path from either the refueling water tank or the spent fuel pool through CH-536 (RWT Gravity Feed Isolation Valve) and a charging pump to the Reactor Coolant System,

b. A gravity feed flow path from the refueling water tank through CH-327 (RWT Gravity Feed/Safety Injection System Isolation Valve) and a charging pump to the Reactor Coolant System,

c. A flow path from either the refueling water tank or the spent fuel pool through CH-164 (Boric Acid Filter Bypass Valve), utilizing gravity feed and a charging pump to the Reactor Coolant System.

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

ACTION:

With only one of the above required boron injection flow paths to the Reactor Coolant System OPERABLE, restore at least two boron injection flow paths to the Reactor Coolant System to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours; restore at least two flow paths to OPERABLE status within the next 7 days or be in COLD SHUTDOWN within the next 30 hours.

## SURVEILLANCE REQUIREMENTS

4.1.2.2.1 At least two of the above required flow paths shall be demonstrated OPERABLE:

a. At least once per 31 days by verifying that each valve (manual, power-operated, or automatic) in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct position.

b. At least once per 18 months when the Reactor Coolant System is at normal operating pressure by verifying that the flow path required by Specification 3.1.2.2 delivers at least 26 gpm for 1 charging pump and 68 gpm for two charging pumps to the Reactor Coolant System.

4.1.2.2.2 The provisions of Specification 4.0.4 are not applicable for entry into Mode 3 or Mode 4 to perform the surveillance testing of Specification 4.1.2.2.1.b provided the testing is performed within 24 hours after achieving normal operating pressure in the reactor coolant system.

## CHARGING PUMPS - SHUTDOWN

### LIMITING CONDITION FOR OPERATION

3.1.2.3 At least one charging pump or one high pressure safety injection pump or one low pressure safety injection pump in the boron injection flow path required OPERABLE pursuant to Specification 3.1.2.1 shall be OPERABLE and capable of being powered from an OPERABLE emergency power source.

APPLICABILITY: MODES 5 and 6.

ACTION:

With no charging pump or high pressure safety injection pump or low pressure safety injection pump OPERABLE or capable of being powered from an OPERABLE emergency power source, suspend all operations involving CORE ALTERATIONS or positive reactivity changes.

### SURVEILLANCE REQUIREMENTS

4.1.2.3 No additional Surveillance Requirements other than those required by Specification 4.0.5.

## CHARGING PUMPS - OPERATING

### LIMITING CONDITION FOR OPERATION

3.1.2.4 At least two charging pumps shall be OPERABLE.

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

ACTION:

With only one charging pump OPERABLE, restore at least two charging pumps to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours; restore at least two charging pumps to OPERABLE status within the next 7 days or be in COLD SHUTDOWN within the next 30 hours.

### SURVEILLANCE REQUIREMENTS

4.1.2.4 No additional Surveillance Requirements other than those required by Specification 4.0.5.

BORATED WATER SOURCES - OPERATING

## LIMITING CONDITION FOR OPERATION

3.1.2.6 Each of the following borated water sources shall be OPERABLE:

a. The spent fuel pool with:

1. A minimum borated water volume as specified in Figure 3.1-2, and
2. A boron concentration of between 4000 ppm and 4400 ppm boron, and
3. A solution temperature between 60°F and 180°F.

b. The refueling water tank with:

1. A minimum contained borated water volume as specified in Figure 3.1-2, and
2. A boron concentration of between 4000 and 4400 ppm of boron, and
3. A solution temperature between 60°F and 120°F.

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

ACTION:

a. With the above required spent fuel pool inoperable, restore the pool to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours; restore the above required spent fuel pool to OPERABLE status within the next 7 days or be in COLD SHUTDOWN within the next 30 hours.

b. With the refueling water tank inoperable, restore the tank to OPERABLE status within 1 hour or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

## SURVEILLANCE REQUIREMENTS

4.1.2.6 Each of the above required borated water sources shall be demonstrated OPERABLE:

a. At least once per 7 days by:

1. Verifying the boron concentration in the water, and
2. Verifying the contained borated water volume of the water source.

b. At least once per 24 hours by verifying the refueling water tank temperature when the outside air temperature is outside the 60°F to 120°F range.

c. At least once per 24 hours by verifying the spent fuel pool temperature when irradiated fuel is present in the pool.

*See Special Test Exception 3.10.7.

## LIMITING CONDITION FOR OPERATION

3.1.2.7 Both startup channel high neutron flux alarms shall be OPERABLE.

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

ACTION:

a. With one startup channel high neutron flux alarm inoperable:

   1. Determine the RCS boron concentration when entering MODE 3, 4, 5, or 6 or at the time the alarm is determined to be inoperable. From that time, the RCS boron concentration shall be determined at the applicable monitoring frequency in Tables 3.1-1 through 3.1-5 by either boronometer or RCS sampling**.

b. With both startup channel high neutron flux alarms inoperable:

   1. Determine the RCS boron concentration by either boronmeter and RCS sampling** or by independent collection and analysis of two RCS samples when entering Mode 3, 4, or 5 or at the time both alarms are determined to be inoperable. From that time, the RCS boron concentration shall be determined at the applicable monitoring frequency in Tables 3.1-1 through 3.1-5, as applicable, by either boronmeter and RCS sampling** or by collection and analysis of two independent RCS samples. If redundant determination of RCS boron concentration cannot be accomplished immediately, suspend all operations involving CORE ALTERATIONS or positive reactivity changes until the method for determining and confirming RCS boron concentration is restored.

   2. When in MODE 5 with the RCS level below the centerline of the hotleg or MODE 6, suspend all operations involving CORE ALTERATIONS or positive reactivity changes until at least one startup channel high neutron flux alarm is restored to OPERABLE status.

c. The provisions of Specification 3.0.3 are not applicable.

## SURVEILLANCE REQUIREMENTS

4.1.2.7 Each startup channel high neutron flux alarm shall be demonstrated OPERABLE by performance of:

---

*Within 1 hour after the neutron flux is within the startup range following a reactor shutdown.

**With one or more reactor coolant pumps (RCP) operating the sample should be obtained from the hot leg. With no RCP operating, the sample should be obtained from the discharge line of the low pressure safety injection (LPSI) pump operating in the shutdown cooling mode.

a. A CHANNEL CHECK:

   1. At least once per 12 hours.

   2. When initially setting setpoints at the following times:

      a) One hour after a reactor trip.
      b) After a controlled reactor shutdown: Within 1 hour after the neutron flux is within the startup range in MODE 3.

b. A CHANNEL FUNCTIONAL TEST every 31 days of cumulative operation during shutdown.

## TABLE 3.1-1

**REQUIRED MONITORING FREQUENCIES FOR BACKUP BORON DILUTION DETECTION AS A FUNCTION OF OPERATING CHARGING PUMPS AND PLANT OPERATIONAL MODES FOR $K_{eff} > 0.98$**

| OPERATIONAL MODE | Number of Operating Charging Pumps | | | |
|---|---|---|---|---|
| | 0 | 1 | 2 | 3 |
| 3 | 12 hours | 1 hour | ONA | ONA |
| 4 not on SCS | 12 hours | 1 hour | ONA | ONA |
| 5 not on SCS | 8 hours | 1 hour | ONA | ONA |
| 4 & 5 on SCS | ONA | ONA | ONA | ONA |

Notes: SCS = Shutdown Cooling System
ONA = Operation not allowed

## TABLE 3.1-2

### REQUIRED MONITORING FREQUENCIES FOR BACKUP BORON DILUTION DETECTION AS A FUNCTION OF OPERATING CHARGING PUMPS AND PLANT OPERATIONAL MODES FOR $0.98 \geq K_{eff} \geq 0.97$

| OPERATIONAL MODE | Number of Operating Charging Pumps | | | |
|---|---|---|---|---|
| | 0 | 1 | 2 | 3 |
| 3 | 12 hours | 2.5 hours | 1 hour | 0.5 hours |
| 4 not on SCS | 12 hours | 2.5 hours | 1 hour | 0.5 hours |
| 5 not on SCS | 8 hours | 2.5 hours | 1 hour | 0.5 hours |
| 4 & 5 on SCS | 8 hours | 0.5 hours | ONA | ONA |

Notes: SCS = Shutdown Cooling System
ONA = Operation not allowed

## TABLE 3.1-3

### REQUIRED MONITORING FREQUENCIES FOR BACKUP BORON DILUTION DETECTION AS A FUNCTION OF OPERATING CHARGING PUMPS AND PLANT OPERATIONAL MODES FOR $0.97 \geq K_{eff} > 0.96$

| OPERATIONAL MODE | Number of Operating Charging Pumps 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| 3 | 12 hours | 3.5 hours | 1.5 hours | 1 hour |
| 4 not on SCS | 12 hours | 3.5 hours | 1.5 hours | 1 hour |
| 5 not on SCS | 8 hours | 3.5 hours | 1.5 hours | 1 hour |
| 4 & 5 on SCS | 8 hours | 1 hour | 0.5 hours | ONA |

Notes: SCS = Shutdown Cooling System
ONA = Operation not allowed

## TABLE 3.1-4

### REQUIRED MONITORING FREQUENCIES FOR BACKUP BORON DILUTION DETECTION AS A FUNCTION OF OPERATING CHARGING PUMPS AND PLANT OPERATIONAL MODES FOR $0.96 \geq K_{eff} \geq 0.95$

| OPERATIONAL MODE | Number of Operating Charging Pumps | | | |
|---|---|---|---|---|
| | 0 | 1 | 2 | 3 |
| 3 | 12 hours | 5 hours | 2 hours | 1 hour |
| 4 not on SCS | 12 hours | 5 hours | 2 hours | 1 hour |
| 5 not on SCS | 8 hours | 5 hours | 2 hours | 1 hour |
| 4 & 5 on SCS | 8 hours | 2 hours | 0.5 hours | ONA |

Notes: SCS = Shutdown Cooling System
ONA = Operation not allowed

## TABLE 3.1-5

### REQUIRED MONITORING FREQUENCIES FOR BACKUP BORON DILUTION DETECTION AS A FUNCTION OF OPERATING CHARGING PUMPS AND PLANT OPERATIONAL MODES FOR $K_{eff} \leq 0.95$

| OPERATIONAL MODE | Number of Operating Charging Pumps | | | |
|---|---|---|---|---|
| | 0 | 1 | 2 | 3 |
| 3 | 12 hours | 6 hours | 3 hours | 1.5 hours |
| 4 not on SCS | 12 hours | 6 hours | 3 hours | 1.5 hours |
| 5 not on SCS | 8 hours | 6 hours | 3 hours | 1.5 hours |
| 4 & 5 on SCS | 8 hours | 2 hours | 1 hour | 0.5 hours |
| 6 | 24 hours | 8 hours | 4 hours | 2 hours |

Note: SCS = Shutdown Cooling System

## TABLE 3.3-1 (Continued)

## REACTOR PROTECTIVE INSTRUMENTATION

## TABLE NOTATIONS

*With the protective system trip breakers in the closed position, the CEA drive system capable of CEA withdrawal, and fuel in the reactor vessel.

#The provisions of Specification 3.0.4 are not applicable.

(a) Trip may be manually bypassed above $10^{-4}$% of RATED THERMAL POWER; bypass shall be automatically removed when THERMAL POWER is less than or equal to $10^{-4}$% of RATED THERMAL POWER.

(b) Trip may be manually bypassed below 400 psia; bypass shall be automatically removed whenever pressurizer pressure is greater than or equal to 500 psia.

(c) Trip may be manually bypassed below $10^{-4}$% of RATED THERMAL POWER; bypass shall be automatically removed when THERMAL POWER is greater than or equal to $10^{-4}$% of RATED THERMAL POWER.

(d) Trip may be bypassed during testing pursuant to Special Test Exception 3.10.3.

(e) See Special Test Exception 3.10.2.

(f) There are four channels, each of which is comprised of one of the four reactor trip breakers, arranged in a selective two-out-of-four configuration (i.e., one-out-of-two taken twice).

## ACTION STATEMENTS

ACTION 1 - With the number of channels OPERABLE one less than required by the Minimum Channels OPERABLE requirement, restore the inoperable channel to OPERABLE status within 48 hours or be in at least HOT STANDBY within the next 6 hours and/or open the protective system trip breakers.

ACTION 2 - With the number of channels OPERABLE one less than the Total Number of Channels, STARTUP and/or POWER OPERATION may continue provided the inoperable channel is placed in the bypassed or tripped condition within 1 hour. If the inoperable channel is bypassed, the desirability of maintaining this channel in the bypassed condition shall be reviewed in accordance with Specification 6.5.1.6.g. The channel shall be returned to OPERABLE status no later than during the next COLD SHUTDOWN.

## TABLE 3.3-1 (Continued)

## REACTOR PROTECTIVE INSTRUMENTATION

## ACTION STATEMENTS

With a channel process measurement circuit that affects multiple functional units inoperable or in test, bypass or trip all associated functional units as listed below:

| Process Measurement Circuit | Functional Unit Bypassed/Tripped |
|---|---|
| 1. Linear Power (Subchannel or Linear) | Variable Overpower (RPS)<br>Local Power Density - High (RPS)<br>DNBR - Low (RPS) |
| 2. Pressurizer Pressure - High (Narrow Range) | Pressurizer Pressure - High (RPS)<br>Local Power Density - High (RPS)<br>DNBR - Low (RPS) |
| 3. Steam Generator Pressure - Low | Steam Generator Pressure - Low<br>Steam Generator Level 1-Low (ESF)<br>Steam Generator Level 2-Low (ESF) |
| 4. Steam Generator Level - Low (Wide Range) | Steam Generator Level - Low (RPS)<br>Steam Generator Level 1-Low (ESF)<br>Steam Generator Level 2-Low (ESF) |
| 5. Core Protection Calculator | Local Power Density - High (RPS)<br>DNBR - Low (RPS) |

ACTION 3 - With the number of channels OPERABLE one less than the Minimum Channels OPERABLE requirement, STARTUP and/or POWER OPERATION may continue provided the following conditions are satisfied:

a. Verify that one of the inoperable channels has been bypassed and place the other channel in the tripped condition within 1 hour, and

b. All functional units affected by the bypassed/tripped channel shall also be placed in the bypassed/tripped condition as listed below:

| Process Measurement Circuit | Functional Unit Bypassed/Tripped |
|---|---|
| 1. Linear Power (Subchannel or Linear) | Variable Overpower (RPS)<br>Local Power Density - High (RPS)<br>DNBR - Low (RPS) |
| 2. Pressurizer Pressure - High (Narrow Range) | Pressurizer Pressure - High (RPS)<br>Local Power Density - High (RPS)<br>DNBR - Low (RPS) |

## 3/4.10.1 SHUTDOWN MARGIN AND $K_{N-1}$ - CEA WORTH TESTS

### LIMITING CONDITION FOR OPERATION

3.10.1 The SHUTDOWN MARGIN and $K_{N-1}$ requirements of Specification 3.1.1.2 may be suspended for measurement of CEA worth and shutdown margin provided reactivity equivalent to at least the highest estimated CEA worth is available for trip insertion from OPERABLE CEA(s), or the reactor is subcritical by at least the reactivity equivalent of the highest CEA worth.

APPLICABILITY: MODES 2, 3* and 4*#.

ACTION:

a. With any full-length CEA not fully inserted and with less than the above reactivity equivalent available for trip insertion, immediately initiate and continue boration at greater than or equal to 26 gpm of a solution containing greater than or equal to 4000 ppm boron or its equivalent until the SHUTDOWN MARGIN and $K_{N-1}$ required by Specification 3.1.1.2 are restored.

b. With all full-length CEAs fully inserted and the reactor subcritical by less than the above reactivity equivalent, immediately initiate and continue boration at greater than or equal to 26 gpm of a solution containing greater than or equal to 4000 ppm boron or its equivalent until the SHUTDOWN MARGIN required by Specification 3.1.1.1 is restored.

### SURVEILLANCE REQUIREMENTS

4.10.1.1 The position of each full-length and part-length CEA required either partially or fully withdrawn shall be determined at least once per 2 hours.

4.10.1.2 Each CEA not fully inserted shall be demonstrated capable of full insertion when tripped from at least the 50% withdrawn position within 24 hours prior to reducing the SHUTDOWN MARGIN to less than the limits of Specification 3.1.1.1.

4.10.1.3 When in MODE 3 or MODE 4, the reactor shall be determined to be subcritical by at least the reactivity equivalent of the highest estimated CEA worth or the reactivity equivalent of the highest estimated CEA worth is available for trip insertion from OPERABLE CEAs at least once per 2 hours by consideration of at least the following factors:

a. Reactor Coolant System boron concentration,

b. CEA position,

c. Reactor Coolant System average temperature,

d. Fuel burnup based on gross thermal energy generation,

e. Xenon concentration, and

f. Samarium concentration.

---

*Operation in MODE 3 and MODE 4 shall be limited to 6 consecutive hours.

#Limited to low power PHYSICS TESTING at the 320°F plateau.

SPECIAL TEST EXCEPTIONS

## 3/4.10.2 MODERATOR TEMPERATURE COEFFICIENT, GROUP HEIGHT, INSERTION, AND POWER DISTRIBUTION LIMITS

### LIMITING CONDITION FOR OPERATION

3.10.2 The moderator temperature coefficient, group height, insertion, and power distribution limits of Specifications 3.1.1.3, 3.1.3.1, 3.1.3.5, 3.1.3.6, 3.2.2, 3.2.3, 3.2.7, and the Minimum Channels OPERABLE requirement of I.C.1 (CEA Calculators) of Table 3.3-1 may be suspended during the performance of PHYSICS TESTS provided:

a. The THERMAL POWER is restricted to the test power plateau which shall not exceed 85% of RATED THERMAL POWER, and

b. The limits of Specification 3.2.1 are maintained and determined as specified in Specification 4.10.2.2 below.

APPLICABILITY: MODES 1 and 2.

ACTION:

With any of the limits of Specification 3.2.1 being exceeded while the requirements of Specifications 3.1.1.3, 3.1.3.1, 3.1.3.5, 3.1.3.6, 3.2.2, 3.2.3, 3.2.7, and the Minimum Channels OPERABLE requirement of I.C.1 (CEA Calculators) of Table 3.3-1 are suspended, either:

a. Reduce THERMAL POWER sufficiently to satisfy the requirements of Specification 3.2.1, or

b. Be in HOT STANDBY within 6 hours.

### SURVEILLANCE REQUIREMENTS

4.10.2.1 The THERMAL POWER shall be determined at least once per hour during PHYSICS TESTS in which the requirements of Specifications 3.1.1.3, 3.1.3.1, 3.1.3.5, 3.1.3.6, 3.2.2, 3.2.3, 3.2.7, or the Minimum Channels OPERABLE requirement of I.C.1 (CEA Calculators) of Table 3.3-1 are suspended and shall be verified to be within the test power plateau.

4.10.2.2 The linear heat rate shall be determined to be within the limits of Specification 3.2.1 by monitoring it continuously with the Incore Detector Monitoring System pursuant to the requirements of Specifications 4.2.1.2 and 3.3.3.2 during PHYSICS TESTS above 20% of RATED THERMAL POWER in which the requirements of Specifications 3.1.1.3, 3.1.3.1, 3.1.3.5, 3.1.3.6, 3.2.2, 3.2.3, 3.2.7, or the Minimum Channels OPERABLE requirement of I.C.1 (CEA Calculators) of Table 3.3-1 are suspended.

## 3/4.10.9 SHUTDOWN MARGIN AND $K_{N-1}$ - CEDMS TESTING

### LIMITING CONDITION FOR OPERATION

3.10.9 The SHUTDOWN MARGIN requirements of Specification 3.1.1.1 and the SHUTDOWN MARGIN and $K_{N-1}$ requirements of Specification 3.1.1.2 may be suspended for pre-startup tests to demonstrate the OPERABILITY of the control element drive mechanism system provided:

a. No more than one CEA is withdrawn at any time.

b. No CEA is withdrawn more than 7 inches.

c. The $K_{N-1}$ requirement of Specification 3.1.1.2 is met prior to the start of testing.

d. All other operations involving positive reactivity changes are suspended during the testing.

APPLICABILITY: MODES 4 and 5.

ACTION: With any of the above requirements not met, suspend testing and comply with the requirements of Specification 3.1.1.1 or 3.1.1.2, as applicable.

### SURVEILLANCE REQUIREMENTS

4.10.9 Surveillance Requirements 4.1.1.2.1.e and 4.1.1.2.2 shall be conducted within one hour prior to the start of testing, and at least once per 12 hours during testing.

## 3/4.1.1 BORATION CONTROL

### 3/4.1.1.1 and 3/4.1.1.2 SHUTDOWN MARGIN and $K_{N-1}$

The function of SHUTDOWN MARGIN is to ensure that the reactor remains subcritical following a design basis accident or anticipated operational occurrence. The function of $K_{N-1}$ is to maintain sufficient subcriticality to preclude inadvertent criticality following ejection of a single control element assembly (CEA). During operation in MODES 1 and 2, with $k_{eff}$ greater than or equal to 1.0, the transient insertion limits of Specification 3.1.3.6 ensure that sufficient SHUTDOWN MARGIN is available.

SHUTDOWN MARGIN is the amount by which the core is subcritical, or would be subcritical immediately following a reactor trip, considering a single malfunction resulting in the highest worth CEA failing to insert. $K_{N-1}$ is a measure of the core's reactivity, considering a single malfunction resulting in the highest worth inserted CEA being ejected.

SHUTDOWN MARGIN requirements vary throughout the core life as a function of fuel depletion and reactor coolant system (RCS) cold leg temperature ($T_{cold}$). The most restrictive condition occurs at EOL, with $T_{cold}$ at no-load operating temperature, and is associated with a postulated steam line break accident and the resulting uncontrolled RCS cooldown. In the analysis of this accident, the specified SHUTDOWN MARGIN is required to control the reactivity transient and ensure that the fuel performance and offsite dose criteria are satisfied. As (initial) $T_{cold}$ decreases, the potential RCS cooldown and the resulting reactivity transient are less severe and, therefore, the required SHUTDOWN MARGIN also decreases. Below $T_{cold}$ of about 210°F, the inadvertent deboration event becomes limiting with respect to the SHUTDOWN MARGIN requirements. Below 210°F, the specified SHUTDOWN MARGIN ensures that sufficient time for operator actions exists between the initial indication of the deboration and the total loss of shutdown margin. Accordingly, with at least one CEA partially or fully withdrawn, the SHUTDOWN MARGIN requirements are based upon these limiting conditions.

Additional events considered in establishing requirements on SHUTDOWN MARGIN that are not limiting with respect to the Specification limits are single CEA withdrawal and startup of an inactive reactor coolant pump.

$K_{N-1}$ requirements vary with the amount of positive reactivity that would be introduced assuming the CEA with the highest inserted worth ejects from the core. In the analysis of the CEA ejection event, the $K_{N-1}$ requirement ensures that the radially averaged enthalpy acceptance criterion is satisfied, considering power redistribution effects. Above $T_{cold}$ of 500°F, Doppler reactivity feedback is sufficient to preclude the need for a specific $K_{N-1}$ requirement. With all CEAs fully inserted, $K_{N-1}$ and SHUTDOWN MARGIN requirements are equivalent in terms of minimum acceptable core boron concentration.

SHUTDOWN MARGIN and $K_{N-1}$ (continued)

Other technical specifications that reference the Specifications on SHUTDOWN MARGIN or $K_{N-1}$ are: 3/4.1.2, BORATION SYSTEMS, 3/4.1.3, MOVABLE CONTROL ASSEMBLIES, 3/4.9.1, REFUELING OPERATIONS-BORON CONCENTRATION, 3/4.10.1, SHUTDOWN MARGIN AND $K_{N-1}$ - CEA WORTH TESTS, and 3/4.10.9, SHUTDOWN MARGIN AND $K_{N-1}$ - CEDMS TESTING.

3/4.1.1.3 MODERATOR TEMPERATURE COEFFICIENT (MTC)

The limitations on moderator temperature coefficient (MTC) are provided to ensure that the assumptions used in the accident and the transient analysis remain valid through each fuel cycle. The surveillance requirements for measurement of the MTC during each fuel cycle are adequate to confirm the MTC value since this coefficient changes slowly due principally to the reduction in RCS boron concentration associated with fuel burnup. The confirmation that the measured MTC value is within its limit provides assurances that the coefficient will be maintained within acceptable values throughout each fuel cycle.

3/4.1.1.4 MINIMUM TEMPERATURE FOR CRITICALITY

This specification ensures that the reactor will not be made critical with the Reactor Coolant System cold leg temperature less than 552°F. This limitation is required to ensure (1) the moderator temperature coefficient is within its analyzed temperature range, (2) the protective instrumentation is within its normal operating range, and (3) consistency with the FSAR safety analysis.

## 3/4.1.2 BORATION SYSTEMS

The boron injection system ensures that negative reactivity control is available during each mode of facility operation. The components required to perform this function include (1) borated water sources, (2) charging pumps, (3) separate flow paths, (4) an emergency power supply from OPERABLE diesel generators, and (5) the volume control tank (VCT) outlet valve CH-UV-501, capable of isolating the VCT from the charging pump suction line. The nominal capacity of each charging pump is 44 gpm at its discharge. Up to 16 gpm of this may be diverted to the volume control tank via the RCP control bleedoff. Instrument inaccuracies and pump performance uncertainties are limited to 2 gpm yielding the 26 gpm value.

With the RCS temperature above 210°F, a minimum of two separate and redundant boron injection systems are provided to ensure single functional capability in the event an assumed failure renders one of the systems inoperable. Allowable out-of-service periods ensure that minor component repair or corrective action may be completed without undue risk to overall facility safety from injection system failures during the repair period.

Each system is capable of providing boration equivalent to a SHUTDOWN MARGIN of 4% delta k/k after xenon decay and cooldown to 210°F. Therefore, the boration capacity of either system is more than sufficient to satisfy the SHUTDOWN MARGIN and/or $K_{N-1}$ requirements of the specifications. The maximum expected boration capability requirement occurs at EOL from full power equilibrium xenon conditions and requires 23,800 gallons of 4000 ppm borated water from either the refueling water tank or the spent fuel pool.

With the RCS temperature below 210°F one injection system is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the additional restrictions prohibiting CORE ALTERATIONS and positive reactivity changes in the event the single injection system becomes inoperable. The restrictions of one and only one operable charging pump whenever reactor coolant level is below the bottom of the pressurizer is based on the assumptions used in the analysis of the boron dilution event.

Each system is capable of providing boration equivalent to a SHUTDOWN MARGIN of 4% delta k/k. Therefore, the boration capacity of the system required below 210°F is more than sufficient to satisfy the SHUTDOWN MARGIN and/or $K_{N-1}$ requirements of the specifications. This condition requires 9,700 gallons of 4000 ppm borated water from either the refueling water tank or the spent fuel pool.

## BASES

### 3/4.10.1 SHUTDOWN MARGIN

This special test exception provides that a minimum amount of CEA worth is immediately available for reactivity control when tests are performed for CEAs worth measurement. This special test exception is required to permit the periodic verification of the actual versus predicted core reactivity condition occurring as a result of fuel burnup or fuel cycling operations. Although testing will be initiated from MODE 2, temporary entry into MODE 3 is necessary during some CEA worth measurements. A reasonable recovery time is available for return to MODE 2 in order to continue PHYSICS TESTING.

### 3/4.10.2 MODERATOR TEMPERATURE COEFFICIENT, GROUP HEIGHT, INSERTION, AND POWER DISTRIBUTION LIMITS

This special test exception permits individual CEAs to be positioned outside of their normal group heights and insertion limits during the performance of such PHYSICS TESTS as those required to (1) measure CEA worth, (2) determine the reactor stability index and damping factor under xenon oscillation conditions, (3) determine power distributions for non-normal CEA configurations, (4) measure rod shadowing factors, and (5) measure temperature and power coefficients. Special test exception permits MTC to exceed limits in Specification 3.1.1.3 during performance of PHYSICS TESTS.

### 3/4.10.3 REACTOR COOLANT LOOPS

This special test exception permits reactor criticality with less than four reactor coolant pumps in operation and is required to perform certain STARTUP and PHYSICS TESTS while at low THERMAL POWER levels.

### 3/4.10.4 CEA POSITION, REGULATING CEA INSERTION LIMITS AND REACTOR COOLANT COLD LEG TEMPERATURE

This special test exception permits the CEAs to be positioned beyond the insertion limits and reactor coolant cold leg temperature to be outside limits during PHYSICS TESTS required to determine the isothermal temperature coefficient and power coefficient.

### 3/4.10.5 MINIMUM TEMPERATURE AND PRESSURE FOR CRITICALITY

This special test exception permits reactor criticality at low THERMAL POWER levels with $T_{cold}$ below the minimum critical temperature and pressure during PHYSICS TESTS which are required to verify the low temperature physics predictions and to ensure the adequacy of design codes for reduced temperature conditions. The Low Power Physics Testing Program at low temperature (300°F) and a pressure of 500 psia is used to perform the following tests:

1. Biological shielding survey test
2. Isothermal temperature coefficient tests
3. CEA group tests
4. Boron worth tests
5. Critical configuration boron concentration

## 3/4.10.6 SAFETY INJECTION TANKS

This special test exception permits testing the low pressure safety injection system check valves. The pressure in the injection header must be reduced below the head of the low pressure injection pump in order to get flow through the check valves. The safety injection tank (SIT) isolation valve must be closed in order to accomplish this. The SIT isolation valve is still capable of automatic operation in the event of an SIAS; therefore, system capability should not be affected.

## 3/4.10.7 SPENT FUEL POOL LEVEL

This special test exception permits loading of the initial core with the spent fuel pool dry.

## 3/4.10.8 SAFETY INJECTION TANK PRESSURE

This special test exception allows the performance of PHYSICS TESTS at low pressure/low temperature (600 psig, 320°F) conditions which are required to verify the low temperature physics predictions and to ensure the adequacy of design codes for reduced temperature conditions.

## 3/4.10.9 SHUTDOWN MARGIN AND $K_{N-1}$ - CEDMS TESTING

This special test exception allows the performance of control element drive mechanism tests prior to startup, without the operator having to be concerned as to whether Specification 3.1.1.1 or 3.1.1.2 is applicable as CEAs are moved. The logarithmic power level-high trip provides additional protection against inadvertent criticality during this test.

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

# SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

# RELATED TO AMENDMENT NO. 23 TO FACILITY OPERATING LICENSE NO. NPF-41

# AND AMENDMENT NO. 13 TO FACILITY OPERATING LICENSE NO. NPF-51

# ARIZONA PUBLIC SERVICE COMPANY, ET AL.

# PALO VERDE NUCLEAR GENERATING STATION, UNIT NOS. 1, AND 2

# DOCKET NOS. STN 50-528 AND STN 50-529

## 1.0 INTRODUCTION

By letter dated January 23, 1987, as supplemented by letters dated April 23, June 8, July 17 and October 1, 1987, the Arizona Public Service Company (APS) on behalf of itself, the Salt River Project Agricultural Improvement and Power District, Southern California Edison Company, El Paso Electric Company, Public Service Company of New Mexico, Los Angeles Department of Water and Power, and Southern California Public Power Authority (licensees), requested changes to the Technical Specifications for Palo Verde Nuclear Generating Station, Units 1, 2 and 3 (Appendices A to Facility Operating License Nos. NPF-41, NPF-51 and NPF-65, respectively). The application requested changes to: (1) revise Specifications 3.1.1.1 and 3.1.1.2, relating to Shutdown Margin requirements for the various modes of operation, and revised Tables 2.2-1 and 3.3-1 in support of these changes; (2) revise Specification 3.1.2.3, and the five Tables in Specification 3.1.2.7, relating to the number of charging pumps in operation while in Mode 5; (3) add a new Special Test Exception (Specification 3.10.9) to allow operability testing of the control element drive mechanism system during pre-startup testing without the need for alternating between Specifications 3.1.1.1 and 3.1.1.2, and (4) revise several other portions of the technical specifications representing related administrative changes, e.g., table of contents, bases sections, added definition of $K_{N-1}$, and renumbering of sections, resulting from the above changes. The October 1, 1987 letter further requested that these changes not be implemented in Palo Verde, Unit 3 until one week after initially reaching 100% power. Although the amendment for Palo Verde, Unit 3 has been deferred pursuant to the licensees' request, the following evaluation is applicable to all three Palo Verde units.

## 2.0 DISCUSSION

A discussion of the various proposed changes to the Technical-Specifications is presented below:

a. Temperature Dependent Shutdown Margin

The current Limiting Conditions for Operation (LCOs) for Specifications 3.1.1.1 and 3.1.1.2 require that the Shutdown Margin be greater than or equal to 6% delta k/k for Modes 1-4 and greater than or equal to 4% delta k/k for Mode 5. The proposed changes would revise the Shutdown Margin requirements according to full-length control element assembly (CEA) position as follows.

The revised Specification 3.1.1.1 would be applicable when all full length CEAs are fully inserted and would require that the Shutdown Margin be greater than or equal to 1% delta k/k for Modes 3, 4 and 5. The licensees stated that verification that all CEAs are fully inserted will be done via the rod bottom contacts, or if these are unavailable, via the reed switch position transmitters.

The revised Specification 3.1.1.2 would be applicable when any full length CEA is withdrawn and would require that for Modes 1 through 5, the Shutdown Margin be greater than or equal to that given in a new Figure 3.1-1A. This figure specifies Shutdown Margin as a function of cold leg temperature, ranging from 6% delta k/k above 500°F and down to 3.5% delta k/k below 350°F.

In addition, a new parameter, $K_{N-1}$, is introduced and defined as the $k_{eff}$ calculated by considering the actual CEA configuration and assuming that the CEA of highest worth is fully withdrawn. The proposed change would require $K_{N-1}$ to be less than 0.99 for reactor coolant cold leg temperatures less than or equal to 500°F.

Shutdown Margin requirements vary throughout core life as a function of fuel depletion and reactor coolant system cold leg temperature. The most restrictive condition occurs at end of cycle, with the cold leg temperature at no-load operating temperature, and is associated with a postulated steam line break accident and the resulting reactivity transient due to the uncontrolled reactor coolant system cooldown in conjunction with a negative moderator temperature coefficient. Standard Review Plan (SRP) Section 15.1.5 requires that steam line break events be evaluated considering potential for fuel damage. If the minimum Departure from Nucleate Boiling Ratio (DNBR) during a steam line break event falls below specified limits (1.231), fuel damage must be assumed.

The licensees have presented the results of reanalyses of the limiting steam line break accidents. The results indicate that for a break occurring during Mode 3 operation for cold leg temperatures less than 500°F, with or without a loss of offsite power and in combination with a single failure, the proposed Shutdown Margin is sufficient to prevent a post trip return to power. For a large steam line break during Mode 4 operation, the proposed Shutdown Margin is also sufficient to prevent a return to core criticality. Since neither of these events result in a return to power operation, the minimum DNBR during these transients remains above 10 which is well above the specified safety limits.

At lower cold leg temperatures, the potential cooldown and the resulting reactivity transient become less severe and, therefore, the required Shutdown Margin also decreases. Below about 210°F, an inadvertent boron dilution event becomes limiting with respect to Shutdown Margin requirements. The licensees have submitted the results of reanalyses which show that the proposed Shutdown Margin ensures that sufficient time exists for operator actions between the initial indication of a deboration event by an audible alarm and the total loss of Shutdown Margin. The inadvertent boron dilution event is discussed further with regard to the proposed changes in Section 2.c below.

The licensees also proposed administrative changes to the following specifications since they specifically include the current Shutdown Margin requirements of Specification 3.1.1.1. The action statements for LCOs 3.1.2.2, 3.1.2.4, and 3.1.2.6 require in part that when the requirements of the LCOs are not met, boration to a Shutdown Margin equivalent to at least 6% delta k/k at 210°F be carried out. The proposed changes would delete any reference to the Shutdown Margin requirements. The licensees indicated that since these action statements require the reactor to be in hot standby, this automatically requires boration to a Shutdown Margin consistent with Specification 3.1.1.1 or 3.1.1.2 and any reference to Shutdown Margin requirements would be redundant.

b. Tables 2.2-1 and 3.3-1

Item B.2 of Table 2.2-1 specifies a trip setpoint for the logarithmic power level high trip of less than or equal to 0.798% of rated thermal power and an allowable value of less than or equal to 0.815% of rated thermal power. The logarithmic power level trip provides protection in the event of an inadvertent CEA bank withdrawal from Modes 2 and 3 with four reactor coolant pumps operating, to assure that the minimum DNBR remains above the plant safety limit of 1.231. The proposed change would revise the trip setpoint and allowable value to 0.010% and 0.011% of rated thermal power, respectively, in support of the proposed revisions to the Shutdown Margin requirements. The results of an evaluation of an inadvertent CEA bank withdrawal with the proposed changes have shown that the core does not exceed its safety limits in terms of DNBR and local power density.

Table notation (c) for Table 3.3-1 and Table notation (5) for Table 2.2-1 state that core protection calculator (CPC) trips may be manually bypassed below 1% of rated thermal power and the bypass shall automatically be removed when thermal power is greater than or equal to 1% of rated thermal power. The proposed changes would revise the value at which the CPC trip may be manually bypassed, and at which the manual bypass is automatically removed, from 1% of rated thermal power to $10^{-4}$% of rated thermal power. This proposed change also provides added protection for an inadvertent CEA bank withdrawal from Modes 3, 4, or 5 with less than four reactor coolant pumps operating.

c. Number of Charging Pumps in Operation in Mode 5

The LCO for Specification 3.1.2.3 currently requires that only one charging pump shall be operating whenever the reactor coolant level is below the bottom of the pressurizer in Mode 5. The proposed change to Specification 3.1.2.3 would remove this restriction.

Tables 3.1-1 through 3.1-5 in Specification 3.1.2.7 specify the monitoring frequencies for backup boron dilution detection whenever the boron dilution alarm is inoperable. The proposed changes to these Tables would include the following:

(1) redefine the operational mode conditions for Modes 4 and 5 according to whether or not the Shutdown Cooling System is being used,

(2) permit operation of more than one charging pump in Mode 5 whenever $k_{eff}$ is below 0.98, and

(3) remove the requirements for Mode 6 whenever $k_{eff}$ is above 0.95, since the definition of Mode 6 is a $k_{eff}$ of less than 0.95.

In support of the above proposed changes, the licensees have reevaluated the inadvertent boron dilution event, with and without the boron dilution alarm available. Standard Review Plan (SRP) Section 15.4.6 states that for such an event, a minimum of 15 minutes must be available between the time when an alarm announces an unplanned dilution and the time of loss of Shutdown Margin. The results of the licensees' reanalysis indicate that for an unplanned boron dilution from the most limiting conditions, i.e., operating three charging pumps while in Mode 5 with the reactor coolant system drained down, the time to a complete loss of shutdown margin would be 52 minutes. Therefore, there is more than the required 15 minutes available for an alarm to alert the operator before a complete loss of Shutdown Margin would occur.

In the event that the boration dilution alarm is inoperable, the results of the reanalysis have also shown that by monitoring the reactor coolant system boron concentration at the frequencies shown in revised Tables 3.1-1 through 3.1-5, the operators would have more than the required 15 minutes to take the necessary actions to mitigate the event. In the case of the most limiting event discussed above, the proposed monitoring frequency of 0.5 hours shown in Table 3.1-5 for three charging pumps operating would allow at least 22 minutes for the operators to take appropriate action.

d. Special Test Exceptions 3.10.9 and 3.10.1

The licensees have proposed a new special test exception (Specification 3.10.9) to allow the suspension of the proposed Shutdown Margin requirements of Specifications 3.1.1.1 and 3.1.1.2 during the pre-startup tests to demonstrate the operability of the control element drive mechanism system (CEDMS). Since testing is performed by withdrawing a single CEA, the proposed Shutdown Margin requirements of Specification 3.1.1.1 would not be applicable since they would apply only when all CEAs are fully inserted. Also, the proposed requirements of Specification 3.1.1.2 are too restrictive for this case since they would require sufficient boration to account for a fully withdrawn maximum worth CEA.

The proposed Specification 3.10.9 would allow only one CEA to be withdrawn at any time (LCO 3.10.9.a), and by no more than seven inches (LCO 3.10.9.b). Since all CEAs during the CEDMS testing are essentially fully inserted except the one being tested (which is withdrawn no more than seven inches), $K_{N-1}$ would be equivalent to the Shutdown Margin in terms of minimum acceptable boron concentration. Therefore, proposed LCO 3.10.9.c, which would require that the $K_{N-1}$ proposed criterion of Specification 3.1.1.2 be met prior to the start of CEDMS testing, would ensure that sufficient subcriticality is maintained to preclude inadvertent criticality in the event of a CEA ejection accident. In addition, the reduction of the logarithmic power high level trip setpoint discussed in Section 2(b) above would ensure that the consequences of an uncontrolled CEA withdrawal are bounded by the reference cycle analysis. Furthermore, LCO 3.10.9.d would require suspension of all other operations involving positive reactivity changes.

Specification 3.10.1, which involves a special test exception for measuring CEA worth and Shutdown Margin, currently requires that a reactivity equivalent to at least the highest estimated CEA worth be available for trip insertion when the Shutdown Margin requirement of Technical Specification 3.1.1.1 is suspended for measurement of CEA worth and Shutdown Margin during physics tests. Boration is required when this requirement is not met. To account for the proposed Shutdown Margin requirements of Specification 3.1.1.2, the proposed change to Specification 3.10.1 states that the Shutdown Margin and $K_{N-1}$ requirements of Specification 3.1.1.2 may also be suspended, provided that reactivity equivalent to at least the highest estimated CEA worth is available for trip insertion from operable CEAs or the reactor is subcritical by at least the reactivity equivalent of the highest worth CEA.

e. Administrative Changes

In support of the above proposed changes to the Technical Specifications, the following additional administrative changes have also been proposed.

(1) revisions to the bases sections to be consistent with the proposed changes,

(2) renumbering of the Specification for the Special Test Exception for Natural Circulation Testing from 3.10.9 to 3.10.10 (Unit 1 only), and

(3) revisions to the Table of Contents to be consistent with the proposed changes.

## 3.0 EVALUATION

The staff has evaluated the licensees' proposed changes to the Technical Specifications. As a result of that evaluation, the staff has made the following determinations.

a. The results of the licensees' reanalysis of the limiting steam line break accidents with the proposed changes to Specifications 3.1.1.1 and 3.1.1.2, demonstrate that the DNBR remains well above the plant safety limit of 1.231.

b. The results of licensees' reanalysis of an inadvertent CEA bank withdrawal with the proposed changes to Specifications 3.1.1.1 and 3.1.1.2, and Tables 2.2-1 and 3.3-1, demonstrate that the core does not exceed its safety limits in terms of DNBR and local power density.

c. The results of the licensees' reanalysis of the limiting inadvertent boron dilution event with the proposed changes to Specifications 3.1.1.1 and 3.1.2.3, and Tables 3.1-1 through 3.1-5, demonstrate that there would be more than the required 15 minutes available to alert the operator before a complete loss of Shutdown Margin would occur.

   With regard to the proposed change in Specification 3.1.2.3, the staff has also reviewed the overpressure protection for the reactor coolant pressure boundary during low temperature operation of the plant (i.e. during startup and shutdown) which is provided by the shutdown cooling system relief valves. These were sized based on an inadvertent safety injection actuation signal (SIAS) with full pressurizer heaters operating from a water-solid condition. The SIAS assumed simultaneous operation of the two high pressure safety injection pumps and three charging pumps with letdown isolated. Therefore, the allowance of more than one operable charging pump is also consistent with the assumptions used in the postulated mass addition event which was analyzed to support the low temperature overpressure protection (LTOP) system.

d. The LCOs for the proposed new special test exception (Specification 3.10.9), to permit pre-startup testing of the CEDMS to demonstrate operability, would ensure that sufficient subcriticality is maintained to preclude inadvertent criticality in the event of a CEA injection accident.

e. The remaining proposed changes are all administrative in nature and are being made in support of the other proposed changes (e.g., changes in the bases sections) or as a result of those changes (e.g., changes in the Table of Contents).

Based on the above evaluation, the staff concludes that the proposed changes to the Technical Specifications are acceptable.

## 4.0 CONTACT WITH STATE OFFICIAL

The Arizona Radiation Regulatory Agency has been advised of the proposed determination of no significant hazards consideration with regard to these changes. No comments were received.

## 5.0 ENVIRONMENTAL CONSIDERATIONS

These amendments involve changes in the installation or use of facility components located within the restricted area as defined in 10 CFR 20. The staff has 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 proposed findings that the amendments involve no significant hazards consideration, and there has been no public comment on such findings. Accordingly, the 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 to be prepared in connection with the issuance of these amendments.

## 6.0 CONCLUSION

The staff has 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, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of these amendments will not be inimical to the common defense and security or to the health and safety of the public. We, therefore, conclude that the proposed changes are acceptable.

Principal Contributor: L. Kopp

Dated: October 9, 1987