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AUTH. NAME AUTHOR AFFILIATION
HAYNES, J. G. Arizona Nuclear Power Project (formerly Arizona Public Serv
RECIP. NAME RECIPIENT AFFILIATION
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SUBJECT: Forwards proposed Tech Spec change re table notation (8) of Tech Spec Table 2.2-1 to provide lower limit to rate at which variable overpower trip setpoint decreases as reactor power decreased.

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Arizona Nuclear Power Project
P.O. BOX 52034 • PHOENIX, ARIZONA 85072-2034

May 4, 1987
161-00182-JGH/BJA

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2 and 3
Docket Nos. STN 50-528 (License No. NPF-41)
STN 50-529 (License No. NPF-51)
STN 50-530 (License No. NPF-65)
Proposed Technical Specification Change - Variable Overpower Trip Function
File: 87-A-056-026; 87-F-005-419.05

Dear Sirs:

The purpose of this letter is to request a change to the PVNGS Units 1, 2 and 3 Technical Specifications. Specifically, the proposed change revises Table Notation (8) of Technical Specification Table 2.2-1 to provide a lower limit to the rate at which the variable overpower trip setpoint can decrease as reactor power is decreasing. This proposed change is in accordance with the PVNGS safety analyses and will help to prevent unnecessary reactor trips during reactor power cutback events at PVNGS.

Enclosed within this change request package are the following:

A. Description of the Proposed Change.
B. Purpose of the Technical Specification.
C. Need for the Technical Specification Amendment.
D. Basis for No Significant Hazards Consideration.
E. Safety Evaluation for the Proposed Change.
F. Environmental Impact Consideration Determination.
G. Marked-up Technical Specification Change Pages.

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Pursuant to the requirements of 10CFR50.91(b)(1), and by copy of this letter, we have notified the Arizona Radiation Regulatory Agency of this request for a Technical Specification change. In accordance with the requirements of 10CFR170.12(C), the license amendment application fee of $150.00 has been forwarded to the USNRC Licensee Fee Management Coordinator.

Very truly yours,

J. G. Haynes
Vice President
Nuclear Production

JGH/BJA/ls
Attachment

cc: O. M. De Michele (all w/a)
E. E. Van Brunt, Jr.
G. W. Knighton
E. A. Licitra
R. P. Zimmerman
J. B. Martin
Director - ARRA
A. C. Gehr
R. M. Diggs (with WFD $150)

ATTACHMENT

A. DESCRIPTION OF THE PROPOSED CHANGE

The existing Table Notation (8) of Technical Specification Table 2.2-1 states that there are no restrictions on the rate at which the variable overpower trip setpoint can decrease (as reactor power decreases). This proposed change to the PVNGS Units 1, 2 and 3 Technical Specifications revises Table Notation (8) of Table 2.2-1 to provide a lower limit of 5% per second for the rate at which the variable overpower trip setpoint is decreased as reactor power decreases. The proposed change constitutes an additional limitation for the variable overpower trip and the limitation is in accordance with the safety analyses. Additionally, clarification is being added to the definition of band which is presented in Table Notation (8). The definition of band for Variable Overpower Trip (VOPT) is being changed to: "BAND is the amount by which the trip setpoint is above the steady state input signal unless limited by the rate or the ceiling." The words "steady state" were inserted to provide additional clarification of the fact that during reactor power increases, the VOPT trip setpoint may be limited by the fixed ceiling (currently set at $\leq$ 110% of rated thermal power) or the rate of increase (currently set at $\leq$ 10.6% of rated thermal power per minute) and during power decreases the setpoint is not reset to the instantaneous input signal (proposed reset rate is no slower than 5% per second).

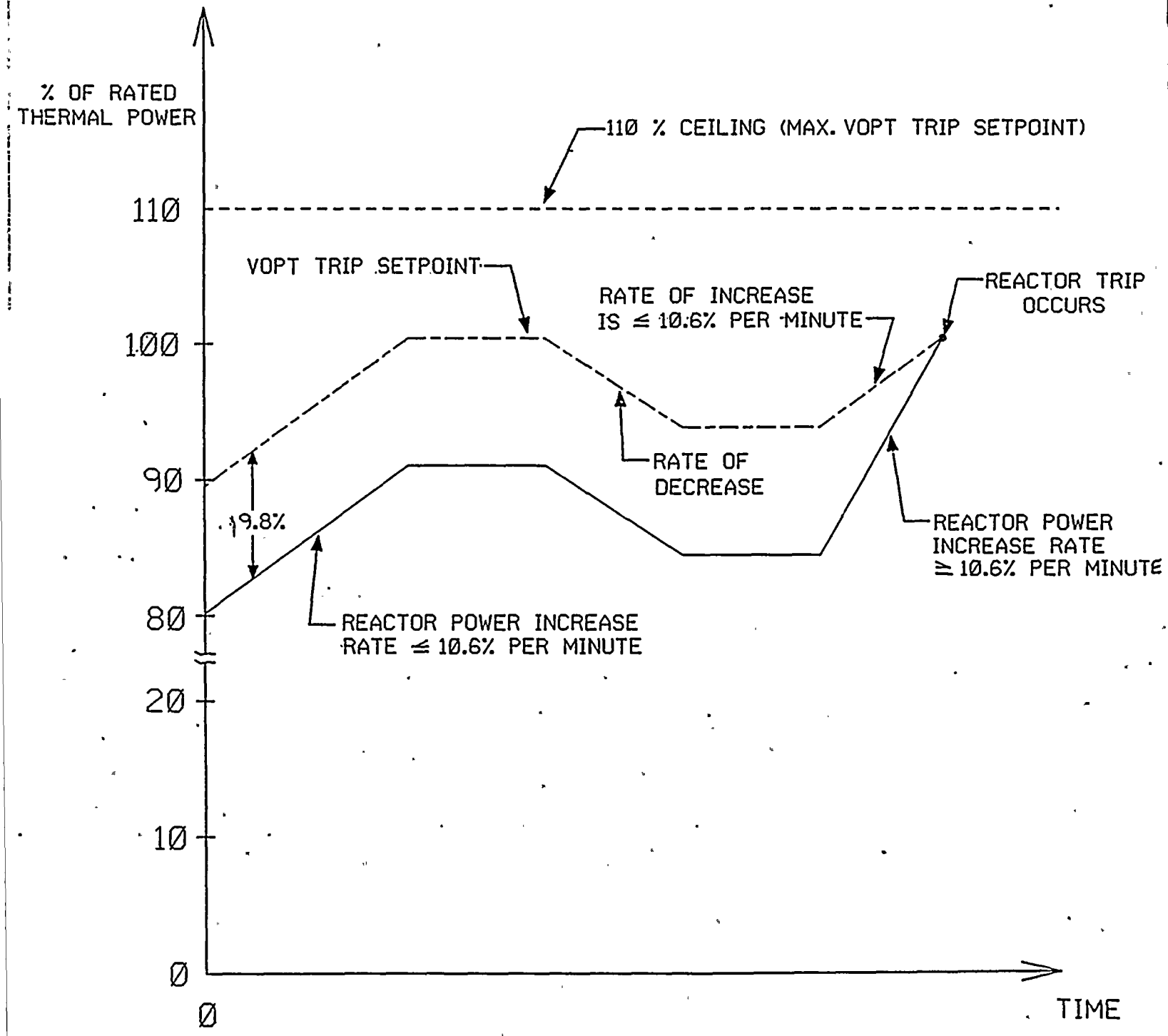
B. PURPOSE OF THE TECHNICAL SPECIFICATION

As stated in Technical Specification bases section 2.2-1, the VOPT is provided to protect the reactor core during rapid positive reactivity excursion events such as during Control Element Assembly (CEA) ejection accidents. A VOPT trip will be received when the measured neutron flux power exceeds a variable trip setpoint.

The behavior of the VOPT trip function is shown in Figure 1. The first part (beginning at time = 0) of Figure 1 shows the behavior of the VOPT trip setpoint during normal reactor power increases where the rate of power increase is less than or equal to 10.6% of Rated Thermal Power (RTP) per minute. For this case, the VOPT trip setpoint increases as reactor power increases while maintaining the band of 9.8% RTP between the trip setpoint and actual reactor power. For the second case, where reactor power is decreasing, the VOPT trip setpoint will track the reactor power downward while maintaining the band of 9.8% RTP. The rate of decrease of the VOPT trip setpoint will be limited to no slower than 5% RTP per second upon approval of this proposed Technical Specification change (currently there are no limits on the rate of decrease). For the third case of Figure 1, where reactor power is rapidly increasing at a rate greater than 10.6% RTP per minute, the reactor power is increasing faster than the VOPT trip setpoint is allowed to increase. This situation will eventually lead to a reactor trip as the reactor power either: i) exceeds the variable trip setpoint (as shown in Figure 1), or ii) exceeds the 110% RTP ceiling setpoint.

FIGURE 1

OPERATION OF THE VOPT REACTOR TRIP



C. NEED FOR THE TECHNICAL SPECIFICATION AMENDMENT

The PVNGS design includes a Reactor Power Cutback System (RPCS) whose function is to eliminate the power unbalance caused by a large loss of load or by a loss of one of the two main feedwater pumps without causing a reactor trip. The RPCS accomplishes this function by producing a step reduction in reactor power by dropping pre-selected CEA groups and by initiating a turbine setback (if needed). The RPCS function of producing a step reduction in reactor power without a reactor trip can not be satisfied at this time in the PVNGS Unit 1 core life. The reason for this is due to the negative Moderator Temperature Coefficient (MTC) which causes an increase in reactor power following the RPCS actuation as shown in Figure 2. As shown in Figure 2, the VOPT trip setpoint will follow actual reactor power closely during the power decrease due to the fact that the VOPT trip setpoint can currently decrease at a rate of 195% RTP per second. Thus, when the reactor power increases (due to negative MTC) following the RPCS actuation, a reactor trip signal is initiated due to the VOPT trip.

In order to avoid reactor trips during RPCS actuations, it is proposed that the VOPT trip function be modified to limit the rate at which the trip setpoint can decrease in response to decreasing reactor power. If the rate of decrease is set at 5% RTP per second, the results will be as shown on Figure 2. For this case, the VOPT trip setpoint remains above the reactor power following a RPCS actuation and no reactor trip signal is received.

D. BASIS FOR NO SIGNIFICANT HAZARDS CONSIDERATION

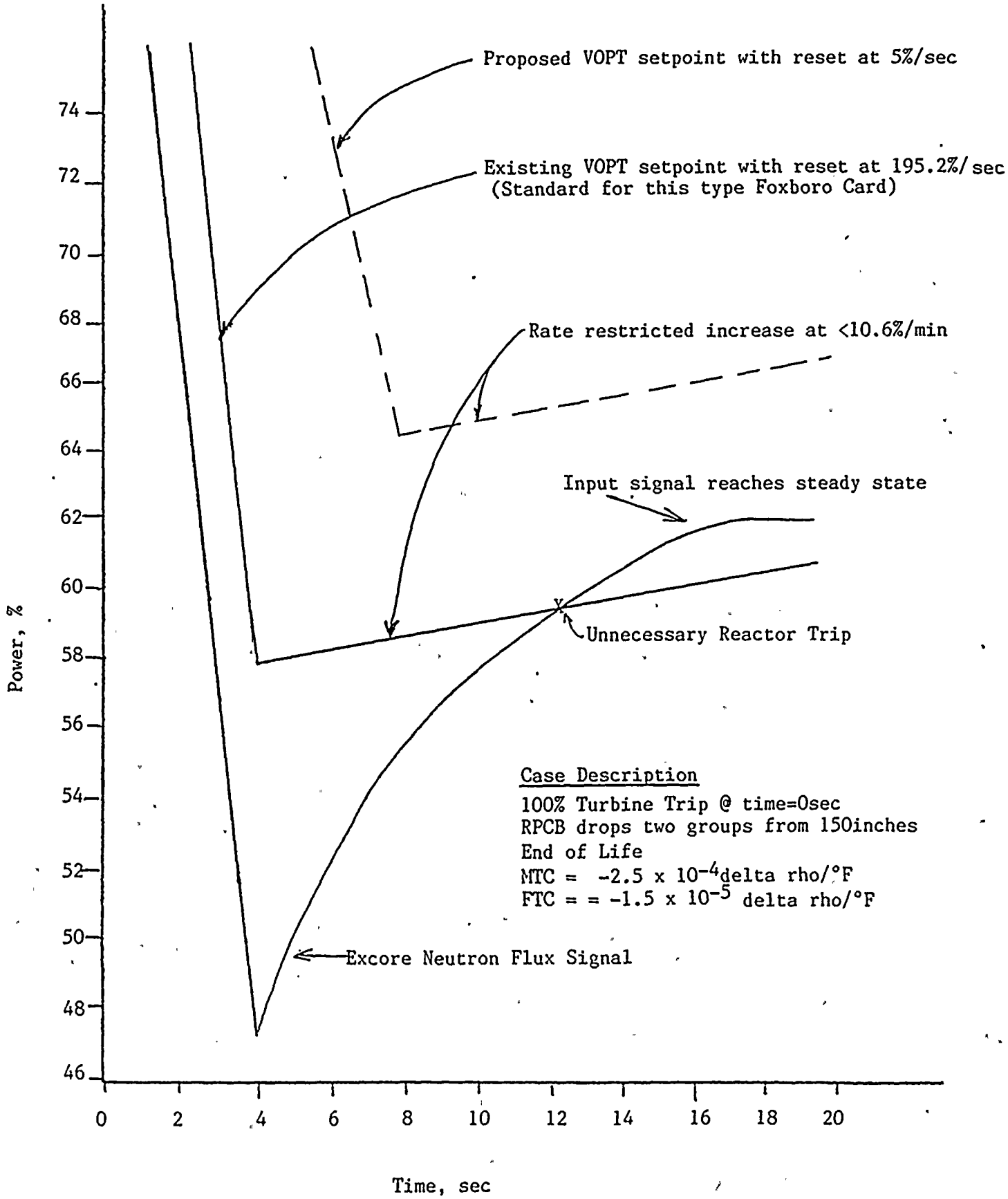
1. The Commission has provided standards for determining whether a significant hazards consideration exists as stated in 10CFR50.92. A proposed amendment to an operating license for a facility involves a no significant hazards consideration if operation of the facility in accordance with a proposed amendment would not: (1) involve a significant increase in the probability or consequences of an accident previously evaluated; or (2) create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) involve a significant reduction in a margin of safety. A discussion of these standards as they relate to the amendment request follows:

   Standard 1--Involve a significant increase in the probability or consequences of an accident previously evaluated.

   Basis = The VOPT reactor trip is credited for providing a reactor trip for several design basis events at PVNGS. Among the events that credit the VOPT as the primary trip are the CEA ejection events and the CEA withdrawal from low power event. Additionally, the VOPT reactor trip is a backup trip for feedwater line break events. The CEA ejection, CEA withdrawal and feedwater line break events are, in all cases, initiated from steady-state conditions and these events all involve an increase in reactor power from this steady-state condition. Therefore, the rate of decrease of the VOPT trip setpoint is not relevant to any of these events.

   The NSSS vendor has also analyzed an additional event that is characterized as a reactor power cutback actuation along with a failure of

FIGURE 2


Proposed VOPT setpoint with reset at 5%/sec
Existing VOPT setpoint with reset at 195.2%/sec
(Standard for this type Foxboro Card)
Rate restricted increase at <10.6%/min
Input signal reaches steady state
Unnecessary Reactor Trip
Case Description
100% Turbine Trip @ time=0sec
RPCB drops two groups from 150inches
End of Life
MTC = -2.5 x 10-4delta rho/°F
FTC = = -1.5 x 10-5 delta rho/°F
Excore Neutron Flux Signal
Power, %
74
72
70
68
66
64
62
60
58
56
54
52
50
48
46
0
2
4
6
8
10
12
14
16
18
20
Time, sec

the turbine to setback. Thus, the analysis assumes that the reactor power is decreased by the RPCS actuation but the turbine remains at the higher power level. The large mismatch between reactor power and secondary power results in a rapid reactor power increase which is terminated by a VOPT reactor trip. For this event, the analysis assumed that the VOPT trip setpoint could decrease at a rate of 5% RTP per second. The results of this analysis yielded acceptable results in that the minimum DNBR was 1.34 and the maximum linear heat rate was 15.6 kw/ft. Both of these values are within the safety limits for PVNGS. This event constitutes the basis for the lower limit on the VOPT trip setpoint decrease rate. Based upon the acceptable results of this abnormal reactor power cutback analysis, this proposed change to add an additional limitation to the Technical Specifications (in the form of a new limit on the decrease rate of the VOPT trip setpoint) will not increase the probability of occurrence or the consequences of an accident previously evaluated.

Standard 2—Create the possibility of a new or different kind of accident from any accident previously analyzed.

Basis = The proposed change to the Technical Specifications is an additional limitation to the downward reset rate of the VOPT trip setpoint. The addition of the words "steady state" in the definition of band given in Table Notation (8) is a clarification which is consistent with the intent of the VOPT trip function. These changes have no adverse impact on the plant operating conditions or characteristics. Therefore, these proposed changes do not create the possibility of a new or different kind of accident from any accident previously analyzed.

Standard 3--Involve a significant reduction in a margin of safety.

Basis = The bases section of the Technical Specifications states that the VOPT trip function is provided to protect the reactor core in the event of a rapid positive reactivity addition excursion. The decrease rate of the VOPT trip setpoint has no effect on the CEA ejection, CEA withdrawal, or feedwater line break events since all of these events are characterized by power increases from a steady state condition. Additionally, the NSSS vendor has evaluated the case of a reactor power cutback actuation with the failure of the turbine to setback. The analysis assumed a decrease rate for the VOPT trip setpoint of no slower than 5% RTP per second and the results of this analysis were acceptable. Therefore, this proposed Technical Specification change will not involve a significant reduction in a margin of safety.

2. The Commission has provided guidance concerning the application of the standards for determining whether a significant hazards consideration exists by providing certain examples (51FR7751) of amendments that are considered least likely to involve a significant hazards consideration. This proposed amendment matches example (ii) in that it is a change that constitutes an additional limitation, restriction or control not presently included in the Technical Specifications. Specifically, Table Notation (8) of Table 2.2-1 presently states that there are no restrictions on the rate at which the VOPT trip setpoint can decrease. This proposed change provides a restriction of 5% RTP per second on the rate at which the VOPT trip setpoint can decrease. The basis for this change is the reactor power cutback analysis that assumes a decrease rate of 5% RTP per second.

E. SAFETY EVALUATION FOR THE PROPOSED CHANGE

This proposed Technical Specification change will not increase the probability of occurrence or the consequences of an accident previously evaluated. This change revises Table Notation (8) of Table 2.2-1 to provide a lower limit on the rate at which the VOPT trip setpoint can decrease as reactor power decreases. The proposed change also provides additional clarification to the definition of band which is given in Table Notation (8). The VOPT reactor trip is credited as the primary trip for: (i) the CEA withdrawal when subcritical or at low power analysis (CESSAR 15.4.1), and (ii) the CEA ejection analysis (CESSAR 15.4.8). The CEA withdrawal event could be caused by a single failure in either the Reactor Regulating System or the Control Element Drive Mechanism Control System. The CEA ejection accident could be caused by a circumferential rupture of a control element drive mechanism housing or nozzle. A change to the rate at which the VOPT trip setpoint decreases does not increase the probability of occurrence of any of these initiating events.

In order to show that the consequences of the above accidents are not increased, it is first necessary to show that the VOPT trip setpoint will decrease as fast as the maximum expected rate of normal reactor power reduction. This ensures that the band between the VOPT trip setpoint and actual reactor power is no greater than 9.8% RTP at the start of the referenced accidents. Calculations have estimated the maximum rate of normal power reduction possible to be 0.22% RTP per second at End of Life (EOL) core conditions. It should be noted that a normal power reduction is assumed to use 120 gpm of charging at a boron concentration of 4000 ppm and high rate CEA insertion. The calculations show that the maximum rate of normal power reduction of 0.22% RTP per second is less than the allowable VOPT trip setpoint reduction rate of 5% RTP per second. Therefore, the band of 9.8% RTP will be maintained prior to event initiation and the consequences of the two referenced CESSAR analyses will not be increased by this proposed change.

The analysis case that establishes the acceptability of the 5% RTP per second downward reset rate is the abnormal reactor power cutback event which requires a VOPT reactor trip This event is characterized by a RPCS actuation where CEA groups 4 and 5 are dropped and the turbine fails to setback. The key assumptions which make this event limiting are the end of cycle core conditions and the minimum reactivity worth of CEA groups 4 and 5. Some of the other assumptions used in this abnormal reactor power cutback analysis are as follows:

Parameter	Value
- rated power, MWt	3817
- initial core power, MWt	3893
- coolant inlet temperature, °F	570
- RCS pressure, psia	2400
- coolant flowrate, 10^6 gpm	0.430
- axial power shape, ASI units	-0.324
- delayed neutron fraction	0.00518
- doppler coefficient	EOC
- doppler multiplier	1.15
- most negative MTC, 10^{-4}/°F	-4.1
- minimum available group worth (group 5 plus group 4),	-0.00464
- radial peaking distortion factor (group 5 plus group 4 dropped)	1.183

Figure 3 shows the response of both reactor power and the VOPT trip setpoint (assuming 5% RTP per second downward reset rate) during this abnormal reactor power cutback analysis. The sequence of events for this analysis are presented below. It should be noted that the minimum DNBR experienced during this analysis is 1.34 and the maximum linear heat rate is 15.6 kw/ft. Both of these values are acceptable because they are within the Specified Acceptable Fuel Design Limits (SAFDLs) on DNBR and linear heat rate.

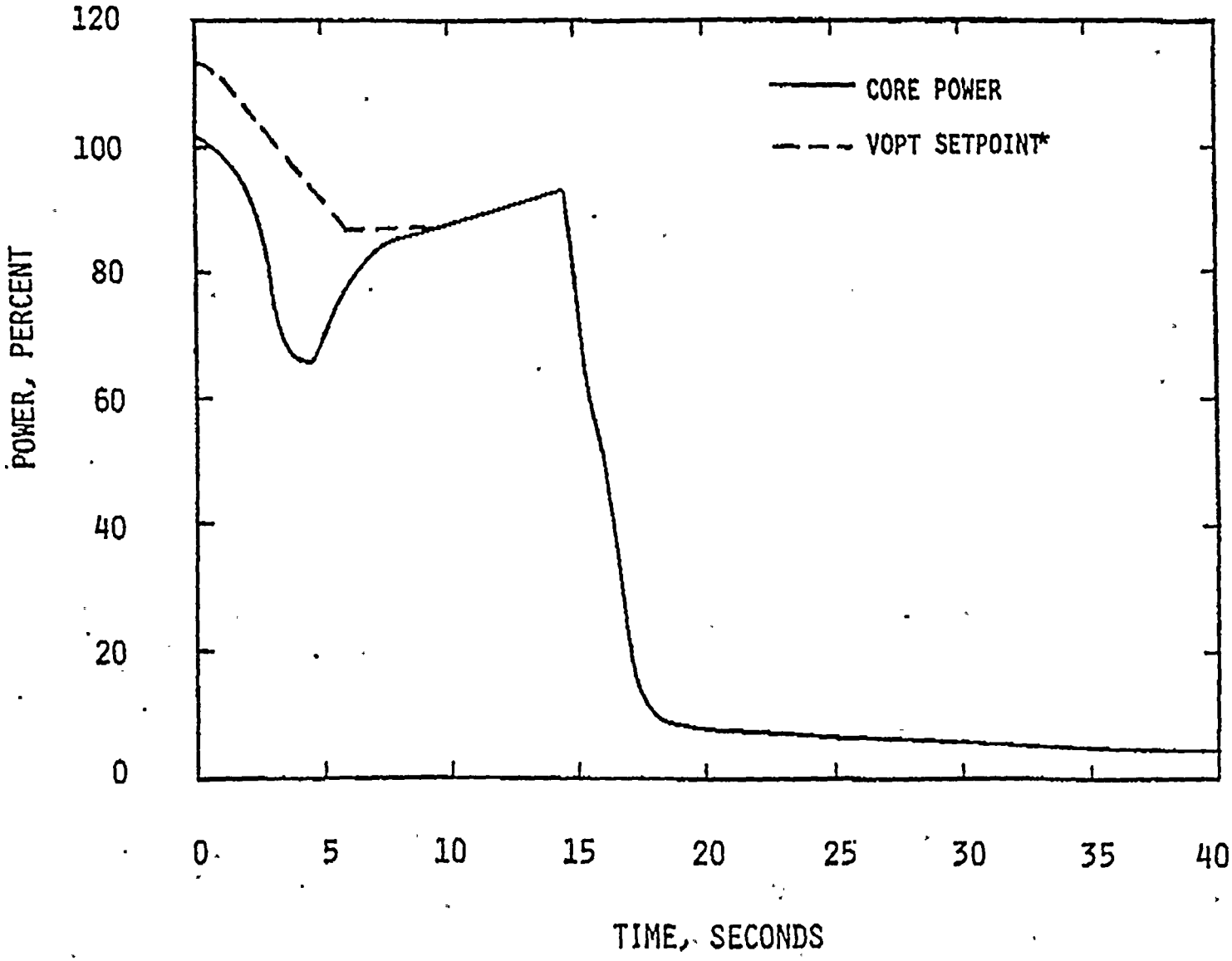
Abnormal Reactor Power Cutback Analysis
Sequence of Events

Time (seconds)	Event	Setpoint or Value
0.0	loss of feedwater pump	-
0.0 +	reactor power cutback signal generated	-
0.0 +	CEA groups 4 and 5 dropped	-
4.5	minimum reactor power	60%
13.81	assumed VOPT reactor trip condition	92.6%
14.36	trip breakers open	-
14.80	CEAs drop	-
14.8	maximum reactor power	93.8%
14.9	minimum DNBR	1.34

Since the results of this analysis are acceptable, with the assumption that the VOPT trip setpoint downward reset rate is 5% RTP per second, this proposed Technical Specification change will not increase the consequences of the previously evaluated accidents.

This proposed Technical Specification change will not create the possibility of a new or different kind of accident from any accident previously evaluated. The allowable plant operating conditions, as defined by the safety analyses that credit a VOPT reactor trip and the abnormal reactor power cutback analysis, are not changed by this proposed Technical Specification change.

FIGURE 3



* Note Trip assumed to occur later than that indicated by the intersection of the VOPT setpoint and calculated core power.

This proposed Technical Specification change will not reduce the margin of safety. The proposed change involves the addition of a limitation to the downward reset rate of the VOPT trip setpoint. This limitation is supported by the analysis which requires the slowest reset rate to be at least 5% RTP per second. Additionally, the addition of the words "steady state" in front of the phrase "input signal" in the band definition is a clarification which is consistent with the intent of the VOPT trip function.

F. ENVIRONMENTAL IMPACT CONSIDERATION DETERMINATION

The proposed change request does not involve an unreviewed environmental question because operation of PVNGS Units 1, 2 and 3 in accordance with this change would not:

1. Result in a significant increase in any adverse environmental impact previously evaluated in the Final Environmental Statement (FES) as modified by the staff's testimony to the Atomic Safety and Licensing Board, Supplements to the FES, Environmental Impact Appraisals, or in any decisions of the Atomic Safety and Licensing Board; or

2. Result in matters not previously reviewed in the licensing basis for PVNGS which may have a significant environmental impact.

G. MARKED-UP TECHNICAL SPECIFICATION CHANGE PAGES

Enclosed are revised page 2-6 of the PVNGS Units 1, 2 and 3 Technical Specifications.