Westinghouse Electric Corporation

Energy Systems

Nuclear and Advanced Technology Division

Box 355
Pittsburgh Pennsylvania 15230-0355

November 5, 1990
CAW-90-085

Document Control Desk
US Nuclear Regulatory Commission
Washington, DC 20555

Attention: Dr. Thomas Murley, Director

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: WCAP-12632, Rev 1 "RTD Bypass Elimination Licensing Report for Turkey Point Units 3 and 4" (Proprietary)

Dear Dr. Murley:

The proprietary information for which withholding is being requested in the enclosed letter by Florida Power and Light Company is further identified in Affidavit CAW-90-085 signed by the owner of the proprietary information, Westinghouse Electric Corporation. The affidavit, which accompanies this letter, sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of 10CFR Section 2.790 of the Commission's regulations.

Accordingly, this letter authorizes the utilization of the accompanying Affidavit by Florida Power and Light Company.

Correspondence with respect to the proprietary aspects of the application for withholding or the Westinghouse affidavit should reference this letter, CAW-90-085, and should be addressed to the undersigned.

Very truly yours,

for

Robert A. Wiesemann, Manager
Regulatory & Legislative Affairs

Enclosures

cc: C. M. Holzle, Esq.
Office of the General Counsel, NRC

V. Wilson, Nuclear Reactor Regulation

CAW-90-085

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF ALLEGHENY:

Before me, the undersigned authority, personally appeared Robert A. Wiesemann, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Corporation ("Westinghouse") and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

Robert A. Wiesemann

Robert A. Wiesemann, Manager
Regulatory and Legislative Affairs

Sworn to and subscribed
before me this 5 day
of November, 1990.

Paulette Demsher

Notary Public

Notarial Seal
My Commission Expires March 10, 1994
Member, Pennsylvania Association of Notaries

(1) I am Manager, Regulatory and Legislative Affairs, in the Nuclear and Advanced Technology Division, of the Westinghouse Electric Corporation and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rulemaking proceedings, and am authorized to apply for its withholding on behalf of the Westinghouse Energy Systems Business Unit.

(2) I am making this Affidavit in conformance with the provisions of 10CFR Section 2.790 of the Commission's regulations and in conjunction with the Westinghouse application for withholding accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by the Westinghouse Energy Systems Business Unit in designating information as a trade secret, privileged or as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.790 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

(g) It is not the property of Westinghouse, but must be treated as proprietary by Westinghouse according to agreements with the owner.

There are sound policy reasons behind the Westinghouse system which include the following:

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

(b) It is information which is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10CFR Section 2.790, it is to be received in confidence by the Commission.

(iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in "RTD Bypass Elimination Licensing Report for Turkey Point Units 3 and 4", WCAP-12632, (Proprietary) for Turkey Point Units 3 and 4, being transmitted by the Florida Power and Light Company (FPL) letter and Application for Withholding Proprietary Information from Public Disclosure, J. Goldberg, FPL, to Document Control Desk, to the Attention Dr. Thomas Murley, Director, Office of NRC, July, 1990. The proprietary information as submitted for use by Florida Power and Light Company for the Turkey Point Units 3 and 4 is expected to be applicable in other licensee submittals in response to certain NRC requirements for justification of actions to remove the existing Resistance Temperature Detector (RTD) Bypass Elimination system and replace with fast response thermowell mounted RTD's in the reactor coolant loop piping.

This information is part or that which will enable Westinghouse to:

(a) Provide documentation of the analyses, methods, and testing for reaching a conclusion relative to the removal of existing Resistance Temperature Detector (RTD) Bypass system and the replacement of fast response thermowell mounted RTD's.

(b) Support the continued validity of Loss-of-Coolant Accident (LOCA) and non-LOCA safety analysis initial condition assumptions.

(c) Establish the effects of the fast response thermowell RTD system on instrumentation and Reactor Coolant uncertainties.

(d) Assist the customer to obtain NRC approval for operation with RTD Bypass Elimination.

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to sell the use of similar information to its customers for purposes of satisfying NRC requirements for licensing documentation.

(b) Westinghouse can sell support and defense of the RTD Bypass Elimination technology to its customers in the licensing process.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar analytical documentation and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended for developing testing and analytical methods and performing tests.

Further the deponent sayeth not.

Westinghouse Electric Corporation

Energy Systems

Nuclear and Advanced Technology Division

Box 355
Pittsburgh Pennsylvania 15230-0355

May 2, 1990
FPL-90-606
NS-OPLS-OPL-II-90-338

Mr. S. T. Hale
Engineering Project Manager
Florida Power & Light Company
P. O. Box 14000
700 Universe Blvd
Juno Beach, Florida 33408

Attention: Mr. R. L. Wade

FLORIDA POWER & LIGHT COMPANY
TURKEY POINT UNITS 3 & 4
Safety Evaluations for Overpower ΔT, Overtemperature ΔT
and Underfrequency Reactor Coolant Pump Trip

Dear Mr. Hale:

Please find the attached safety evaluations for the Overpower ΔT, Overtemperature ΔT and the Underfrequency Reactor Coolant Pump Trip. These evaluations were performed to support the current safety analysis.

With the installation of Rosemount transmitters for monitoring pressurizer pressure, the Containment High-1 channel has been utilized in calculating the Pressurizer Pressure Low SI trip function. This was done in order to accommodate the large environment eerors associated with the Rosemount transmitters. The use of Containment High-1 is inconsistent with standard Westinghouse design practices.

Westinghouse is currently investigation an internal recommendation with reqards to utilization of protection channels for accident mitigation which do not directly measure the parameter of interest (i. e. taking credit for Containment high - 1 for Pressurizer Pressure Low SI). When the results of the investigation are available they will be forwarded.

If you have any questions, please contact the undersigned.

Very truly yours,

WESTINGHOUSE ELECTRIC CORPORATION

for/ J. J. DeBlasio

D. J. Richards, Manager
Florida Power & Light Project

SECL NO. 89-1164

Customer Reference No(s).

Westinghouse Reference No(s).

WESTINGHOUSE NUCLEAR SAFETY
SAFETY EVALUATION CHECK LIST

1.) NUCLEAR PLANT(S): Turkey Points Units 3 & 4

2.) SUBJECT (TITLE): Revised f(ΔI) Penalty Functions for the Overpower and Overtemperature ΔT Setpoints

3.) The written safety evaluation of the revised procedure, design change or modification required by 10CFR50.59(b) has been prepared to the extent required and is attached. If a safety evaluation is not required or is incomplete for any reason, explain on Page 2.

Parts A and B of this Safety Evaluation Check List are to be completed only on the basis of the safety evaluation performed.

CHECK LIST - PART A - 10CFR50.59(a) (1)

(3.1) Yes X No ___ A change to the plant as described in the FSAR?
(3.2) Yes ___ No X A change to procedures as described in the FSAR?
(3.3) Yes ___ No X A test or experiment not described in the FSAR?
(3.4) Yes X No ___ A change to the plant technical specifications (See Note on Page 2)

4) CHECK LIST - PART B - 10CFR50.59(a) (2) (Justification for Part B answers must be included on Page 2.)

(4.1) Yes ___ No X Will the probability of an accident previously evaluated in the FSAR be increased?
(4.2) Yes ___ No X Will the consequences of an accident previously evaluated in the FSAR be increased?
(4.3) Yes ___ No X May the possibility of an accident which is different than any already evaluated in the FSAR be created?
(4.4) Yes ___ No X Will the probability of a malfunction of equipment important to safety previously evaluated in the FSAR be increased?
(4.5) Yes ___ No X Will the consequences of a malfunction of equipment important to safety previously evaluated in the FSAR be increased?
(4.6) Yes ___ No X May the possibility of a malfunction of equipment important to safety different than any already evaluated in the FSAR be created?
(4.7) Yes ___ No X Will the margin of safety as defined in the bases to any technical specification be reduced?

NOTES:

If the answers to any of the above questions are unknown, indicated under 5.) REMARKS and explain below.

If the answer to any of the above questions in Part A (3.4) or Part B cannot be answered in the negative, based on written safety evaluation, the change review would require an application for license amendment as required by 10CFR50.59(c) and submitted to the NRC pursuant to 10CFR50.90.

5.) REMARKS:

The following summarizes the justification upon the written safety evaluation (1) for answers given in Part A (3.4) and Part B of this SECL

The effect of eliminating the f(ΔI) penalty function for the Overpower ΔT reactor trip has been evaluated based on the current CAOC band for the Turkey Point units. The evaluation considered the effect of the penalty function elimination on Condition II accidents. It was confirmed that the resulting overpower conditions did not yield a linear power density that would contribute to fuel centerline melting. FSAR and Technical Specification changes required to implement this change are included.

(1)Reference to document(s) containing written safety evaluation:

FOR FSAR UPDATE

Section: 14.1.2 Page(s): 14.1.2-1 Table(s): None Figure(s): None

Reason for/Description of Change:

In performing the Turkey Point Setpoint study it was determined that the overpower and overtemperature reactor trip setpoints could not be supported by the current safety analysis. In order to reduce the channel uncertainties, an evaluation was performed justifying the elimination of the f(ΔI) penalty function for the overpower ΔT setpoint and reduction of the slope of the f(ΔI) for the overtemperature ΔT setpoint.

SAFETY EVALUATION APPROVAL LADDER:

Prepared by (Nuclear Safety): John J DeBlasio Date: 4/30/90

Coordinated with Engineer(s): ______ Date: ______

Coordinating Group Manager(s): ______ Date: ______

Nuclear Safety Group Manager: R W Orr for SDR Date: 5/1/90

Turkey Point Units 3 & 4

Safety Evaluation Supporting Revised f(ΔI) Penalty Functions for the Overpower and Overtemperature ΔT Reactor Trip Setpoints

1.0 Background

In performing the Turkey Point setpoint study it was determined that the uncertainty allowances between the safety analysis and nominal values of the overpower ΔT (OPΔT) and overtemperature ΔT (OTΔT) reactor trip setpoints were insufficient. The purpose of the overpower and overtemperature protection system is to define a region of permissible core operation in terms of power, temperature, reactor coolant system (RCS) pressure, and axial power shape; and to trip the reactor automatically when the limits of this region are approached. This region of permissible operation is defined by three boundaries: the thermal overpower limit, the thermal overtemperature limit, and the locus of conditions where the steam generator safety valves are open. The thermal overpower limit protects the core against excessive fuel centerline temperature, which could cause fuel melt. The thermal overtemperature limits protect the core against DNB and hot leg boiling. This safety evaluation describes the evaluation performed to justify the relaxation of the slope of the f(ΔI) penalty function for the OTΔT trip and elimination of the f(ΔI) penalty function for the OPΔT trip. A detailed description of the design basis for the OPΔT and OTΔT trip functions can be found in WCAP-8746.

2.0 Non-LOCA Analysis

Overpower ΔT

The OPΔT reactor trip is designed to ensure operation within the fuel temperature design basis. Experience has shown that this can be accomplished by preventing the core average power from exceeding a prescribed limit of 118% of nominal power. This is achieved via the OPΔT trip by correlating core thermal power with the coolant temperature difference across the vessel. Since the prescribed overpower limit may not be adequate for highly skewed axial power distributions, a penalty function that lowers the setpoint is factored into the OPΔT trip channels. This term is a function of the axial flux difference, ΔI, and is known as the f(ΔI) penalty function. If it can be demonstrated that the peak linear heat generation remains below the design limit during ANS Condition II overpower events without penalizing the overpower setpoint, the f(ΔI) penalty function for the OPΔT setpoint is not necessary and can be eliminated.

An evaluation of analyses previously performed was conducted to support elimination of the f(ΔI) function based on the current constant axial offset control (CAOC) strategy used at the Turkey Point units. The evaluation examined Condition II overpower transients that could produce potentially limiting linear heat generation rates. These events were analyzed with the assumption that the OPΔT trip setpoint (without f(ΔI)) provides a reactor trip at 118% of the nominal full power. The events considered were:

control bank malfunction, core cooldown, and boration/dilution system malfunctions. These limiting transients are analyzed to determine the core power level and power distribution using static nuclear core models.

An analysis was performed showing that a heat generation rate of less than 22 kw/ft does not violate the fuel centerline temperature design basis for any of the fuel types used in the Turkey Point core. The linear heat generation rates from the limiting transients noted above were compared to the 22 kw/ft value, confirming that the overpower conditions did not yield any linear power densities that would violate the fuel centerline design basis. Therefore, the $f(\Delta I)$ function can be eliminated in the OPΔT setpoint with no adverse effect on core protection.

Overtemperature ΔT

The thermal overtemperature trip is designed to ensure plant operation within the DNB design basis and the hot-leg boiling limit. Since both of these limits are functions of coolant temperature and pressure as well as core thermal power, the OTΔT trip is correlated with the core ΔT, vessel average temperature and primary system pressure. This is accomplished in the following manner. First the core DNB limits are determined for a range of reactor operating conditions. The core DNB limits are represented as the locus of points of core thermal power, primary system pressure and coolant inlet temperature that define a DNBR at the DNBR limit. These conditions are calculated assuming a reference axial power shape characterized by a chopped cosine with a peak to average ratio of 1.55. Similar to the OPΔT reactor trip, a compensating term which is a function of ΔI is factored into the OTΔT trip setting to offset the effects of core axial power distributions more severe than the reference power shape on DNB. Essentially the $f(\Delta I)$ penalty function allows the power distribution effects to be separated from the core-wide parameters.

The $f(\Delta I)$ function for the OTΔT setpoint is determined in the following way. For each of a set of five standard asymmetric axial power distributions and core inlet temperatures, the power level that results in DNBR at the limit value is determined by the THINC computer code. The standard asymmetric axial power distributions are calculated in a fashion that bounds all ANS condition I and II DNB events. A $f(\Delta I)$ penalty function is calculated that will ensure the OTΔT setpoint is reached before limiting core power, pressure and power conditions are reached. Note that certain constraints limit the range over which the core DNB limits must apply. The OPΔT reactor trip places a limit on the maximum power level that needs to be considered, the high and low pressurizer reactor trip limits the pressure range that needs to be considered and the steam generator safety valves place a physical upper limit on the coolant temperature that needs to considered.

From this analysis it was determined that an $f(\Delta I)$ penalty function slope of 1.5 on both the positive and negative wings is sufficient for core protection for Turkey Point Units 3 and 4. This is less restrictive than the current Technical Specification slope of 2.0 on the negative wing and 3.5 on the positive wing.

3.0 Conclusions

An evaluation was performed to establish that the f(ΔI) penalty function can be removed for the OPΔT setpoint and that the f(ΔI) penalty function slope can be revised and relaxed to 1.5 for the OTΔT setpoint without compromising core protection. This evaluation is applicable to reactor cores containing standard (LOPAR), optimized (OFA), or debris resistant fuel (DRFA) assemblies for both Turkey Point Units 3 and 4. Note that these conclusions will be reconfirmed on a cycle specific basis for future fuel reloads as part of the normal reload design process. Justification for the answers provided in section 4 of the Safety Evaluation Checklist are addressed below.

1. **Will the probability of an accident previously evaluated in the FSAR be increased?**

   The OPΔT and OTΔT reactor trips protect the core from fuel centerline melting and DNB during ANS Condition I and II events. The particular values of the setpoints do not affect the probability that an event will occur.

2. **Will the consequences of an accident previously evaluated in the FSAR be increased?**

   Elimination of the f(ΔI) penalty function for the OPΔT setpoint does not increase the consequences of any accident previously analyzed in the FSAR. An evaluation was performed that demonstrated that none of the non-LOCA transients require the f(ΔI) penalty function of the OPΔT reactor trip for mitigation. The evaluation established that the OPΔT reactor trip continues to prevent the fuel centerline melting design basis from being violated.

   A separate evaluation established that the proposed reduction in the slope of the f(ΔI) penalty function for the OTΔT setpoint does not increase the consequences of any accident previously analyzed the FSAR. The OTΔT setpoint continues to trip the reactor core before an operating condition that would violate the DNB design basis is reached.

3. **May the possibility of an accident which is different than any already evaluated in the FSAR be created?**

   The recommended changes in the f(ΔI) penalty function for the OPΔT and the OTΔT reactor trip setpoints will not create the possibility that a different accident than that which is already analyzed in the FSAR will occur. As stated above, the OPΔT and OTΔT reactor trips protect the core from fuel centerline melting and DNB during postulated ANS Condition I and II events. The particular value of the reactor trip setpoints do not affect the possibility that any event will occur.

4. **Will the probability of a malfunction of equipment important to safety previously evaluated in the FSAR be increased?**

   The recommended changes in the f(ΔI) penalty function will not increase the probability of a malfunction to any equipment important to safety previously analyzed in the FSAR. The reactor core relies on these trips for protection during ANS Condition I and II events. Setpoint changes do not impair the ability of the protection to perform its intended function. Analysis has shown that the reactor core remains protected for the recommended penalty function modifications. Therefore, the proposed change will have no impact on any equipment important to safety.

5. **Will the consequences of a malfunction of equipment important to safety previously evaluated in the FSAR be increased?**

   The recommended changes in the f(ΔI) penalty function for the OPΔT and the OTΔT reactor trip setpoints will not increase the consequences of any malfunction of equipment important to safety different than that which was previously evaluated in the FSAR. Analysis has shown that the reactor core is in no way impacted by the proposed changes to the setpoints. The consequences of any equipment malfunction remain the same.

6. **May the possibility of a malfunction of equipment important to safety different than any already evaluated in the FSAR be created?**

   The recommended changes in the f(ΔI) penalty function for the OPΔT and the OTΔT reactor trip setpoints will not create the possibility that a malfunction of equipment important to safety different than that previously evaluated in the FSAR will be created. As stated above, the reactor core relies on the OPΔT and OTΔT reactor trips for protection during ANS Condition I and II events. Analysis has shown that the reactor core remains protected with the proposed changes. Therefore, the proposed changes will have no impact on any equipment important to safety.

7. **Will the margin of safety as defined in the bases to any technical specification be reduced?**

   The OPΔT and OTΔT reactor trips are designed to ensure reactor operation within the DNB and fuel centerline melting design basis. The analyses described above demonstrate that with the recommended changes to the f(ΔI) penalty function the DNB and fuel centerline design bases continue to be met. No margin of safety is reduced.

Attachment 1 Technical Specification Modifications

REACTOR COOLANT TEMPERATURE

a. Overtemperature $\Delta T \leq \Delta T_o$ $(K_1 - 0.0107\ (T-574) + 0.000453\ (P-2235) - f(\Delta q))$

ΔT_o = Indicated ΔT at rated power, F

T = Average temperature, F

P = Pressurizer pressure, psig

$f(\Delta q)$ = a function of the indicated difference between top and bottom detectors of the power-range nuclear ion chambers; with gains to be selected based on measured instrument response during startup tests such that:

For $(q_t - q_b)$ within + 10 percent and -14 percent where q_t and q_b are the percent power in the top and bottom halves of the core respectively, and $q_t + q_b$ is total core power in percent of rated power, $f(\Delta q) = 0$.

For each percent that the magnitude of $(q_t - q_b)$ exceeds + 10 percent, the Delta-T trip setpoint shall be automatically reduced by ~~3.5~~ 1.5 percent of its value at interim power.

For each percent that the magnitude of $(q_t - q_b)$ exceeds -14 percent, the Delta-T trip setpoint shall be automatically reduced by ~~2~~ 7.5 percent of its value at interim power.

K_1 (Three Loop Operation) = 1.095

~~(Two Loop Operation) = 0.88~~

This amendment effective as of date of issuance for Unit 3 and date of startup, Cycle 10, for Unit 4.

TABLE 2.2-1 (Continued)

TABLE NOTATIONS (Continued)

NOTE 1: (Continued)

P' = 2235 psig (Nominal RCS operating pressure);

S = Laplace transform operator, s^{-1};

and $f(\Delta I)$ is a function of the indicated difference between top and bottom detectors of the power-range neutron ion chambers; with gains to be selected based on measured instrument response during plant startup tests such that:

(1) For $q_t - q_b$ between - 14% and + 10%, $f(\Delta I) = 0$, where q_t and q_b are percent RATED THERMAL POWER in the top and bottom halves of the core respectively, and $q_t + q_b$ is total THERMAL POWER in percent of RATED THERMAL POWER;

(2) For each percent that the magnitude of $q_t - q_b$ exceeds - 14%, the ΔT Trip Setpoint shall be automatically reduced by ~~2.0%~~ 1.5 of its value at RATED THERMAL POWER; and

(3) For each percent that the magnitude of $q_t - q_b$ exceeds + 10%, the ΔT Trip Setpoint shall be automatically reduced by ~~3.5%~~ 1.5 of its value at RATED THERMAL POWER.

NOTE 2: ~~The channel's maximum Trip Setpoint shall not exceed its computed Trip Setpoint by more than 2%~~ 1.97.

~~(This note number is not used.)~~ ReTAIN

Overpower ΔT

The Overpower ΔT trip prevents power density anywhere in the core from exceeding 118% of the design power density. This provides assurance of fuel integrity (e.g., no fuel pellet melting and less than 1% cladding strain) under all possible overpower conditions, limits the required range for Overtemperature ΔT trip, and provides a backup to the High Neutron Flux trip. The setpoint is automatically varied with: (1) coolant temperature to correct for temperature induced changes in density and heat capacity of water, (2) rate of change of temperature for dynamic compensation for piping delays from the core to the loop temperature detectors, ~~and (3) axial power distribution,~~ to ensure that the allowable heat generation rate (kW/ft) is not exceeded.

Pressurizer Pressure

In each of the pressurizer pressure channels, there are two independent bistables, each with its own trip setting to provide for a High and Low Pressure trip thus limiting the pressure range in which reactor operation is permitted. The Low Setpoint trip protects against low pressure which could lead to DNB by tripping the reactor in the event of a loss of reactor coolant pressure.

On decreasing power the Low Setpoint trip is automatically blocked by P-7 (a power level of approximately 10% of RATED THERMAL POWER with turbine first stage pressure at approximately 10% of full power equivalent); and on increasing power, automatically reinstated by P-7.

The High Setpoint trip functions in conjunction with the pressurizer safety valves to protect the Reactor Coolant System against system overpressure.

Pressurizer Water Level

The Pressurizer Water Level-High trip is provided to prevent water relief through the pressurizer safety valves. On decreasing power the Pressurizer High Water Level trip is automatically blocked by P-7 (a power level of approximately 10% of RATED THERMAL POWER with a turbine first stage pressure at approximately 10% of full power equivalent); and on increasing power, automatically reinstated by P-7.

Reactor Coolant Flow

The Reactor Coolant Flow-Low trip provides core protection to prevent DNB by mitigating the consequences of a loss of flow resulting from the loss of one or more reactor coolant pumps.

On increasing power above P-7 (a power level of approximately 10% of RATED THERMAL POWER or a turbine first stage pressure at approximately 10%

Overpower $\Delta T \leq \Delta T_0 \left[1.09 - K_1 \frac{dT}{dt} - K_2 (T - T') - f(\Delta q) \right]$

ΔT_0 = Indicated T at rated power, F

T = Average temperature, F

T' = Indicated average temperature at nominal conditions and rated power, F

K_1 = 0 for decreasing average temperature; 0.2 sec./F for increasing average temperature

K_2 = 0.00068 for T equal to or more than T'; 0 for T less than T'

$\frac{dT}{dt}$ = Rate of change of temperature, F/sec

$f(\Delta q)$ = ~~[illegible]~~ 0, for all Δq

<u>Pressurizer</u>

Low Pressurizer pressure - equal to or greater than 1835 psig.

High Pressurizer pressure - equal to or less than 2385 psig.

High Pressurizer water level - equal to or less than 92% of full scale.

<u>Reactor Coolant Flow</u>

Low reactor coolant flow - equal to or greater than 90% of normal indicated flow.

Low reactor coolant pump motor frequency equal to or greater than 56.1 Hz.

Undervoltage on reactor coolant pump motor bus - equal to or greater than 60% of normal voltage.

<u>Steam Generators</u>

Low-low steam generator water level - equal to or greater than 15% of narrow range instrument scale.

This amendment effective as of date of issuance for Unit 3 and date of startup, Cycle 10, for Unit 4.

TABLE 2.2-1 (Continued)

TABLE NOTATIONS (Continued)

NOTE 3: OVERPOWER ΔT

$$\Delta T \left(\frac{1}{(1+\tau_4 S)}\right) \le \Delta T_0 \left\{K_4 - K_5 \left(\frac{\tau_3 S}{(1+\tau_3 S)}\right)\left(\frac{1}{(1+\tau_6 S)}\right) T - K_6 \left[T \left(\frac{1}{(1+\tau_6 S)}\right) - T''\right] - f_2(\Delta I)\right\}$$

Where:

ΔT	=	As defined in Note 1.
$\frac{1}{1+\tau_4 S}$	=	As defined in Note 1.
τ_4	=	As defined in Note 1.
ΔT_0	=	As defined in Note 1.
K_4	=	1.09.
K_5	=	0.02/°F for increasing average temperature and 0 for decreasing average temperature.
$\frac{\tau_3 S}{1+\tau_3 S}$	=	The function generated by the rate-lag compensator for T_{avg} dynamic compensation.
τ_3	=	Time constants utilized in the rate-lag compensator for T_{avg}, τ_3 = 10 s.
$\frac{1}{1+\tau_6 S}$	=	As defined in Note 1.
τ_6	=	As defined in Note 1.

TABLE 2.2-1 (Continued)

TABLE NOTATIONS (Continued)

~~2:~~ NOTE [3:] (Continued)

K_6 = 0.00068/°F for $T > T''$ and $K_6 = 0$ for $T \leq T''$,

T = As defined in Note 1,

T'' = Indicated T_{avg} at RATED THERMAL POWER (Calibration temperature for ΔT instrumentation, ≤ 574.2°F),

S = As defined in Note 1, and

$f(\Delta I)$ = ~~As defined in Note 1.~~ 0, for all ΔI

RETAIN

[NOTE 4: ~~The channel's maximum Trip Setpoint shall not exceed its computed Trip Setpoint by more than~~ 1.9% ~~2.0%~~

~~(This note number is not used.)~~]

[# If no allowable value is specified as indicated by [ ], the trip set point shall also be the allowable value.]

Attachment 2 FSAR Modifications

14.1.2 UNCONTROLLED RCCA WITHDRAWAL AT POWER

An uncontrolled RCCA withdrawal at power results in an increase in core heat flux. Since the heat extraction from the steam generator remains constant, there is a net increase in reactor coolant temperature. Unless terminated by manual or automatic action, this power mismatch and resultant coolant temperature rise would eventually result in DNB. Therefore, to prevent the possibility of damage to the cladding, the Reactor Protection System is designed to terminate any such transient with an adequate margin to DNB.

The automatic features of the Reactor Protection System which prevent core damage in a rod withdrawal accident at power include the following:

a) Nuclear power range instrumentation actuates a reactor trip if two out of the four channels exceed an overpower setpoint.

b) Reactor trip is actuated if any two out of three ΔT channels exceed an overtemperature ΔT setpoint. This setpoint is automatically varied with power distribution, temperature and pressure to protect against DNB.

c) Reactor trip is actuated if any two out of three ΔT channels exceed an overpower ΔT setpoint. ~~This setpoint is automatically varied with power distribution to ensure that the allowable fuel power rating is not exceeded.~~

d) A high pressure reactor trip, actuated from any two out of three pressure channels, is set at a fixed point. This set pressure will be less than the set pressure for the pressurizer safety valves.