



Westinghouse Electric Company
Nuclear Services
P.O. Box 355
Pittsburgh, Pennsylvania 15230-0355
USA

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555-0001

Direct tel: (412) 374-4643
Direct fax: (412) 374-4011
e-mail: greshaja@westinghouse.com

Attention: Mr. J. S. Wermiel, Chief
Reactor Systems Branch
Office of Nuclear Reactor Regulation

Our ref: LTR-NRC-04-5

January 29, 2004

Subject: Request for Review and Approval of "Proposed Method for Satisfying 10 CFR 50.46 Reanalysis Requirements for Best-Estimate LOCA Evaluation Models (Addendum 1 to WCAP-12945-P-A and WCAP-14449-P-A (proprietary versions), and WCAP-14747 and WCAP-14450-NP-A (non-proprietary versions))"

Dear Mr. Wermiel:

Westinghouse is resubmitting these documents which were originally submitted by LTR-NRC-02-51 & AW-02-1560 on October 9, 2002.

The Westinghouse best-estimate large break LOCA methodology for 3 and 4-loop plants with cold leg ECCS injection is described in WCAP-12945-P-A. The extension of that methodology to 2-loop plants with low head safety injection into the upper plenum is described in WCAP-14449-P-A. Attached are three copies each of proprietary and non-proprietary versions of a proposed method for satisfying 10 CFR 50.46 reanalysis requirements for both of those methodologies.

It is our intent to publish the attachments as Addendum 1 to WCAP-12945-P-A and WCAP-14449-P-A (proprietary versions), and WCAP-14747 and WCAP-14450-NP-A (non-proprietary versions).

This submittal contains proprietary information of Westinghouse Electric Company, LLC. In conformance with the requirements of 10 CFR Section 2.790, as amended, of the Commission's regulations, we are enclosing with this submittal an Application for Withholding from Public Disclosure and an affidavit. The affidavit sets forth the basis on which the information identified as proprietary may be withheld from public disclosure by the Commission.

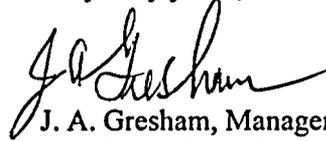
This material is for your internal use only and may be used for the purpose for which it is submitted. It should not be otherwise used, disclosed, duplicated, or disseminated, in whole or in part, to any other person or organization outside the Commission, the Office of Nuclear Reactor Regulation, the Office of Nuclear Regulatory Research, and the necessary subcontractors that have signed a proprietary non-disclosure agreement with Westinghouse without the express written approval of Westinghouse.

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LTR-NRC-04-5
January 29, 2004

Please contact Mitch Nissley at (412) 374-4303 if you have any questions concerning this transmittal.
Correspondence with respect to the affidavit or Application for Withholding should reference AW-04-1781.

Very truly yours,



J. A. Gresham, Manager
Regulatory Compliance and Plant Licensing

Enclosures

cc: D. Holland
B. Benney
E. Peyton



Westinghouse Electric Company
Nuclear Services
P.O. Box 355
Pittsburgh, Pennsylvania 15230-0355
USA

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555-0001

Direct tel: (412) 374-4643
Direct fax: (412) 374-4011
e-mail: greshaja@westinghouse.com

Our ref: AW-04-1781

January 29, 2004

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: Proposed Method for Satisfying 10 CFR 50.46 Reanalysis Requirements for Best-Estimate LOCA Evaluation Models (Addendum 1 to WCAP-12945-P-A and WCAP-14449-P-A (proprietary versions), and WCAP-14747 and WCAP-14450-NP-A (non-proprietary versions))

Reference: Westinghouse Letter J. A. Gresham to J. S. Wermiel, LTR-NRC-04-5, dated January 29, 2004

This Application for Withholding is submitted by Westinghouse Electric Company LLC (Westinghouse), pursuant to the provisions of Paragraph (b) (1) of Section 2.790 of the Commission's regulations. It contains commercial strategic information proprietary to Westinghouse and customarily held in confidence.

The proprietary material for which withholding is being requested is identified in the proprietary version of the subject report. In conformance with 10 CFR Section 2.790, Affidavit AW-04-1781 accompanies this Application for Withholding, setting forth the basis on which the identified proprietary information may be withheld from public disclosure.

Accordingly, it is respectfully requested that the subject information which is proprietary to Westinghouse be withheld from public disclosure in accordance with 10 CFR Section 2.790 of the Commission's regulations.

Correspondence with respect to this Application for Withholding or the accompanying affidavit should reference AW-04-1781 and should be addressed to J. A. Gresham, Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company LLC, P.O. Box 355, Pittsburgh, Pennsylvania 15230-0355.

Very truly yours,

A handwritten signature in black ink, appearing to read "J. A. Gresham".

J. A. Gresham, Manager
Regulatory Compliance and Plant Licensing

Enclosures

cc: D. Holland
B. Benney
E. Peyton

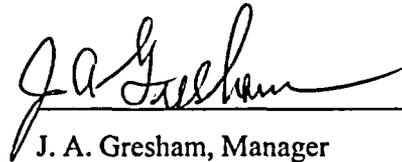
AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

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COUNTY OF ALLEGHENY:

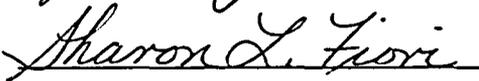
Before me, the undersigned authority, personally appeared J. A. Gresham, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC (Westinghouse), and that the averments of fact set forth in this Affidavit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



J. A. Gresham, Manager

Regulatory Compliance and Plant Licensing

Sworn to and subscribed
before me this 29th day
of January, 2004



Notary Public

Notarial Seal
Sharon L. Fiori, Notary Public
Monroeville Boro, Allegheny County
My Commission Expires January 29, 2007

Member, Pennsylvania Association Of Notaries

- (1) I am Manager, Regulatory Compliance and Plant Licensing, in Nuclear Services, Westinghouse Electric Company LLC (Westinghouse), 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 rule making proceedings, and am authorized to apply for its withholding on behalf of Westinghouse.
- (2) I am making this Affidavit in conformance with the provisions of 10 CFR 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 Westinghouse 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.

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 that 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 10 CFR 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 the enclosures being transmitted by Westinghouse letter (LTR-NRC-04-5) and Application for Withholding Proprietary Information from Public Disclosure AW-04-1781, to the Document Control Desk. The proprietary information as submitted for use by Westinghouse proposes a method for satisfying 10 CFR 50.46 reanalysis requirements for the best-estimate large break LOCA methodologies described in WCAP-12945-P-A and WCAP-14449-P-A, and is expected to be applicable to licensees who utilize these methodologies.

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

- (a) Support licensees in meeting the reanalysis requirements of 10 CFR 50.46.

- (b) Provide an appropriate reanalysis work scope for plants using best-estimate LOCA methodologies.

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 demonstrating compliance with 10 CFR 50.46 reanalysis requirements.
- (b) Westinghouse can sell support and defense of ECCS evaluation model reanalyses based on this methodology.
- (c) The information requested to be withheld reveals the distinguishing aspects of a methodology which was developed by Westinghouse.

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 calculations 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.

Further the deponent sayeth not.

PROPRIETARY INFORMATION NOTICE

Transmitted herewith are proprietary and/or non-proprietary versions of documents furnished to the NRC in connection with requests for generic and/or plant-specific review and approval.

In order to conform to the requirements of 10 CFR 2.790 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(i)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuant to 10 CFR 2.790(b)(1).

COPYRIGHT NOTICE

The reports transmitted herewith each bear a Westinghouse copyright notice. The NRC is permitted to make the number of copies of the information contained in these reports which are necessary for its internal use in connection with generic and plant-specific reviews and approvals as well as the issuance, denial, amendment, transfer, renewal, modification, suspension, revocation, or violation of a license, permit, order, or regulation subject to the requirements of 10 CFR 2.790 regarding restrictions on public disclosure to the extent such information has been identified as proprietary by Westinghouse, copyright protection notwithstanding. With respect to the non-proprietary versions of these reports, the NRC is permitted to make the number of copies beyond those necessary for its internal use which are necessary in order to have one copy available for public viewing in the appropriate docket files in the public document room in Washington, DC and in local public document rooms as may be required by NRC regulations if the number of copies submitted is insufficient for this purpose. Copies made by the NRC must include the copyright notice in all instances and the proprietary notice if the original was identified as proprietary.

Westinghouse Non-Proprietary Class 3

PROPOSED METHOD FOR SATISFYING 10 CFR 50.46 REANALYSIS REQUIREMENTS FOR BEST-ESTIMATE LOCA EVALUATION MODELS (Addendum 1 to WCAP-12945-P-A and WCAP-14449-P-A (proprietary versions), and WCAP-14747 and WCAP-14450-NP-A (non-proprietary versions))

SECTION 1 INTRODUCTION

10 CFR 50.46 includes the following requirements relative to ECCS evaluation model changes and errors:

"For each change to or error discovered in an acceptable evaluation model or in the application of such a model that affects the temperature calculation, the applicant or licensee shall report the nature of the change or error and its estimated effect on the limiting ECCS analysis to the Commission at least annually as specified in § 50.4. If the change or error is significant, the applicant or licensee shall provide this report within 30 days and include with the report a proposed schedule for providing a reanalysis or taking other action as may be needed to show compliance with § 50.46 requirements."

The purpose of this report is to provide a technical and regulatory basis for using the superposition correction step of the Westinghouse best-estimate large break LOCA methodology to satisfy the reanalysis requirements stated in 10 CFR 50.46. This justification is applicable to the following evaluation models:

1996 Westinghouse Best Estimate Large Break LOCA Evaluation Model (Bajorek et al., 1998)
1999 Westinghouse Best Estimate Large Break LOCA Evaluation Model, Application to PWRs with Upper Plenum Injection (Dederer et al., 1999)

SECTION 2
OVERVIEW OF WESTINGHOUSE BEST-ESTIMATE LARGE BREAK LOCA METHODOLOGY

A detailed description of the Westinghouse best-estimate large break LOCA methodology for 3-/4-loop PWRs with cold leg ECCS injection is given in Section 26 of WCAP-12945-P-A (Bajorek et al., 1998). The methodology uses a combination of response surfaces and Monte Carlo techniques to develop an uncertainty distribution for the peak cladding temperature (PCT). This can be qualitatively illustrated using the following simplified equation for iteration i:

$$PCT_i = PCT_{REF} + \Delta PCT_{PD,i} + \Delta PCT_{IC,i} + \Delta PCT_{MOD,i} + \Delta PCT_{SUP,i}$$

where,

PCT_{REF} = peak cladding temperature for a fixed set of reference conditions defined by the approved methodology

$\Delta PCT_{PD,i}$ = change in PCT due to the power distribution parameters sampled for iteration i

$\Delta PCT_{IC,i}$ = change in PCT due to sampling of the initial and boundary condition uncertainty distribution for iteration i

$\Delta PCT_{MOD,i}$ = change in PCT due to the thermal-hydraulic models sampled for iteration i

$\Delta PCT_{SUP,i}$ = change in PCT due to application of the superposition correction factor, and sampling of the superposition correction uncertainty for iteration i

The methodology for treating each of the uncertainty components in this equation is summarized below.

Power Distribution Parameters – Variations in total peaking factor (FQ), enthalpy rise peaking factor (FdH), and axial power distribution (characterized by normalized 1/3 power integrals PBOT and PMID) are considered. Additionally, uncertainties in core power, decay heat, gamma energy redistribution, and peaking factor calculational uncertainties are considered [

]a.c

A typical power distribution run matrix is shown in Table 1.

Initial and Boundary Conditions – Other plant parameters that are considered in the uncertainty methodology include RCS fluid temperature and pressure; accumulator water volume, temperature, pressure and line resistance; and safety injection (refueling water storage tank) temperature. [

]a.c

[

]a.c.

The plant parameters considered in this category are shown in Table 2 for a typical plant-specific application.

Thermal-Hydraulic Models— The thermal-hydraulic models are separated into two groups. “Global” models are those that affect the system response to the transient. “Local” models are those that affect only the hot spot response. The global models considered in the uncertainty analysis are break flow rate (CD), broken cold leg nozzle resistance (KN), broken loop pump resistance (KP), downcomer condensation (XC), and break type (guillotine or split). [

]a.c.

The global model run matrix for 3- and 4-loop plants is shown in Table 3 for guillotine breaks, and in Table 4 for split breaks. The local models considered in the HOTSPOT code are:

Local Hot Spot Peaking Factor

Fuel Conductivity Before Burst

Fuel Conductivity After Burst

Fuel Relocation

Gap Conductance

Rod Internal Pressure

Burst Temperature

Burst Strain

Zirc-Water Reaction

Heat Transfer Coefficient

Minimum Film Boiling Temperature

The above discussion is applicable to 3- and 4-loop plants with ECCS injection into the cold legs. For 2-loop plants with low head safety injection into the upper plenum, variations in parameters that control the upper plenum drain distribution are important, while downcomer condensation is not. Therefore, the methodology for 2-loop plants with upper plenum injection replaces variations in downcomer condensation with simultaneous variations in interfacial drag (XD) and condensation (XCU) in the regions of the vessel that control the drain distribution. The revised global model run matrix for 2-loop plants is shown in Table 5 for guillotine breaks, and in Table 6 for split breaks. A detailed description of the Westinghouse best-estimate large break LOCA methodology for 2-loop PWRs with upper plenum injection is given in Sections 5 and 6 of WCAP-14449-P-A (Dederer et al., 1999).

Superposition Correction and Calculation of Total Uncertainty – A preliminary estimate of the PCT uncertainty distributions for the guillotine and limiting split break transients is first performed. A simplified (illustrative) description of the methodology as applied to guillotine breaks follows:

- 1) Sample from the probability distributions for FQN, FdH, PBOT, PMID, core power, decay heat, gamma energy redistribution, and peaking factor calculational uncertainties. []^{a,c} Insert the resulting values into the response surface equation to obtain the change in PCT due to power related parameters for iteration i, $\Delta PCT_{PD,i}$.
- 2) Sample from the []^{a,c} to obtain the change in PCT due to initial/boundary conditions for iteration i, $\Delta PCT_{IC,i}$.
- 3) Sample from the probability distributions for CD, KN' and XC. Insert the resulting values into the response surface equations to obtain $HPCT_{ave}$ and σ_{HPCT} . Sample from the normal distribution defined by σ_{HPCT} , and add the result to $HPCT_{ave}$ to obtain the change in PCT due to thermal hydraulic models for iteration i, $\Delta PCT_{MOD,i}$. (For split breaks, sample from the probability distributions for KN' and XC. For UPI plants, sampling of XD+XCU replaces sampling of XC.)

4) Add the results of steps 1 through 3 to obtain the overall PCT for iteration i:

$$PCT_i = PCT_{REF} + \Delta PCT_{PD,i} + \Delta PCT_{IC,i} + \Delta PCT_{MOD,i}$$

5) Repeat steps 1 through 4 10,000 times to develop the overall PCT uncertainty distribution.

The above is performed for guillotine and split breaks, and the most limiting break type is selected. An additional set of analyses is then performed for the limiting break type, to account for the uncertainty in the assumption that the uncertainty components are additive. This is referred to as the "superposition correction" step. A series of WCOBRA/TRAC runs are made, with global models, power distributions, and initial/boundary conditions all varied simultaneously. The run matrix is designed to [

] ^{a,c}

The final PCT uncertainty distribution is then calculated for the limiting break type. Steps 1 through 4 are performed for each iteration. [

] ^{a,c} Again, 10,000

iterations are used to get the final PCT uncertainty distribution.

SECTION 3
USE OF SUPERPOSITION CORRECTION STEP TO PERFORM REANALYSES

As noted previously, 10 CFR 50.46 includes the following requirements relative to ECCS evaluation model changes and errors:

“For each change to or error discovered in an acceptable evaluation model or in the application of such a model that affects the temperature calculation, the applicant or licensee shall report the nature of the change or error and its estimated effect on the limiting ECCS analysis to the Commission at least annually as specified in § 50.4. If the change or error is significant, the applicant or licensee shall provide this report within 30 days and include with the report a proposed schedule for providing a reanalysis or taking other action as may be needed to show compliance with § 50.46 requirements.”

For licensees with an existing best-estimate analysis, it is proposed that the 10 CFR 50.46 reanalysis requirement for significant changes or errors can be satisfied by reanalyzing the reference transient and the superposition correction cases from the original analysis. A more detailed description of this process is given below.

[

]a.c

- 4) The local and core-wide oxidation results from the prior analysis will be reviewed, and updated if necessary using the methodology described in Section 26-5-3 of WCAP-12945-P-A (Bajorek et al., 1999).

It is noted that the NRC has previously approved the use of a similar reanalysis philosophy in the case of a steam generator replacement program (Padovan, 1999).

Several illustrative examples of the use of this reanalysis approach to establish a new 95th percentile PCT follow.

Example 1: A significant error is found in the application of the evaluation model. No changes in the expected operating range of the plant are contemplated.

[

]a.c

Example 2: A significant error is found in the application of the evaluation model. [

]a.c

In each of these examples, a partial reanalysis of the affected portions of the original analysis would be used to quantify the effect of the change(s) on PCT. The final 95th percentile PCT would be considered to be the result of a new analysis, meeting the requirements for 10 CFR 50.46 reanalysis. As such, it would be reported as the new licensing basis PCT.

SECTION 4 APPLICATION TO ANALYSES THAT BOUND MULTIPLE UNITS

Several licensees have used a single best-estimate large break LOCA analysis to bound multiple units. In each of these cases, any plant-to-plant variation in design and/or operating conditions was carefully considered, and comparative calculations were used to aid selection of the bounding plant configuration.

Any applications of the reanalysis strategy presented in this report to analyses that bound multiple units will include comparative calculations of the reanalysis scenario to ensure that the previously selected bounding plant configuration remains applicable. In the event that this cannot be clearly established, additional discussions will be held with the NRC on the proposed plan for completing the reanalysis.

It is noted that the above approach is considered to be consistent with the NRC recommendations in the aforementioned steam generator replacement program (Padovan, 1999).

Example 3: A significant error is found in the application of the evaluation model for a licensee that uses one analysis to bound two units with the same power rating and fuel type, but different vessel designs. As in example 2, [

]a.c

SECTION 5 CONCLUSIONS

This report provides a technical and regulatory basis for using the superposition correction step of the Westinghouse best-estimate large break LOCA methodology to satisfy the reanalysis requirements stated in 10 CFR 50.46. For significant changes to, or errors in, the approved codes and methods, the reanalysis involves [

] ^{a,c} The resulting 95th percentile peak cladding temperature is considered to be the new licensing basis PCT.

As part of the reanalysis process, the licensee may wish to make small changes in allowable operating conditions that would not be expected to affect the previously determined sensitivity to variations in power distributions, initial conditions, or thermal-hydraulic models. Examples have been presented to illustrate how these types of changes would be incorporated in the reanalysis.

SECTION 6 REFERENCES

Bajorek, S. M., et al., 1998, "Code Qualification Document for Best Estimate LOCA Analysis," WCAP-12945-P-A, Volume 1, Revision 2, and Volumes 2 through 5, Revision 1, and WCAP-14747 (Non-Proprietary).

Dederer, S. I., et al., 1999, "Application of Best Estimate Large Break LOCA Methodology to Westinghouse PWRs with Upper Plenum Injection," WCAP-14449-P-A, Revision 1, and WCAP-14450-NP-A (Non-Proprietary).

Letter, L. M. Padovan to D. N. Morey, "Joseph M. Farley Nuclear Plant, Units 1 and 2 – Issuance of Amendments Re: Steam Generator Replacements," December 29, 1999.

