

Westinghouse Non-Proprietary Class 3



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LTR-NRC-17-72

November 8, 2017

Subject: Pre-Submittal Meeting Package for Topical Report WCAP-16260, Revision 2, "The Spatially Corrected Inverse Count Rate (SCICR) Method for Subcritical Reactivity Measurement" (Proprietary/Non-Proprietary)

Enclosed are the proprietary and non-proprietary versions of "Pre-Submittal Meeting Package for Topical Report WCAP-16260, Revision 2, 'The Spatially Corrected Inverse Count Rate (SCICR) Method for Subcritical Reactivity Measurement.'" This information is being provided for a pre-submittal meeting on November 16, 2017.

This submittal contains proprietary information of Westinghouse Electric Company LLC ("Westinghouse"). In conformance with the requirements of 10 CFR Section 2.390, as amended, of the Nuclear Regulatory Commission's ("Commission's") regulations, we are enclosing with this submittal an Application for Withholding Proprietary Information 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.

Correspondence with respect to the proprietary aspects of the Application for Withholding or the Westinghouse Affidavit should reference AW-17-4667, and should be addressed to James A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company, 1000 Westinghouse Drive, Building 3 Suite 310, Cranberry Township, Pennsylvania 16066.

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

James A. Gresham, Manager
Regulatory Compliance

Enclosures

cc: Ekaterina Lenning



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AW-17-4667

November 8, 2017

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: LTR-NRC-17-72 P-Attachment, "Pre-Submittal Meeting Package for Topical Report WCAP-16260, Revision 2, 'The Spatially Corrected Inverse Count Rate (SCICR) Method for Subcritical Reactivity Measurement' "

Reference: Letter from James A. Gresham to the Document Control Desk, LTR-NRC-17-72, dated November 8, 2017.

The Application for Withholding Proprietary Information from Public Disclosure is submitted by Westinghouse Electric Company LLC ("Westinghouse"), pursuant to the provisions of paragraph (b)(1) of Section 2.390 of the Nuclear Regulatory Commission's ("Commission's") regulations. It contains commercial strategic information proprietary to Westinghouse and customarily held in confidence.

The proprietary information for which withholding is being requested in the above-referenced report is further identified in Affidavit AW-17-4667 signed by the owner of the proprietary information, Westinghouse. 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 10 CFR Section 2.390 of the Commission's regulations.

Correspondence with respect to the proprietary aspects of the Application for Withholding or the Westinghouse Affidavit should reference AW-17-4667, and should be addressed to James A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company, 1000 Westinghouse Drive, Building 3 Suite 310, Cranberry Township, Pennsylvania 16066.

A handwritten signature in black ink, appearing to read 'James A. Gresham', written over a horizontal line.

James A. Gresham, Manager
Regulatory Compliance

AFFIDAVIT

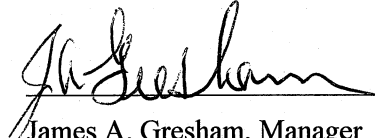
COMMONWEALTH OF PENNSYLVANIA:

SS

COUNTY OF BUTLER:

I, James A. Gresham, am authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC (“Westinghouse”) and declare that the averments of fact set forth in this Affidavit are true and correct to the best of my knowledge, information, and belief.

Executed on: 11/8/17


James A. Gresham, Manager
Regulatory Compliance

- (1) I am Manager, Regulatory Compliance, 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 2.390 of the Nuclear Regulatory Commission’s (“Commission’s”) regulations and in conjunction with the Westinghouse Application for Withholding Proprietary Information from Public Disclosure 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 2.390 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 constitute Westinghouse policy and provide 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.
- (iii) 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.
- (iv) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.390, is to be received in confidence by the Commission.
- (v) 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.
- (vi) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in LTR-NRC-17-72 P-Attachment, "Pre-Submittal Meeting Package for Topical Report WCAP-16260, Revision 2, 'The Spatially Corrected Inverse Count Rate (SCICR) Method for Subcritical Reactivity Measurement' " (Proprietary), for submittal to the Commission. The proprietary information as submitted by Westinghouse is that associated with Revision 2 of WCAP-16260 and may be used only for that purpose.
- (a) This information is part of that which will enable Westinghouse to maintain an advantage over its competitors.
 - (b) Further, this information has substantial commercial value as follows:

- (i) Westinghouse plans to sell the use of similar information to its customers for the purpose of startup physics testing.
- (ii) Westinghouse can sell support and defense of industry guidelines and acceptance criteria for plant-specific applications.
- (iii) 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 technical evaluation justifications 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 non-proprietary versions of a document, furnished to the NRC in connection with requests for generic review and approval.

In order to conform to the requirements of 10 CFR 2.390 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)(ii)(a) through (4)(ii)(f) of the Affidavit accompanying this transmittal pursuant to 10 CFR 2.390(b)(1).

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**Pre-Submittal Meeting Package for Topical Report WCAP-16260, Revision 2, “The Spatially Corrected Inverse Count Rate (SCICR) Method for Subcritical Reactivity Measurement”
(Non-Proprietary)**

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WCAP-16260, Revision 2, The Spatially Corrected Inverse Count Rate (SCICR) Method for Subcritical Reactivity Measurement

Pre-Submittal Meeting

November 16, 2017



Safety Brief

- Westinghouse always starts meetings with a Safety Brief

Nuclear Safety Culture Behaviors

- | | |
|---|--|
| <ul style="list-style-type: none">• Show Respect for Others• Follow the Rules• Stop When Unsure | <ul style="list-style-type: none">• Promptly Report Problems• My Signature is My Word |
|---|--|

Safety Impacts

- | | |
|--|---|
| <ul style="list-style-type: none">• Nuclear Safety | <ul style="list-style-type: none">• Industrial Safety |
|--|---|

Quality Impacts

- | | |
|---|---|
| <ul style="list-style-type: none">• Defect-free• Reliability | <ul style="list-style-type: none">• Cost of Poor Quality (COPQ)• Corrective Action Process |
|---|---|

Agenda

- Opening Remarks
 - Introductions and Purpose
 - Background Information
- Presentation:
 - SCICR Method for Subcritical Reactivity Measurement
 - Introduction, Theory, and Method Application
 - SPT Demonstration, Process Controls, & Evaluation Criteria
 - Regulatory Considerations and Closing
- Summary & Open Discussions

Technical Presenters

- Lou Grobmyer, Consulting Engineer
 - 43 years of experience in testing and core instrumentation technology
- Patrick Sebastiani, P.E., Principal Engineer
 - 13 years of experience in testing, test method development, and nuclear design
- Mark Dicus, Principal Engineer
 - 22 years of experience in reactor engineering, testing and core instrumentation technology



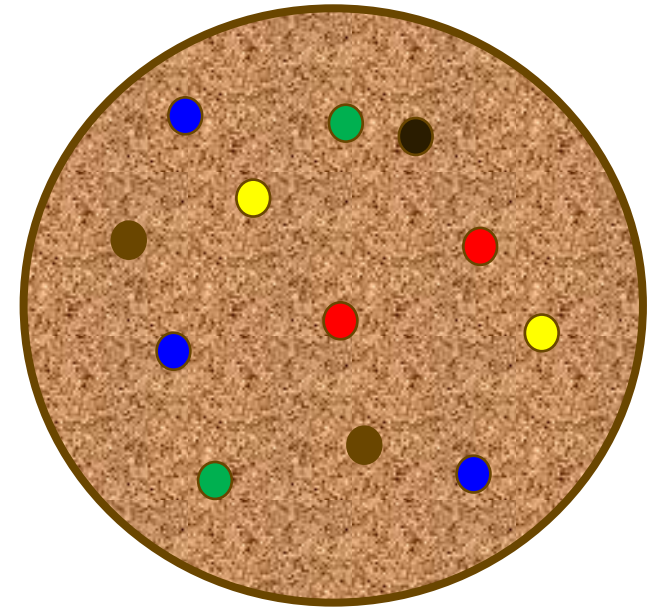
Now, everyone else:
Name, organization, background

Purpose of Topical Report

- Westinghouse is seeking NRC approval to implement Revision 2 of the SCICR Topical Report, WCAP-16260
 - Basic SCICR theory is retained from Revision 1
 - Revision 2 introduces new Subcritical Physics Testing (SPT) application

Model for Core Design Verification

- Consider all conditions that the plant (core) can possibly be in being represented by the large circle
- Certain calculated parameters can be measured in a non-destructive manner. These parameters are represented by the smaller circles (state points)
- Given that the state points are confirmed, then the models and tools used to calculate the normal and the off-normal conditions are confirmed to be consistent with the constructed core



SCICR Topical Report Changes – Introduction, Theory, and Method Application

Patrick J. Sebastiani
Principal Engineer
New Reactor Technology



Introduction (Section 1)

Purpose

- The fundamental uses of SCICR are unchanged

– [

] a, c

- However, a revised Subcritical Physics Testing (SPT) application has been developed

– [

] a, c

Introduction (Section 1)

Background

- This section recaps the subcritical neutron flux distribution and corresponding design methods
- The original SRWM application was flawed due to the potential inability to detect anomalies; an overall lack of detectability
 - [

] a, c

Introduction (Section 1)

Issue Resolution and SPT Reconstruction

- The new SPT application [

] a,c

- The new SPT process enhances detectability
 - New measurement parameters and evaluation criteria based on [

] a, c

Introduction (Section 1)

Report Organization

Sec.	Title	Summary Description
1	Introduction	<ul style="list-style-type: none"> Updated purpose and introduction of the revised application Includes background information and history Content comparison of Revision 1 and Revision 2
2	Theory	<ul style="list-style-type: none"> Original method retained Includes additional equations to transform the original method for revised application
3	Method Application	<ul style="list-style-type: none"> Revised process overview Includes discussion on plant integration and fulfillment of traditional LPPT objectives
4	Application Demonstration	<ul style="list-style-type: none"> Presents results from recent plant demonstrations to validate revised application Re-visits a sampling of past demonstrations to re-validate plant applicability

Introduction (Section 1)

Report Organization

Sec.	Title	Summary Description
5	Process Controls	<ul style="list-style-type: none"> • Presents measurement process controls • Presents design process controls, including studies to demonstrate detectability of the revised application
6	Regulatory Considerations	<ul style="list-style-type: none"> • Includes regulatory nexus and SCICR history • Re-validates compliance with previous Westinghouse topical reports related to physics testing • Includes proposed limitations and conditions
7	Summary and Conclusions	<ul style="list-style-type: none"> • Self explanatory
8	References	<ul style="list-style-type: none"> • Updated with latest design methodology references and other references supporting the revision

Introduction (Section 1)

Report Organization

Appx.	Title	Summary Description
A	SPT Guideline Instructions	<ul style="list-style-type: none"> General steps to perform the SPT application during plant startup
B	Bank Withdrawal Enhancement	<ul style="list-style-type: none"> Summarizes the subject process improvement as part of the revised application
C	Implementation Outside of Experience Base	<ul style="list-style-type: none"> Describes validation process for SPT application at plant types beyond those presented in the topical report
D	Extension to Other Codes or Designers	<ul style="list-style-type: none"> Describes validation process for performance of SCICR calculations with non-Westinghouse codes and/or by non-Westinghouse nuclear designers
E	Correspondence to Previous Revisions	<ul style="list-style-type: none"> Provides a cross-reference of past technical queries (e.g., RAIs) to information in the revised topical report

Introduction (Section 1)

Content Comparison (Revision 1 to 2)

- Most significant changes:

– [

] a, c

- SPT does not include ITC measurement results
 - Will be measured by traditional means at criticality (after completion of SPT scope)

Introduction (Section 1) Content Comparison (Revision 1 to 2)

- Some items remain the same, primarily:
 - [

] a, c



Introduction (Section 1) SCICR Applications

1. [

] a, c

Introduction (Section 1) SCICR Applications

2. [

] a, c



Introduction (Section 1) SCICR Applications

3. [

] a, c

Introduction (Section 1) SCICR Applications

4. [

] a, c



SCICR Theory (Section 2)

Spatial Correction to ICRR (Retained)

- During subcritical operation, three-dimensional spatial effects result in neutron detector count rates (M) that deviate from the theoretical point core behavior
 - Advanced tools can calculate [

$$\left[\begin{array}{c} \\ \\ \\ \\ \end{array} \right]^{a, c}$$
$$\left[\begin{array}{c} \\ \\ \\ \\ \end{array} \right]^{a, c}$$

SCICR Theory (Section 2)

SPT Application Theory (Updated)

- A fundamental change is the [

] a, c

[

] a, c

[

] a, c



SCICR Theory (Section 2)

SPT Application Theory (Updated)

- Measured ICRR ($ICRR_M$ or I_M below) can be calculated concurrently at each state point condition
 - $ICRR_M$ is a function only of count rate measurements (M) at the reference (R) and current (i) state point conditions
 - Spatial-correction is no longer applied to the measurement

$$\left[\quad \quad \quad \right]_{a, c}$$

$$\left[\quad \quad \quad \right]_{a, c}$$

SCICR Theory (Section 2)

SPT Application Theory (Updated)

- [

] a, c

[

]

a, c

- Subsequent evaluations define the overall quality and acceptance of the data. Detailed explanations are provided in **Sections 3 and 4**

Method Application (Section 3) Process Overview

1. [

] a, c



Method Application (Section 3) Process Overview

5. [

] a, c



Method Application (Section 3) Process Overview



a, b, c

In order to remain in-bounds, both the reactivity effect of rod withdrawal and the global core reactivity must be well understood



Method Application (Section 3) Process Overview

7. [

] a, c



Method Application (Section 3) Process Overview

a, b, c

Acceptable linear fit parameters
validate the core power distribution



Method Application (Section 3) Process Overview

a, b, c



Method Application (Section 3) Process Overview

Note that, for SPT, Steps 3 through 7 are repeated []^{a, c}

8. [

] ^{a, c}



Method Application (Section 3) Merging SPT into Existing Plant Processes

- SPT process guidelines provided in **Appendix A**
- [

] a, c

Method Application (Section 3)

Pre-MODE 1 Core Design Validation

Core Characteristic	Typical Critical Physics Test Parameter	SPT Parameter(s)
Reactivity Balance	ARO Critical Boron Concentration (i.e., Boron Endpoint, BEP)	• [] ^{a, c}
Shutdown Capability	Total Bank Worth (sum of all individual measurements)	• [] ^{a, c}
Core Power Distribution (<5% power)	Individual Bank Worth Measurements (via various methods)	• [] ^{a, c}
Reactivity Control	Isothermal Temperature Coefficient (ITC)	[] ^{a, c}

SPT provides a comprehensive initial evaluation of the core M-P behavior

SCICR Demonstration, Process Controls, and Evaluation Criteria

Mark Dicus
Principal Engineer
Nuclear Operations



Application Demonstration (Section 4) Demonstration Details & Results

- [

] a, c



Application Demonstration (Section 4) Previous Demonstrations

- Data from earlier SCICR applications was used to
[

] a, c

Application Demonstration (Section 4) Implementation Outside Experience Base

- The SCICR experience base is [

] a, c

- **Appendix C** outlines a process for extending to plants outside this experience base
– [

] a, c



Limitations & Conditions (Section 6.4) Extension to Other Codes or Designers

- **Appendix D** outlines a process for [

] a, c

Process Controls (Section 5)

Measurement Controls

- Quality of nuclear instrumentation indication is important
 - “Quality” meaning fidelity of instrumentation channel output to detector output
 - Offsets can be introduced by calibration
- Measurement process controls for future use
 - [

] a, c

These are new enhancements above
the typical channel calibration

Process Controls (Section 5)

Design Method Controls

- Refers to the re-built processes for method application and results evaluation
 - **Westinghouse core design methods are not changing**
- [

] a, c

[

] a, c

Process Controls (Section 5) Evaluation Criteria

- Review Criteria
 - By definition, no direct link to safety significant limit
 - Purpose to identify non-critical errors in design or measurement
 - Based on design tolerance or measurement experience
 - Subject to change as database of results expands

a, c



Process Controls (Section 5) Evaluation Criteria

a, b, c



Process Controls (Section 5) Evaluation Criteria

- [

] a, c

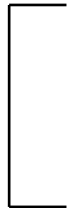


Process Controls (Section 5)

Evaluation Criteria

- Acceptance Criteria

- By definition, have a direct link to a safety significant parameter or defined in Technical Specifications



] a, c

- Actions for failed evaluation criteria:

- Investigate to determine whether measurement or design error is suspected
- Confirm or refute failure by further measurement and/or considering related measurements
- If confirmed, evaluate for impact on plant safety and implement mitigation steps
- Failed Acceptance Criteria must be resolved before MODE 1 entry

Regulatory Considerations and Closing

James D. Smith
Licensing Project Manager
Plant Licensing



Regulatory Considerations (Section 6)

- **Section 6.1** provides the regulatory nexus
- **Section 6.2** discusses regulatory history
 - WCAP-16260-P-A (Revision 0) was approved in August 2005
 - The transmittal letters for the Topical and for formal responses to requests for additional information (RAIs) are listed in this section
 - **Appendix E** provides a table that maps RAIs to the corresponding sections in Revision 2
 - Revision 1, which addressed compliance with two previous topical reports, was approved in July 2007
 - [

] a, c

Regulatory Considerations (Section 6)

- **Section 6.2** also discusses the []^{a, c}
- **Section 6.3** documents continued compliance with []

] a, c

Regulatory Considerations (Section 6)

- **Section 6.4** discusses Proposed Limitations and Conditions

1. [

] a, c

Regulatory Considerations (Section 6)

- **Section 6.4** discusses Proposed Limitations and Conditions
2. [

] a, c

Regulatory Considerations (Section 6)

- **Section 6.4** discusses Proposed Limitations and Conditions
3. [

] a, c

Summary

- WCAP-16260 Revision 2 details the SCICR applications and provides supporting analyses
 - Issues associated with [] a, c
 - Revised SPT application can be used to [] a, c
 - Revised application establishes [] a, c
- Submittal planned for mid-December
- Multiple utilities plan to implement

NRC Priority Matrix Assessment

Factors	Satisfied Criteria	Points	Assigned Points
TR Classification	New technology improves Safety	2	2
TR Applicability	Potentially applicable to entire groups of licensees	2	2
TR Implementation Certainty	Implementation by an entire group of licensees who sponsored TR	2	1.5
	Docketed intent by U.S. plants but no formal LAR schedule yet	1	
Tie to a LAR	None	0	0
Review Progress [NRC]			--
NRC management discretion adjustment [NRC]			--
Total Points (preliminary estimate)			5.5

Open Discussion

- Staff feedback on the proposed topical report contents
- Timetable and process for the requested review
- Any additional questions/comments

Subcritical Physics Testing Application Using Spatially Corrected Inverse Count Rate (SCICR) Method

End of Presentation



Subcritical Physics Testing Application Using Spatially Corrected Inverse Count Rate (SCICR) Method

Supplemental Information



Acronyms and Abbreviations

- Σ_a macroscopic absorption cross-section
- ACC Actual Critical Conditions
- ARI all rods inserted
- ARO all rods out
- BEP Boron End Point
- CFR Code of Federal Regulations
- EOL End of Life
- ICRR Inverse Count Rate Ratio
- $ICRR_{M \text{ or } I_M}$ measured Inverse Count Rate Ratio
- $ICRR_{P \text{ or } I_P}$ predicted Inverse Count Rate Ratio
- $ICRR_{SC}$ spatially-corrected Inverse Count Rate Ratio
- ITC Isothermal Temperature Coefficient

Acronyms and Abbreviations

- k_{eff} effective core multiplication factor
- LPPT Low Power Physics Testing
- M-P measured-to-predicted difference
- MAX-D [] a, c
- MD Mean Deviation
- NRC Nuclear Regulatory Commission
- NSSS Nuclear Steam Supply System
- PCCF [] a, c
- pcm percent milli rho
- R^2 coefficient of determination
- RAI Request for Additional Information
- RCS Reactor Coolant System

Acronyms and Abbreviations

- RG Regulatory Guide
- RMS Root Mean Square Deviation
- SCF []^{a, c}
- SCICR Spatially Corrected Inverse Count Rate method
- SPT Subcritical Physics Testing
- SRWMTM Subcritical Rod Worth Measurement application
- SUM-D []^{a, c}
- $S_{y/x}$ standard error of the y-estimate
- WCAP Westinghouse Commercial Atomic Power (formal report)