Westinghouse

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: LTR-NRC-05-3

Attn: J. S. Wermiel, Chief
Reactor Systems Branch
Division of Systems Safety and Analysis

January 20, 2005

Subject: "Response to NRC Request for Additional Information on WCAP-16260-P" (Proprietary/Non-Proprietary)

Dear Mr. Wermiel:

Enclosed are four (4) Proprietary and two (2) Non-Proprietary copies of "Response to NRC Request for Additional Information on WCAP-16260-P".

Also enclosed is:

1. One (1) copy of the Application for Withholding, AW-05-1941 (Non-Proprietary) with Proprietary Information Notice.
2. One (1) copy of Affidavit (Non-Proprietary).

This submittal contains proprietary information of Westinghouse Electric Company LLC. In conformance with the requirements of 10 CFR Section 2.390, 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.

T007

Add: F.M. Akstulewicz
B.J. Benney
L.M. Feizollahi
A. Attard
J.S. Wermiel

Correspondence with respect to this affidavit or Application for Withholding should reference AW-05-1941 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,

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

Enclosures

cc: F. M. Akstulewicz/NRR
B. J. Benney/NRR
L. M. Feizollahi/NRR
A. Attard/NRR

Westinghouse

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-05-1941

January 20, 2005

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: "Response to NRC Request for Additional Information on WCAP-16260-P" (Proprietary)

Reference: Letter from J. A. Gresham to J. S. Wermiel, LTR-NRC-05-3, dated January 20, 2005

The Application for Withholding is submitted by Westinghouse Electric Company LLC (Westinghouse), pursuant to the provisions of Paragraph (b) (1) of Section 2.390 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 2.390, Affidavit AW-05-1941 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 2.390 of the Commission's regulations.

Correspondence with respect to this Application for Withholding or the accompanying affidavit should reference AW-05-1941 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,

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

Enclosures

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

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 20th day
of January, 2005

Sharon L. Fiori
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 2.390 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 2.390 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 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 2.390, 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, "Response to NRC Request for Additional Information on WCAP-16260-P" (Proprietary), for submittal to the Commission, being transmitted by Westinghouse letter (LTR-NRC-05-3) and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted by Westinghouse is that associated with Westinghouse's request for NRC approval of WCAP-16260-P, "The Spatially Corrected Inverse Count Rate (SCICR) Method for Subcritical Reactivity Measurement".

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

(a) Obtain generic approval for the Westinghouse Methodology for Spatially Corrected Inverse Count Rate (SCICR) Methodology for Subcritical Reactivity Measurement.

(b) Westinghouse can use this methodology to further enhance their licensing position over their competitor.

(c) Assist customers to obtain license changes. designs.

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to sell the use of this information to its customers for purposes of enhancing plant operations.

(b) Westinghouse can sell support and defense of and defense of SCICR.

(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 methodology, measurements 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 2.390 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).

Westinghouse Non-Proprietary Class 3

Response to NRC Request for Additional Information on WCAP-16260-P

Westinghouse Electric Company LLC
Nuclear Fuel/Nuclear Services
4350 Northern Pike
Monroeville, PA 15146

Response to NRC Request for Additional Information on WCAP-16260-P

1. Page 3, middle of 2nd paragraph, the statement is made that the current ICRR behavior is [ ]^{a,c}. Yet typical 1/M plots are generally [ ]^{a,c}. Please provide additional clarification. In addition, elaborate further on the 3rd. and 5th. paragraphs, demonstrating the [ ]^{a,c} of the point core model.

   [

   ]^{a,c}

   Attachment A, the Station Nuclear Engineer (SNE) Course for Reactor Engineering Surveillances presentation, is provided to further demonstrate the behavior of the 1/M plot.

a, b, c

Pg. 3, last, Application of the SCICR methodology

The basic idea of SCICR is to [

][a,c] The 10-steps process on page 11 of the Topical describes how this 3D-core to point-core conversion is performed.

Figure 4-1 is used for illustration. [

][a,c]

[

][a,c]

[

][a,c] Therefore, SCICR can serve as an alternative to the traditional rod worth measurements during startup physics test.

[

][a,c] Examples of this are provided in the last column of Table 4-3 of the Topical Report.

[

][a,c] Therefore the SCICR methodology can be applied to periodically measure core reactivity at the ARI shut down condition, which in turn can verify the core shut-down margin that is predicted by core design and assumed in the safety analysis. Furthermore, The SCICR methodology, if incorporated in a core monitoring system, can be used for on-line continuous monitoring of the negative reactivity of a sub-critical core.

3. Pg. 5, 1st paragraph. Please provide clear and precise definitions of [

]a,c.

[

]a,c

4. Pg. 5, last paragraph. Please provide definition/explanation of the [
]a,c alluded to in the same paragraph.

[

]a,c

5. Pg. 6, last paragraph needs further discussion at the site.

[

]a,c

6. On page 7, the 5th paragraph alludes to [

]^{a,c} stated anywhere. Please provide clarifications.

[ ]^{a,c} (2-6)

[

]^{a,c}

[

]^{a,c}

[ ]^{a,c} (2-6)

[

]^{a,c}

7. For chapter 3, Methodology, please provide two examples demonstrating the ten steps of the methodology. Be specific, demonstrating each and sub-step along the way.

   All the figures in Chapter 4 of the Topical Report are examples.

   Attachment B, Abstract for Sub-Critical Rod Worth Measurement (SRWM) Process is provided to describe the ten steps of the methodology.

8. Table 4-2 of the same page, tabulates some of the statistics associated with the SCICR methodology. Please provide the data base for the tabulated results and the associated equations for each of the headings.

   As an example, the data base for the cases of Plant 6 Cycle 10 and Plant 7 Cycle 25 is provided on the following two pages.

a,b, c

a, b, c

9. (a) The 1^{st}. paragraph on page 22 attempts to summarize the results in Table 4-2. The same paragraph also alludes to the [ ]^{a,c} discrepancy/[ ]^{a,c} presented in the table, as being due to very low detector signal. Is it proposed that the SCICR should not be used below a defined detector signal??

(b) The next paragraph of the same page also alludes to short comings associated with the SCICR methodology. Please be prepared to provide qualitative and quantitative technical justification as to why conditions should not be imposed on the SCICR methodology (particularly regarding rod worth) to insure that detector signal is of high quality at all time when this methodology is applied.

The following answer is for both (a) and (b).

The quality of low signal detector data depends on the signal acquisition system at site. Instead of imposing a specific cut-off limit on the detector signal level, its impact on the SCICR results is assessed via the quality parameters of the SCICR analysis result. Part of the SCICR methodology is [

]a,c The overall global fit is measured by the RMS value of the fit. Local fit quality is measured by the maximum deviation of individual data points to the linear fit. These two indicators are traditional statistical parameters. They can measure the quality of the data base from the statistics perspective, such as if the data base is large enough, what kind of data distribution and what is the associated uncertainty in estimators. However, statistical parameters, by the nature of randomness of statistics, can not effectively determine and quantify systematic biases in a core model, because a systematic bias is by definition not random.

To identify and quantify potential systematic biases, specific problem dependent bias modes based on the physics characteristics of problems at hand have to be assumed and tested. This is problem dependent and there is no standard text book solution to it. For this purpose, Chapter 5 of the Topical Report is devoted to the sensitivity analysis of SCICR to reactivity bias due to errors in control rod constants or solvable boron concentration. To reflect the major characteristics of reactivity bias, the [

]a,c

The key of the SCICR methodology is [

]a,c

[

]a,c

[

]^{a,c}

10. (a) Please provide clarification to the 3rd. paragraph on page 26 regarding the subject of "bias".

See the answer to question 11.

(b) The last paragraph on page 27 need additional clarification and description. Please provide it, and be prepared to discuss it further.

See the answer to question 11.

(c) Please walk through the entries of one line (say, last line in the table) of Tables 5.3 and 5.4 and elaborate on the conclusions.

We already did the walk-through satisfactorily during the site visit by the NRC Staff.

11. (a) The 2nd. paragraph under Section 5.3 refers to "contaminated" spatial correction factors. What are contaminated spatial correction factors??

(b) This paragraph also talks about comparing the adjusted ICRR to obtain SCICR and comparing it to the "true" total rod worth (obtained by the conventual's way) to determine the sensitivity of the SCICR calculation. Is this correct? Please clarify.

(c) This paragraph refers to "biased SCF". What is meant by this statement which in turn translates into a "Masking effect"?

The following answer covers all the parts in questions 10 and 11.

[

]^{a,c}

[

]a,c

Statistical Issues
Page 28,Table 5-1.

Last column is labeled as [ ]a,c, but the calculations appeared to be only [ ]a,c. Please explain. Also elaborate on the interpretation of this table.

The last column of Table 5-1 is [

]a,c

As indicated in the last paragraph of page 27, Table 5-1 presents the sensitivity of the SCICR measured total rod worth with respect to any possible boron concentration bias in the actual core. Although the [ ]a,c bias in core reactivity is quite significant, however, it changes the predicted total rod worth by only [ ]a,c. But the impact of this bias on the SCF and consequently on the SCICR measured total rod worth can be much larger than [ ]a,c for some cases. The impact, when appreciable, is such that the observed discrepancy between the measured and predicted appears enlarged from [ ]a,c. So there is an anti-masking effect that reveals the model bias and magnifies the discrepancy between prediction and measurement, which is conservative.

Issues to be discussed

1. This first paragraph on page 33 asserts that the SCICR methodology should be applicable to any subcritical core. The staff presumes that Westinghouse means Specific Westinghouse fleet plants only?? Application of SCIRC to plants other than Westinghouse will need to be discussed.

   Westinghouse intended that SCICR methodology can be applied to any core for subcritical reactivity measurement as long as the core can be modeled and licensed with Westinghouse APA core design code system. However, precautionary steps will be taken for first time SCICR application on the plant type that is not included in the topical. A pre-trial of SCICR application will be performed on the previous cycle to demonstrate the applicability of SCICR method. Westinghouse will then notify the NRC of the results and the date of the intended first application of SCICR methodology at the plant.

2. The application of SCICR to the 4 specified measurements (4 bullets on page 33) will need to be discussed.

   The response provided to question 2 in the previous section applies here as well.

RAI from EEIB-I&C

1. The traditional objective of NI for a subcritical core is to verify that both core activity and the rate of change of core activity do not exceed certain predetermined limits. The proposed application requires accurate measurement of activity, rather than a simple assessment relative to a bounding value. Conformance to a bounding value requires only that the measurement be conservative in the sense of not underestimating core activity: the proposed application also requires that the activity not be *over*-estimated. Show that the types of instruments used for this function, and the calibration and maintenance of these instruments, is suitable for obtaining measurements of adequate accuracy.

   The Source Range detectors used to collect the information on changes in the core neutron population in Pressurized Water Reactors (PWR) are carefully designed to allow changes in the sub-critical core reactivity to be monitored to some degree. In order to ensure that this capability is maintained, the plant Tech Specs (typically SR 3.3.1.11 in Westinghouse Standard Tech Specs) imposes requirements for periodic verification of proper detector system calibration and operation. The required operability verification includes measures to ensure that the signal measured by the Source Range detector signal processing system is not significantly affected by non-neutron induced signal components. The Source Range channel calibration performed as part of every refueling outage includes the following items:

   a. High voltage plateau determination and setting the detector operating voltage
   b. Pulse signal preamplifier calibration
   c. Detector upper and lower pulse height discriminator settings
   d. Scaler-timer calibration
   e. Isolated pulse-rate signal output calibration (for plant computer, etc..)

   Once the required channel calibration has been completed, the continued proper operation of the Source Range detectors in verified as required by additional plant Tech Specs (typically SR 3.3.1.1, 3.3.1.8, and 3.3.1.7 in the Westinghouse Standard Tech Specs).

   Just prior to using the Source Range detector signals for reactivity change monitoring purposes, it is necessary to establish that the measured signal characteristics from each detector used in the monitoring process is behaving in a fashion consistent with expectations. This is typically accomplished using a variant of a Chi-Squared statistics measurement technique. The basic Chi-Square statistical evaluation for the Source Range detector signals is accomplished by comparing the measured standard deviation of a set of measured count rate data with the theoretical standard deviation derived from the mean value of the sample population. The probability of a given relationship between the two standard deviations occurring if the detector is measuring the local neutron population correctly can easily be established using standard statistical methods. The successful conclusion of this type of evaluation is a required initial condition for monitoring core alterations and subsequently for the SRWM methodology. Only once the statistical reliability of the signals produced by the Source Range detectors is demonstrated can the reactivity change measurement process proceed.

The adequacy of the instrumentation used to acquire the core response data has also been demonstrated. The plant data used to populate the information contained in the SCICR Topical Report was obtained from Source Range detector systems at many different plants. No special data acquisition techniques or instrument calibration was performed to obtain the data used to develop the results presented in the SCICR Topical Report. The application of the additional data validation checks that are part of the setup process for the SRWM method will provide an added layer of data quality assurance.

2. As a core approaches criticality, the steady-state core activity becomes high relative to the baseline activity but the core response time also becomes long. The relationship between inverse count rate and degree of subcriticality (upon which the proposed application is based) presumes steady-state, which can, under some circumstances, take the better part of an hour to achieve. The effect of insufficient dwell time during power ascension will always be an underestimation of core steady-state activity and thus an overestimation of the degree of subcriticality. Show that the process for obtaining the required measurements will ensure adequate dwell time at each system state.

The amount of time required to achieve a steady-state neutron population in a sub-critical reactor is a function of the value of K_{eff}. As the value of K_{eff} approaches 1.00000, the time to achieve a steady-state condition increases exponentially. This effect is illustrated in Figure 1. The core reactivity conditions required to allow the Control and Shutdown banks to be completely withdrawn in Operating Mode 3 without violating the required reactor shutdown margin ensure that the reactor boron concentration is sufficient to ensure that the value of K_{eff} is less than [ ]^{a,c}. This represents the maximum value of K_{eff} that will be present during the SRWM measurement process. As can be seen from the information provided on Figure 1, the time needed to wait for steady-state conditions is of the order of [ ]^{a,c}.

The SRWM data collection process includes an evaluation of reactor startup rate. This feature is specifically designed to ensure steady-state conditions are present before the collection of the Source Range detector data begins. Data collection will not begin [ ]^{a,c}.

[ ]a, b, c

3. The inverse count rate is a measure of the observed time between detected fission events, which is a purely stochastic process. Determination of the inverse count rate therefore requires integration over many events. The required integration time increases as the event rate decreases and as the tolerable degree of uncertainty decreases. If the core activity has been increasing during part of the integration time (whether due to the inherent lag in core activity level or due to on-going change in poison concentration, for example), then the inverse count rate determination will include the influence of the artificially low count rate and the inverse count rate will therefore be overestimated. As a result, core subcriticality will be overestimated. Staff observes that the inverse count rate could be within an order of magnitude of the core time constant, which could result in an integration time comparable to the time constant, and so this effect, although small, is not obviously negligible. Show that the time required to obtain an adequate measure of the inverse count rate is sufficiently short that the measurement will not be adversely affected by the dynamic characteristics of the core, and show that the procedure for implementing the proposed application ensures adequate consideration of such time-related effects.

As noted in the response to Question 2, the time required to achieve steady-state conditions during the SRWM processes is of the order of [ ]a,c. The startup rate verification that occurs prior to the beginning of data acquisition following the establishing of each prescribed Control and Shutdown Bank configuration ensures steady-state conditions are reached. The SRWM measurement process requires that the reactor coolant system boron concentration, including the pressurizer boron concentration, is within pre-established limits. [

]a,c

[

]a,c

4. Under subcritical conditions, the total core free neutron population will be proportional to the static source contribution "S". The deeper the degree of subcriticality, the lower the multiplier and the greater the relative fraction of "static-source" neutrons. Because S-neutrons are detected differently from those neutrons which result from fuel fission, the observed count rate will depend upon the relative populations from these two sources. The topical report indicates that the S-neutrons are not counted at all, because they never get out of the core. If this is true, then the relative population is not important. But if some small fraction do indeed get detected, then the subcriticality estimate will be affected in some non-trivial way. Show that the bounding value of the detected fraction of the S-neutrons is indeed sufficiently low that they can be ignored under all conditions under which the proposed application could be used.

   The answer to this question is already provided, to a large extent, by the answers to Questions 3 and 6 in the first section of this RAI. Please refer to the discussions there.

   [

   ]a,c

5. It is credible that signals from the neutron detection system will be influenced by noise such as the "detection" of extraneous phenomena by the sensors or the associated electronics. Such noise would tend to increase the estimated count rate. At low core activity, it is credible that such false detections could compromise the observed count rate and thus influence the estimated degree of subcriticality. Describe the characteristics of anticipated noise. For example, what are the mean and standard deviation of the time between noise events, and how do they affect the inverse count rate measurement? What other characteristics should be considered, and what values are expected? How do these compare with the similar

characteristics of the actual fission process? Should application of the proposed method be limited in consideration of noise?

[

]a,c

Response to NRC Request for Additional Information on WCAP-16260-P

Station Nuclear Engineer (SNE) Course

Reactor Engineering Surveillances

a, c

[ ]

Westinghouse Nuclear Services Division
Plant Operations & Evaluation

Reactor Engineering Surveillances
TRAINING OBJECTIVES

a, c

Terminal Objectives:

Reactor Engineering Surveillances
PARTIAL CORE FLUX MAP (PCFM)

OBJECTIVE:

a, c

Reactor Engineering Surveillances
PARTIAL CORE FLUX MAP (PCFM)

a, c

Reactor Engineering Surveillances
PARTIAL CORE FLUX MAP (PCFM)

PRECAUTIONS:

[ ] a, c

Reactor Engineering Surveillances

PCFM TRACE ANALYSIS FOR RCCA ALIGNMENT

a, b, c

[ ]

Reactor Engineering Surveillances

PCFM TRACE ANALYSIS FOR RCCA ALIGNMENT

a, b, c

[ ]

Reactor Engineering Surveillances
PARTIAL CORE FLUX MAP (PCFM) FOR QPTR

BASES & POSITION STATEMENT

a, c

[ ]

Reactor Engineering Surveillances
PARTIAL CORE FLUX MAP (PCFM) FOR QPTR

OBJECTIVE:

a, c

Reactor Engineering Surveillances
PARTIAL CORE FLUX MAP (PCFM) FOR QPTR

METHOD:

a, c

Reactor Engineering Surveillances

PARTIAL CORE FLUX MAP (PCFM) FOR QPTR

PRECAUTIONS:

a, c

[ ]

Reactor Engineering Surveillances
PARTIAL CORE FLUX MAP (PCFM) FOR QPTR

OTHER CONSIDERATIONS: (continued)

a, c

Reactor Engineering Surveillances
APPROACH TO CRITICALITY

Reactivity Management Principles:

a, c

Reactor Engineering Surveillances
APPROACH TO CRITICALITY

Reactivity Management Principles:

a, c

[ ]

Reactor Engineering Surveillances
APPROACH TO CRITICALITY

Reactivity Management Principles:

a, c

[ ]

Reactor Engineering Surveillances
APPROACH TO CRITICALITY

Reactivity Management Principles:

a, c

Reactor Engineering Surveillances
APPROACH TO CRITICALITY

Reactivity Management Principles:

a, c

[ ]

Reactor Engineering Surveillances
APPROACH TO CRITICALITY

Reactivity Management Principles:

a, c

Reactor Engineering Surveillances
APPROACH TO CRITICALITY

Reactivity Management Principles:

[ ]a, c

Reactor Engineering Surveillances
APPROACH TO CRITICALITY

Criticality Methods:

a, c

[ ]

Reactor Engineering Surveillances
APPROACH TO CRITICALITY

Criticality Methods:

a, c

[ ]

Reactor Engineering Surveillances
APPROACH TO CRITICALITY

Criticality Methods:

a, c

Reactor Engineering Surveillances
APPROACH TO CRITICALITY

Criticality Methods:

a, c

Reactor Engineering Surveillances
APPROACH TO CRITICALITY

Criticality Methods:

a, c

[ ]

Reactor Engineering Surveillances
APPROACH TO CRITICALITY

Criticality Methods:

a, c

Reactor Engineering Surveillances
APPROACH TO CRITICALITY

Criticality Methods:

a, c

Reactor Engineering Surveillances

APPROACH TO CRITICALITY

Source Range ICRR Response During Rod Pulls at BOL

a, b, c

Reactor Engineering Surveillances
APPROACH TO CRITICALITY

a, b, c

[ ]

Reactor Engineering Surveillances
APPROACH TO CRITICALITY

a, b, c

Reactor Engineering Surveillances
APPROACH TO CRITICALITY

Criticality Methods

a, c

Reactor Engineering Surveillances
APPROACH TO CRITICALITY

a, b, c

Average Source Range Detector Response During Control Bank Withdrawal

[ ]

Reactor Engineering Surveillances
APPROACH TO CRITICALITY

a, c

Criticality Methods

Reactor Engineering Surveillances
APPROACH TO CRITICALITY

Criticality Methods

a, c

[ ]

Reactor Engineering Surveillances

APPROACH TO CRITICALITY

a, b, c

[ ]

Station Nuclear Engineer (SNE) Course

Reactor Engineering Surveillances

END OF PRESENTATION

ABSTRACT
Sub-Critical Rod Worth Measurement (SRWM) Process

Response to NRC Request for Additional Information on WCAP-16260-P

DISCLAMER: The following description of the SRWM process is subject to change as experience is gained during performance of the measurements.

[ ] a, c

ABSTRACT
Sub-Critical Rod Worth Measurement (SRWM) Process

Outline of Site SCPT/SRWM Testing Condition Requirements

Plant Conditions:

[ ] a, c

ABSTRACT

Sub-Critical Rod Worth Measurement (SRWM) Process

a, c

ABSTRACT

Sub-Critical Rod Worth Measurement (SRWM) Process

a, c

ABSTRACT

Sub-Critical Rod Worth Measurement (SRWM) Process

a, c

ABSTRACT

Sub-Critical Rod Worth Measurement (SRWM) Process

a, c

ABSTRACT
Sub-Critical Rod Worth Measurement (SRWM) Process

a, c