

Jeffrey B. Archie
Vice President, Nuclear Operations
803.345.4214



September 3, 2004
RC-04-0147

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

Dear Sir / Madam:

Subject: VIRGIL C. SUMMER NUCLEAR STATION
DOCKET NO. 50-395
OPERATING LICENSE NO. NPF-12
REQUEST FOR EXEMPTION FOR CLADDING MATERIAL
SPECIFIED IN 10CFR50.44, 10CFR50.46 and 10CFR 50 APPENDIX K

Pursuant to 10CFR50.12, South Carolina Electric & Gas Company (SCE&G) requests Nuclear Regulatory Commission (NRC) approval of an exemption to allow use of a different fuel cladding material as an alternative to that specified in the Code of Federal Regulations. The affected regulations are:

- 10CFR50.44, "Standards for Combustible Gas Control in Light-Water-Cooled Power Reactors"
- 10CFR50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Nuclear Power Reactors"
- 10CFR50 Appendix K, "ECCS Evaluation Models"

The regulations, as written, presume Zircaloy or ZIRLO™ is used as fuel rod cladding material. In order to use a different cladding material, a limited exemption to these regulations is needed.

SCE&G intends to use up to four lead test assemblies (LTAs) containing fuel rods clad with two different cladding materials. There are two separate exemptions for the two clad materials being used. The exemption attachments to this letter provide justification for the acceptability of the two cladding materials.

SCE&G plans to insert the LTAs in non-limiting core locations during the V. C. Summer Nuclear Station (VCSNS) refueling outage scheduled to begin in spring 2005. All operating parameters for the LTAs will remain within the bounds of the licensed limits.

Post-irradiation examination of the LTAs currently planned include the following: 1) After one operating cycle the LTAs will undergo a limited post irradiation exam including profilometry, peripheral rod oxide and growth, and visual examinations. These examinations will be conducted during the core off-load window of refueling outage 16. 2) Oxide

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measurements and a visual examination will be performed after the second cycle of operation. 3) Further detailed examinations will be performed after their final cycle of operation. Oxidation limits of less than 100 microns are expected.

To support fuel procurement and delivery for the VCSNS spring 2005 refueling outage, SCE&G requests that review and approval of these exemption requests be completed by November 30, 2004.

As demonstrated in the attachment to this letter, the requested exemption:

- Is authorized by law;
- Presents no undue risk to public health and safety;
- Is consistent with common defense and security; and
- Is supported by special circumstances.

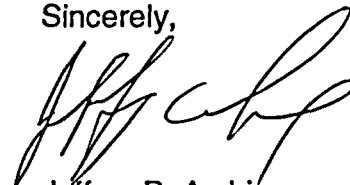
Enclosed is a Westinghouse authorization letter, CAW-04-1880, with accompanying affidavit, proprietary information notice, and copyright notice, and the technical justifications for each exemption request. There are two versions of the technical justifications for each exemption request: the first is proprietary and the second is non-proprietary.

Classification of information as "proprietary" to Westinghouse Electric Company LLC is supported by the affidavit signed by Westinghouse, the owner of the information. The affidavit 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 Section 2.390 of the Commission's regulations. Accordingly, SCE&G requests that information 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 the copyright or proprietary aspects of the items listed above or the supporting Westinghouse affidavit should reference CAW-04-1880 and be addressed to J. A. Gresham, Manager of Regulatory Compliance and Plant Licensing, Westinghouse Electric Company LLC, P. O. Box 355, Pittsburgh, Pennsylvania 15230-0355.

If there are any questions, please contact Mr. Ron Clary at 803-345-4757.

Sincerely,



Jeffrey B. Archie

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Attachments:

1. Application for Withholding Proprietary Information from Public Disclosure, with Affidavit, Proprietary Information Notice, and Copyright Notice (CAW-04-1880)
2. Request for Exemption from the Provisions of 10 CFR 50.44, 10 CFR 50.46, and 10 CFR 50 Appendix K for Four Lead Test Assemblies (LTAs) with the First Clad Material and Supporting Justification (Proprietary), June 2004
3. Request for Exemption from the Provisions of 10 CFR 50.44, 10 CFR 50.46, and 10 CFR 50 Appendix K for Four Lead Test Assemblies (LTAs) with the First Clad Material and Supporting Justification (Non-Proprietary), June 2004
4. Request for Exemption from the Provisions of 10 CFR 50.44, 10 CFR 50.46, and 10 CFR 50 Appendix K for Select Rods in Two Lead Test Assemblies (LTAs) with the Second Clad Material and Supporting Justification (Proprietary), June 2004
5. Request for Exemption from the Provisions of 10 CFR 50.44, 10 CFR 50.46, and 10 CFR 50 Appendix K for Select Rods in Two Lead Test Assemblies (LTAs) with the Second Clad Material and Supporting Justification (Non-Proprietary), June 2004

AMM/JBA

c: N. O. Lorick
N. S. Carns
T. G. Eppink (w/o attachment)
R. J. White
W. D. Travers
K. R. Cotton
NRC Resident Inspector
K. M. Sutton
NSRC
RTS (LTI-38)
File (810.32)
DMS (RC-04-0147)

ATTACHMENT 1

**Application for Withholding Proprietary Information from
Public Disclosure, with Affidavit, Proprietary Information Notice, and
Copyright Notice (CAW-04-1880)**



Westinghouse Electric Company
Nuclear Services
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USA

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

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Our ref: CAW-04-1880

August 18, 2004

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: V. C. Summer Nuclear Station, Docket No. 50-395, "Request for Exemption for Cladding Material Specified in 10 CFR 50.44, 10 CFR 50.46 and 10 CFR 50 Appendix K" (Proprietary)

The proprietary information for which withholding is being requested in the above-referenced report is further identified in Affidavit CAW-04-1880 signed by the owner of the proprietary information, Westinghouse Electric Company LLC. 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.

Accordingly, this letter authorizes the utilization of the accompanying affidavit by South Carolina Electric and Gas Company.

Correspondence with respect to the proprietary aspects of the application for withholding or the Westinghouse affidavit should reference this letter, CAW-04-1880 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', written over a horizontal line.

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

Enclosures

cc: K. Cotton/NRR
F. M. Akstulewicz/NRR
W. A. Macon Jr./NRR
E. S. Peyton/NRR

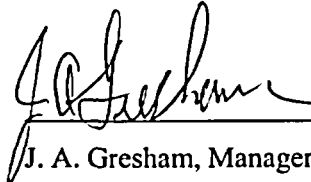
AFFIDAVIT

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:

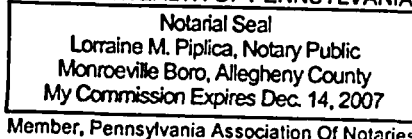

J. A. Gresham, Manager

Regulatory Compliance and Plant Licensing

Sworn to and subscribed
before me this 18th day
of August, 2004


Notary Public

COMMONWEALTH OF PENNSYLVANIA



- (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 V. C. Summer Nuclear Station, Docket No. 50-395, "Request for Exemption for Cladding Material Specified in 10 CFR 50.44, 10 CFR 50.46 and 10 CFR 50 Appendix K" (Proprietary), for review and approval, being transmitted by the South Carolina Electric and Gas Company letter and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted by Westinghouse for V. C. Summer Nuclear Station is in support of an exemption request for cladding material (Proprietary).

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

- (a) Provide technical information in support of exemption request.
- (b) Assist customer to obtain license change.

Further this information has substantial commercial value as follows:

- (a) Westinghouse can use this information to further enhance their licensing position with their competitors.
- (b) 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 analyses 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).

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 2.390 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

ATTACHMENT 3

**Request for Exemption from the Provisions of 10 CFR 50.44,
10 CFR 50.46, and 10 CFR 50 Appendix K for Four Lead
Test Assemblies (LTAs) with the First Clad Material
and Supporting Justification
(Non-Proprietary), August 2004**

V. C. Summer Nuclear Station

Request for Exemption from the Provisions of 10 CFR 50.44, 10 CFR 50.46, and 10 CFR 50 Appendix K for Four Lead Test Assemblies (LTAs) with the First Clad Material and Supporting Justification (Non-Proprietary), August 2004

[Proprietary information is enclosed in brackets. Superscripts a, b, and c refer to Affidavit paragraphs 4(ii)(a), 4(ii)(b), and 4(ii)(c), respectively.]

PURPOSE

This attachment provides supporting justification pursuant to 10 CFR 50.12 for an exemption request to allow use of Optimized ZIRLO™ Lead Test Assemblies at the V. C. Summer Nuclear Station.

10 CFR 50.44, "Standards for combustible gas control system in light-water-cooled power reactor," references analysis for water-metal reactions. This relates back to the use of the Baker-Just equation which assumes use of a zirconium alloy different than the Optimized ZIRLO™ used in Lead Test Assemblies. 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," specifically refers to fuel with Zircaloy or ZIRLO™ cladding. 10 CFR 50 Appendix K, "ECCS Evaluation Models," paragraph I.A.5, references an analysis that utilizes the Baker-Just equation which assumes use of a zirconium alloy different than the Optimized ZIRLO™ used in Lead Test Assemblies. Therefore, 10 CFR 50.44, 10 CFR 50.46, and 10 CFR 50 Appendix K do not allow for use of the proposed Lead Test Assemblies because the concentration of tin in the Optimized ZIRLO™ is nominally []^{a, c}. This reduced tin concentration is below the lower bound (0.80%) of the licensed limit of ZIRLO™ as specified in Appendix A of WCAP-12610-P-A, "VANTAGE+ Fuel Assembly Reference Core Report," dated April 1995.

BACKGROUND

As the nuclear industry pursues longer operating cycles with increased fuel discharge burnups and more aggressive fuel management, corrosion performance requirements for nuclear fuel cladding become more demanding. In addition, fuel rod internal pressures (resulting from increased fuel duty, use of integral fuel burnable absorbers (IFBAs) and corrosion/temperature feedback effects) have become more limiting with respect to fuel rod design criteria.

Available industry data from the American Nuclear Society, the International Atomic Energy Agency, the Electric Power Research Institute, and Westinghouse indicate the corrosion resistance improves for cladding with a lower tin content. The optimum tin concentration

provides a reduced corrosion rate while maintaining the benefits of mechanical strengthening and resistance to accelerated corrosion from abnormal chemistry conditions. Reducing the associated corrosion buildup and thus minimizing temperature feedback effects obtains additional margin to fuel rod internal pressure design criteria.

To meet these needs, Westinghouse Electric Company developed a lead test assembly program in cooperation with the V. C. Summer Nuclear Station. One element of the program is use of Optimized ZIRLO™ cladding. The Byron Station, Catawba, Calvert Cliffs, and Millstone have received NRC approval of an exemption with respect to 10 CFR 50.44, 10 CFR 50.46, and 10 CFR 50 Appendix K to allow use of Optimized ZIRLO™ lead test assemblies. Westinghouse and the V. C. Summer Nuclear Station intend to include Optimized ZIRLO™ in four lead test assemblies to be initially inserted into the V. C. Summer Nuclear Station during the refueling outage in Spring 2005. The V. C. Summer Nuclear Station lead test assemblies will have the same nominal tin concentration of []^{a, c} as that used for Catawba, Calvert Cliffs and Millstone, compared to the nominal tin concentration of []^{a, c} used for Byron.

The V. C. Summer Nuclear Station Technical Specifications, Section 5.3.1, "Fuel Assemblies," specifies that each fuel assembly shall consist of Zircaloy-4 or ZIRLO™-clad fuel rods. Since the Optimized ZIRLO™ cladding material has a tin concentration less than that currently licensed in WCAP-12610-P-A, an exemption from 10 CFR 50.44, 10 CFR 50.46, and 10 CFR 50 Appendix K is required.

Westinghouse has determined []^{a, b, c}. Therefore, Westinghouse will perform a LOCA evaluation of the V. C. Summer Nuclear Station lead test assemblies using existing LOCA methods prior to implementation to ensure they are bounded by the current analysis of record.

The V. C. Summer Nuclear Station Technical Specifications have sufficient flexibility as written to allow use of Optimized ZIRLO™; therefore, no additional changes to the Technical Specifications are necessary to allow use of the lead test assemblies.

TECHNICAL JUSTIFICATION

The V. C. Summer Nuclear Station and Westinghouse will jointly perform evaluations of the lead test assemblies during the program development phase. These evaluations will include both testing and analysis, and will address all aspects of safety, including mechanical, neutronic, thermal-hydraulic, transient, and loss-of-coolant accident analyses, and will address the design feature changes for the lead test assemblies. The evaluations pertinent to the Optimized ZIRLO™ are as follows:

- The V. C. Summer Nuclear Station lead test assemblies will be evaluated mechanically with respect to criteria governing acceptability considering its mechanical design. The same design methods utilized for the current VANTAGE + fuel will be used. No new or altered design limits for purposes of 10 CFR 50, Appendix A, General Design Criterion 10, "Reactor Design," need to be applied or are required for this program. A fuel rod design evaluation will be performed for the V. C. Summer Nuclear Station lead test assemblies. The objective of this evaluation will be to show that all fuel rod design criteria (i.e., specified acceptable fuel design limits as required by GDC 10) would be met.

With respect to the mechanical evaluations, inclusive of material properties, three specific areas would be potentially impacted by use of Optimized ZIRLO™. These areas are:

▪ **Material Properties**

[

]

a, b, c

a, b, c

[

▪ Corrosion

[

a, b, c

[

▪ Thermal Creep

[

a, b, c

[

The design criteria will be confirmed in the cycle-specific reload safety evaluations.

- Impact of the lead test assemblies on the nuclear design has been evaluated. The standard reload methodologies can be used to model the lead test assemblies. The features of the lead test assemblies do not challenge the validity of the standard methodologies. The V. C. Summer Nuclear Station will use the standard reload methodologies for reloads containing the lead test assemblies. The lead test assemblies will not be placed in limiting core locations.
- Thermal-hydraulic, safety analysis evaluations of loss-of-coolant accident (LOCA) and non-LOCA transients will be performed for the lead test assemblies. These evaluations are to confirm that the lead test assemblies are bounded by the current analyses of record.

JUSTIFICATION OF EXEMPTION

10 CFR 50.12, "Specific exemptions," states that the Nuclear Regulatory Commission may grant exemptions from the requirements of this part provided three conditions are met:

- The exemption is authorized by law;
- The exemption will not present an undue risk to the health and safety of the public;
- The exemption is consistent with the common defense and security.

In addition, the Commission will not consider granting an exemption unless special circumstances are present.

The requested exemption to allow use of reduced-tin ZIRLO™ cladding material rather than Zircaloy or ZIRLO™ in the lead test assemblies satisfies these criteria as described below:

1. This exemption is authorized by law.

Selection of a specific cladding material in 10 CFR 50.46, and implied in 10 CFR 50.44 and 10 CFR 50 Appendix K was at the discretion of the Commission consistent with its statutory authority. No statute required the NRC to adopt this specification. Additionally, the NRC has the authority under Section 50.12 to grant exemptions from the requirements of Part 50 with provision of proper justification. Furthermore, this request does not seek an exemption from the acceptance and analytical criteria of 10 CFR 50.44, 10 CFR 50.46, and 10 CFR 50 Appendix K. The request is intended only to allow application of these regulations to reduced-tin ZIRLO™ cladding material.

2. This exemption will not present an undue risk to public health and safety.

The lead test assembly safety evaluation will ensure that these acceptance criteria are met following insertion of the assemblies containing Optimized ZIRLO™ material. Fuel assemblies using Optimized ZIRLO™ cladding will be evaluated using NRC-approved analytical methods and will address the changes in the cladding material properties. The safety analysis for the V. C. Summer Nuclear Station is supported by the applicable technical specifications. The V. C. Summer Nuclear Station reload cores containing Optimized ZIRLO™ cladding will continue to be operated in accordance with the operating limits specified in the technical specifications. Lead test assemblies using Optimized ZIRLO™ cladding will be placed in non-limiting core locations. Therefore, this exemption will not pose an undue risk to public health and safety.

3. This exemption is consistent with common defense and security.

The exemption request is only to allow application of regulatory requirements to a slightly different cladding material. Requirements and acceptance criteria will be maintained. Special nuclear material in these assemblies will continue to be handled and controlled in accordance with approved procedures. Use of the lead test assemblies in V. C. Summer Nuclear Station will not affect plant operations and is consistent with maintaining the common defense and security.

SPECIAL CIRCUMSTANCES

10 CFR 50.12(a)(2) states that the NRC will not consider granting an exemption to the regulations unless special circumstances are present. The requested exemption meets the special circumstances of 10 CFR 50.12(a)(2)(ii) which states that, "Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule." In this particular circumstance,

application of the subject regulations is not necessary to achieve the underlying purpose of the regulations.

The underlying purpose of 10 CFR 50.44 is to ensure that there is an adequate means of controlling generated hydrogen. The hydrogen produced in a post-LOCA scenario comes from a reaction between water and zirconium. Tests performed by Westinghouse on the Optimized ZIRLO™ have demonstrated that reducing the tin content has an [

] ^{a, c} versus current ZIRLO™. Therefore, using Optimized ZIRLO™ will have no significant effect on current assessments of hydrogen gas production.

10 CFR 50.46 identifies acceptance criteria for ECCS performance at nuclear power plants. Due to similarities in the material properties of the Optimized ZIRLO™ and current ZIRLO™, the current ECCS analysis approach remains applicable and unchanged. Westinghouse will perform a LOCA evaluation of the V. C. Summer Nuclear Station lead test assemblies using existing LOCA methods prior to implementation to ensure the assemblies are bounded by the current analysis of record. Therefore, the conclusion is that the ECCS performance of the V. C. Summer Nuclear Station will not be affected by insertion of four Optimized ZIRLO™ lead test assemblies.

10 CFR 50, Appendix K, paragraph I.A.5 applies an equation of rates of energy release, hydrogen generation, and cladding oxidation from a metal-water reaction that conservatively bounds all post-LOCA scenarios. Application of the Baker-Just equation has been demonstrated to be appropriate for the Optimized ZIRLO™ alloy.

CONCLUSION

10 CFR 50.44 references analysis for water-metal reactions. This relates back to the use of the Baker-Just equation which assumes use of a zirconium alloy different than the Optimized ZIRLO™ used in Lead Test Assemblies. 10 CFR 50.46 only applies to use of fuel rods clad with Zircaloy or ZIRLO™. 10 CFR 50.46 does not apply to use of the proposed Optimized ZIRLO™ lead test assemblies because composition of tin in these fuel rods will be nominally [] ^{a, c} which is below the lower bound of the licensing basis for ZIRLO™ (i.e., 0.80%) as defined in WCAP-12610-P-A. In addition, paragraph I.A.5 of 10 CFR 50 Appendix K, "ECCS Evaluation Models," references an analysis utilizing the Baker-Just equation which assumes use of a zirconium alloy different from the Optimized ZIRLO™ used in the lead test assemblies.

In order to support optimization of the ZIRLO™ material with regard to improved corrosion resistance, an exemption from the requirements of 10 CFR 50.44, 10 CFR 50.46, and 10 CFR 50, Appendix K is requested. As required by 10 CFR 50.12, the requested exemption is authorized by law, does not present undue risk to public health and safety, and is consistent with common defense and security. Approval of this exemption request does not violate the

underlying purpose of the rule. Special circumstances do exist to justify the approval of an exemption from the subject requirements.

REFERENCES

- 1) Davidson, S. L. and Nuhfer, D. L. (Eds.), "VANTAGE + Fuel Assembly Reference Core Report," WCAP-12610-P-A, April 1995.

ATTACHMENT 5

**Request for Exemption from the Provisions of 10 CFR 50.44,
10 CFR 50.46, and 10 CFR 50 Appendix K for Select Rods in Lead
Test Assemblies (LTAs) with the Second Clad Material
and Supporting Justification
(Non-Proprietary), August 2004**

V. C. Summer Nuclear Station

Request for Exemption from the Provisions of 10 CFR 50.44, 10 CFR 50.46, and 10 CFR 50 Appendix K for Select Rods in Lead Test Assemblies (LTAs) with the Second Clad Material and Supporting Justification (Non-Proprietary), August 2004

[Proprietary information is enclosed in brackets. Superscripts a, b, and c refer to Affidavit paragraphs 4(ii)(a), 4(ii)(b), and 4(ii)(c), respectively.]

PURPOSE

This attachment provides supporting justification pursuant to 10 CFR 50.12 for an exemption request to allow use of a select number of rods clad in []^{a, c} Lead Test Assemblies at the V. C. Summer Nuclear Station.

10 CFR 50.44, "Standards for combustible gas control system in light-water-cooled power reactor," references analysis for water-metal reactions. This relates back to the use of the Baker-Just equation which assumes use of a zirconium alloy different than the []^{a, c} Lead Test Assemblies. 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," specifically refers to fuel with Zircaloy or ZIRLO™ cladding. 10 CFR 50 Appendix K, "ECCS Evaluation Models," paragraph I.A.5, references an analysis that utilizes the Baker-Just equation which assumes use of a zirconium alloy different than the []^{a, c} Lead Test Assemblies. While []^{a, c} is a variant of ZIRLO™, it does not fall within the definition of ZIRLO™ as documented in WCAP-12610-P-A/CENPD-404-P-A, Addendum 1 since it has a []^{a, c}.

BACKGROUND

As the nuclear industry pursues longer operating cycles with increased fuel discharge burnups and more aggressive fuel management (inclusive of uprates), corrosion performance requirements for nuclear fuel cladding become more demanding. Optimized ZIRLO™ was developed to meet these more demanding conditions, but in the future there will be advanced fuel designs and still higher fuel duties and discharge burnups along with potential regulatory changes that will require further advances in the cladding performance. Thus, it is important to the industry to develop even more advanced alloys for the future. With the extensive testing and lead times needed to generate data for licensing new alloys, it is critical that in-reactor testing of the advanced alloys begin now.

Available industry data from the American Nuclear Society, the International Atomic Energy Agency, the Electric Power Research Institute, and Westinghouse indicate the corrosion resistance improves for cladding with a lower tin content. In addition, developmental testing has shown that small additions of some alloying elements will further improve the corrosion resistance, microstructure and mechanical properties of the cladding. As such, Westinghouse is continuing to focus on improved cladding materials and is [

provide additional margin for fuel rod internal pressures (resulting from the increased fuel duty, use of integral fuel burnable absorbers (IFBAs) and corrosion/temperature feedback effects) and reduced corrosion/improved microstructure to enhance margins for long term storage and transient analyses.

To meet these needs, Westinghouse Electric Company has developed a lead test assembly program in cooperation with the V. C. Summer Nuclear Station. One element of the program is use of Optimized ZIRLO™ cladding (refer to the exemption request in Attachments 2 and 3). A second element, as addressed in Attachment 4 and 5, is the use of [

] ^{a, c} LTAs. The [

$\gamma^{a,c}$ are shown in Table 1.

Table 1

a, b, c

It is planned that []^{a, c} LTAs, to be placed into the V. C. Summer Nuclear Station core during the spring 2005 reload, will include []

]^{a, c}. All four LTAs will be placed in non-limiting core locations.

The rationale for setting the number of [

] ^{a, c}.

[

] ^{a, c} well within the Technical Specification limits for doses and in all cases, core coolable geometry would be maintained.

The V. C. Summer Nuclear Station Technical Specifications, Section 5.3.1, "Fuel Assemblies," specifies that each fuel assembly shall consist of Zircaloy-4 or ZIRLO™-clad fuel rods. Since the [] ^{a, c} cladding material is different than either Zircaloy-4 or ZIRLO™, an exemption from 10 CFR 50.44, 10 CFR 50.46, and 10 CFR 50 Appendix K is required.

The V. C. Summer Nuclear Station Technical Specifications have sufficient flexibility as written to allow use of the [] ^{a, c} LTAs; therefore, no additional changes to the Technical Specifications are necessary to allow use of the lead test assemblies.

TECHNICAL JUSTIFICATION

The V. C. Summer Nuclear Station and Westinghouse will jointly perform evaluations of the LTAs during the program development phase. These evaluations will include both testing and analysis and will address all aspects of safety including mechanical, nuclear, and thermal-hydraulic design, and transient and loss-of-coolant accident analyses.

- Mechanical evaluations (including fuel rod design) will be completed to demonstrate that the pertinent design criteria are satisfied. No new or altered design limits for purposes of 10 CFR 50, Appendix A, General Design Criterion 10, "Reactor Design" are required for this program. With respect to the mechanical evaluations, the three primary areas that will be impacted by the use of advanced alloy cladding are (A) material properties, (B) corrosion, and (C) thermal creep.

(A) Material Properties:

[

a, b, c
]

(B) Corrosion:

[

a, b, c
]

(C) Thermal Creep:

[

a, b, c
]

- Nuclear design evaluations addressing the LTAs will be completed as part of the final LTA evaluation. The standard reload methodologies are considered to be applicable to the advanced cladding alloys and will be used to evaluate the LTA design and complete the reload safety evaluation. The nuclear design evaluations will also confirm that the LTAs are placed in non-limiting core locations.
- Thermal-hydraulic, LOCA, and non-LOCA evaluations addressing the LTAs will be completed as part of the final LTA evaluation. These evaluations will confirm that the LTAs are bounded by the current analyses of record.

JUSTIFICATION OF EXEMPTION

10 CFR 50.12, "Specific exemptions," states that the Nuclear Regulatory Commission may grant exemptions from the requirements of this part provided three conditions are met:

- The exemption is authorized by law;
- The exemption will not present an undue risk to the health and safety of the public;
- The exemption is consistent with the common defense and security.

In addition, the Commission will not consider granting an exemption unless special circumstances are present.

The requested exemption to allow use of []^{a, c} cladding material rather than Zircaloy or ZIRLO™ in the lead test assemblies satisfies these criteria as described below:

1. This exemption is authorized by law.

Selection of a specific cladding material in 10 CFR 50.46, and implied in 10 CFR 50.44 and 10 CFR 50 Appendix K was at the discretion of the Commission consistent with its statutory authority. No statute required the NRC to adopt this specification. Additionally, the NRC has the authority under Section 50.12 to grant exemptions from the requirements of Part 50 with provision of proper justification. Furthermore, this request does not seek an exemption from the acceptance and analytical criteria of 10 CFR 50.44, 10 CFR 50.46, and 10 CFR 50 Appendix K. The request is intended only to allow application of these regulations to []^{a, c} cladding material.

2. This exemption will not present an undue risk to public health and safety.

The lead test assembly safety evaluation will ensure that these acceptance criteria are met following insertion of the assemblies containing []^{a, c} material. Fuel assemblies using []^{a, c} cladding will be evaluated using NRC-approved analytical methods and will address the changes in the cladding material properties. The safety analysis for the V. C. Summer Nuclear Station is supported by the applicable technical specifications. The V. C. Summer Nuclear Station reload cores containing []^{a, c} cladding will continue to be operated in accordance with the operating limits specified in the technical specifications. Lead test assemblies using []^{a, c} cladding will be placed in non-limiting core locations. Therefore, this exemption will not pose an undue risk to public health and safety.

3. This exemption is consistent with common defense and security.

The exemption request is only to allow application of regulatory requirements to a variant cladding material. Requirements and acceptance criteria will be maintained. Special nuclear material in these assemblies will continue to be handled and controlled in accordance with approved procedures. Use of the lead test assemblies in V. C. Summer Nuclear Station will not affect plant operations and is consistent with maintaining the common defense and security.

SPECIAL CIRCUMSTANCES

10 CFR 50.12(a)(2) states that the NRC will not consider granting an exemption to the regulations unless special circumstances are present. The requested exemption meets the special circumstances of 10 CFR 50.12(a)(2)(ii) which states that, "Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule." In this particular circumstance, application of the subject regulations is not necessary to achieve the underlying purpose of the regulations.

The underlying purpose of 10 CFR 50.44 is to ensure that there is an adequate means of controlling generated hydrogen. The hydrogen produced in a post-LOCA scenario comes from a reaction between water and zirconium. [

assessments of hydrogen gas production.]^{a, c} will not adversely affect current

10 CFR 50.46 identifies acceptance criteria for ECCS performance at nuclear power plants. Westinghouse will perform a LOCA evaluation of the V. C. Summer Nuclear Station lead test assemblies prior to implementation to ensure the assemblies are bounded by the current

analysis of record. Therefore, the conclusion is that the ECCS performance of the V. C. Summer Nuclear Station will not be affected by insertion of []^{a, c} lead test assemblies.

10 CFR 50, Appendix K, paragraph I.A.5 applies an equation of rates of energy release, hydrogen generation, and cladding oxidation from a metal-water reaction that conservatively bounds all post-LOCA scenarios. Application of the Baker-Just equation is expected to be conservative for []^{a, c}.

CONCLUSION

10 CFR 50.44 references analysis for water-metal reactions. This relates back to the use of the Baker-Just equation which assumes use of a zirconium alloy different than the []^{a, c} Lead Test Assemblies. 10 CFR 50.46 only applies to use of fuel rods clad with Zircaloy or ZIRLO™. 10 CFR 50.46 does not apply to use of the proposed []^{a, c} lead test assemblies because the composition is different than that of Zircaloy-4 or ZIRLO™. In addition, paragraph I.A.5 of 10 CFR 50 Appendix K, "ECCS Evaluation Models," references an analysis utilizing the Baker-Just equation which assumes use of a zirconium alloy different from the []^{a, c} used in the lead test assemblies.

In order to support []^{a, c} material with regard to improved corrosion resistance, an exemption from the requirements of 10 CFR 50.44, 10 CFR 50.46, and 10 CFR 50, Appendix K is requested. As required by 10 CFR 50.12, the requested exemption is authorized by law, does not present undue risk to public health and safety, and is consistent with common defense and security. Approval of this exemption request does not violate the underlying purpose of the rule. Special circumstances do exist to justify the approval of an exemption from the subject requirements.