Westinghouse
Electric Company

Box 355
Pittsburgh Pennsylvania 15230-0355

December 7, 1999
NSBU-NRC-99-5957

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

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

Subject: Westinghouse Fuel Performance Update (Slide Presentation of December 7, 1999), (Proprietary)

Dear Mr. Wermiel:

Enclosed are copies of the Proprietary and Non-Proprietary versions of the presentation material from the Westinghouse/NRC meeting on Fuel Performance held in Rockville on December 7, 1999.

Also enclosed are:

1. One (1) copy of the Application for Withholding, AW-1372 with Proprietary Information Notice and Copyright Notice.

2. One (1) copy of Affidavit, AW-1372.

This submittal contains Westinghouse proprietary information of trade secrets, commercial or financial information which we consider privileged or confidential pursuant to 10 CFR 9.17(a)(4). Therefore, it is requested that the Westinghouse proprietary information attached hereto be handled on a confidential basis and be withheld from public disclosure.

This material is for your internal use only and may be used solely for the purpose for which it is submitted. It should not be otherwise used, disclosed, duplicated, or disseminated, in whole or in part, to any other person or organization outside the Office of Nuclear Reactor Regulation without the expressed prior written approval of Westinghouse.

Correspondence with respect to any Application for Withholding should reference AW-1372 and should be addressed to H. A. Sepp, Manager of Regulatory and Licensing Engineering, Westinghouse Electric Company, P. O. Box 355, Pittsburgh, Pennsylvania 15230-0355.

Very truly yours,

Henry A. Sepp, Manager
Regulatory and Licensing Engineering

Copy to:
S. L. Wu, NRR
R. Caruso, NRR
M. S. Chatterton, NRR
S. Bloom, NRR

Westinghouse
Electric Company

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December 7, 1999
AW-1372

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ATTN: Document Control Desk
Washington, DC 20555

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

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: Westinghouse Fuel Performance Update (Slide Presentation of December 7, 1999), (Proprietary)

Reference: Letter from H. A. Sepp to J. S. Wermiel, NSBU-NRC-99-5957, dated December 7, 1999

Dear Mr. Wermiel:

The application for withholding is submitted by Westinghouse Electric Company LLC, a Delaware limited liability company ("Westinghouse"), pursuant to the provisions of paragraph (b)(1) of Section 2.790 of the Commission's regulations. It contains commercial strategic information proprietary to Westinghouse and customarily held in confidence.

The proprietary material for which withholding is being requested is identified in the proprietary version of the subject report. In conformance with 10 CFR Section 2.790, Affidavit AW-1372 accompanies this application for withholding, setting forth the basis on which the identified proprietary information may be withheld from public disclosure.

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

Correspondence with respect to this application for withholding or the accompanying affidavit should reference AW-1372 and should be addressed to the undersigned.

Very truly yours,

Henry A. Sepp, Manager
Regulatory and Licensing Engineering

cc: T. Carter / NRC (5E7)

Proprietary Information Notice

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

Copyright Notice

The documents transmitted herewith each bear a Westinghouse copyright notice. The NRC is permitted to make the number of copies for the information contained in these reports which are necessary for its internal use in connection with generic and plant-specific reviews and approvals as well as the issuance, denial, amendment, transfer, renewal, modification, suspension, revocation, or violation of a license, permit, order, or regulation subject to the requirements of 10 CFR 2.790 regarding restrictions on public disclosure to the extent such information has been identified as proprietary by Westinghouse, copyright protection not withstanding. With respect to the non-proprietary versions of these reports, the NRC is permitted to make the number of copies beyond these 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.

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF ALLEGHENY:

Before me, the undersigned authority, personally appeared Henry A. Sepp, 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, a Delaware limited liability company ("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:

Henry A. Sepp, Manager
Regulatory and Licensing Engineering

Sworn to and subscribed
before me this 3rd day
of December, 1999.

Notary Public

Notarial Seal
Janet A. Schwab, Notary Public
Monroeville Boro, Allegheny County
My Commission Expires May 22, 2000
Member, Pennsylvania Association of Notaries

JANET A. SCHWAB
NOTARY PUBLIC

(1) I am Manager, Regulatory and Licensing Engineering, in the Nuclear Services Division, of the Westinghouse Electric Company LLC, a Delaware limited liability company ("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 rulemaking proceedings, and am authorized to apply for its withholding on behalf of the Westinghouse Electric Company.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked " Westinghouse Fuel Performance Update (Slide Presentation of December 7, 1999)," (Proprietary), December 7, 1999, for submittal to the Commission, being transmitted by Westinghouse Electric Company (W) letter (NSD-NRC-99-58xx) and Application for Withholding Proprietary Information from Public Disclosure, Henry A. Sepp, Westinghouse, Manager Regulatory and Licensing Engineering to the attention of J. S. Wermiel, Chief, Reactor Systems Branch, Division of Systems Safety and Analysis. The proprietary information as submitted by Westinghouse Electric Company is to provide the material as presented to the NRC staff at the Fuel Performance meeting on December 7, 1999.

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

(a) Correct any problems associated with fuel failures and ensure proper fuel performance of fuel operating in reactors.

(b) Assist customers in improving their fuel performance (zero defects).

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to continue to implement corrective actions to ensure the highest quality of fuel in order to meet the customer needs.

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 for developing the enclosed improved core thermal performance methodology.

Further the deponent sayeth not.

bcc: S. D. Rupprecht (ECE 4-16), 1L
Bev Smith (ECE 4-7A), 1L, w/affidavit
R. Prior (Brussels), 1L, 1A
J. M. Moore (EXPO 335) 1L, 1A
N. J. Liparulo (COLA), 1L, 1A
A. L. Casadei (ECE 4-26), 1L, 1A
R. J. Buechel (COLA), 1L, 1A
K. Hoskins (ECE 4-23), 1L, 1A
D. Colburn (COLA), 1L, 1A
W. Slagle (ECE 4-24), 1L, 1A
J. Foster (COLA), 1L, 1A
S. Sidener (COLA), 1L, 1A
K. Bahr (ECE 4-25), 1L, 1A
T. Croyle (ECE 4-24), 1L, 1A
A. Harris (ECE 4-22), 1L, 1A
CE Staff (route), 1L, 1A
CE FRD and Licensing (route), 1L, 1A
COLA FRD (route), 1L, 1A
NRC Ltr File, 1L, 1A

Westinghouse
Fuel Performance Update
(Slide Presentation of May 11, 1999)

May 1999

Westinghouse Fuel Performance Update Meeting

December 7, 1999

Presented by:
William H. Slagle

Westinghouse Fuel Performance Update Meeting

This is the second Fuel Performance Update Meeting held between Westinghouse and the NRC in 1999. It had been requested by the NRC to hold the meeting semi-annually vs annually and to focus on selected topics.

The NRC views this meeting as a valuable information exchange. Thus, it was viewed that if fewer topics were addressed each meeting, then more questions could be asked and a better understanding of the information would exist.

Westinghouse Fuel Performance Update Meeting

The major topics of discussion for this meeting are:

- LTA Programs and Fuel Inspection Plans
- Top Nozzle Holddown Spring Screws Root Cause Analysis
- Top Nozzle Holddown Spring Screws Licensing Option
- Westinghouse Improved Performance Analysis and Design Model (PAD 4.0)

Westinghouse Fuel Performance Update Meeting

- LTA/LUA Programs and Fuel Inspection Plans (Proprietary Briefing):
  - Provide a summary of on-going LTA programs.
  - Provide a summary of on-going or planned Fuel Inspections.

Westinghouse Fuel Performance Update Meeting

- Top Nozzle Holddown Spring Screws Root Cause Analysis (Proprietary Briefing):
  - To address status of the root cause investigation.
  - To discuss immediate and long-term corrective actions being taken.

Westinghouse Fuel Performance Update Meeting

- Top Nozzle Holddown Spring Screws Licensing Option (Proprietary Briefing):
  - To address a possible licensing option associated with this issue.
  - To get feedback from the NRC with regards to this option.

Westinghouse Fuel Performance Update Meeting

- Westinghouse Improved Performance Analysis and Design Model (PAD 4.0) (Proprietary Briefing):
  - Brief Chronological Update
  - Brief Overview of Final Submittal
  - Review of RAI #9 (Typical Plots)
  - Review of IFA-432 Modeling
  - Conclusions
  - Implementation and Legacy Fuel
  - Schedules

Westinghouse Fuel Performance Update Meeting

This ends the non-proprietary part of the briefing.

The remaining briefings are all proprietary.

LTA/LUA Programs and Fuel Inspection Plans

Fuel Performance Meeting
with USNRC
December 7, 1999

Presented by
William H. Slagle

High Burnup ZIRLO™ LTA Programs

a, b, c

Other LTA/LUA Programs

Other Test Programs to Obtain Fuel Performance Data

a, b, c

Top Nozzle Screw Fracture Update

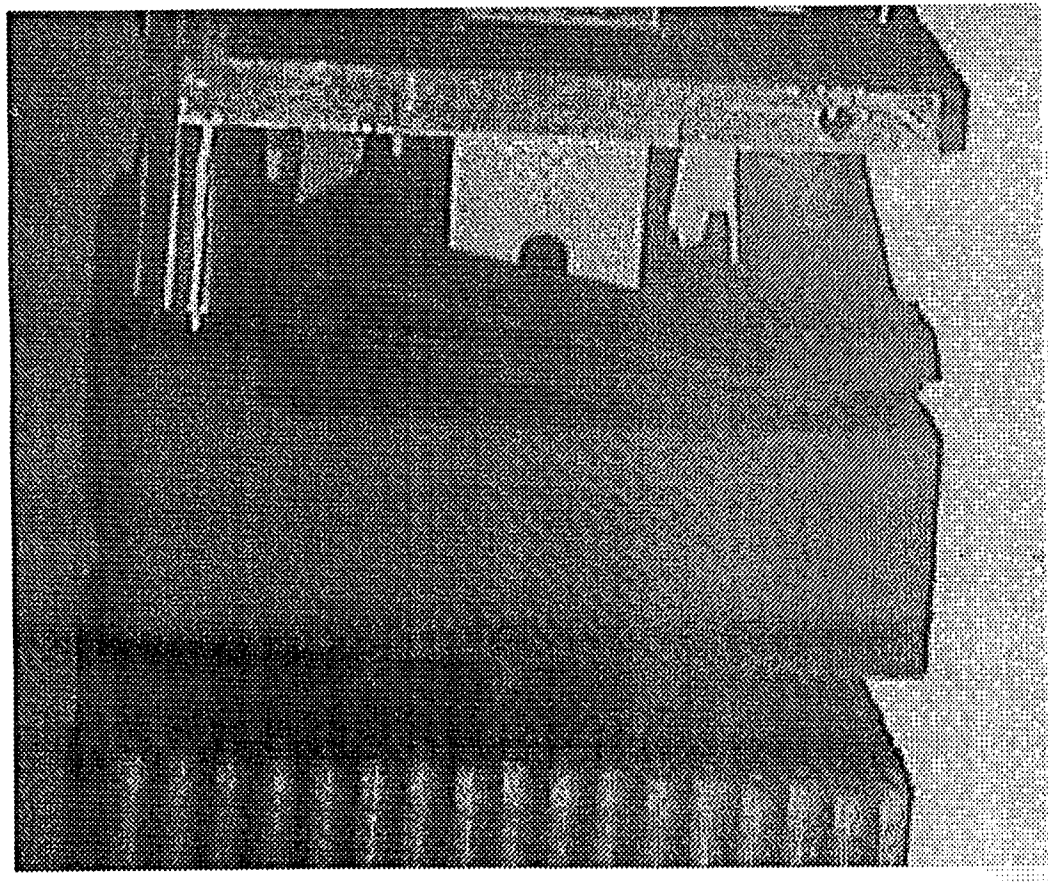
Fuel Performance Meeting

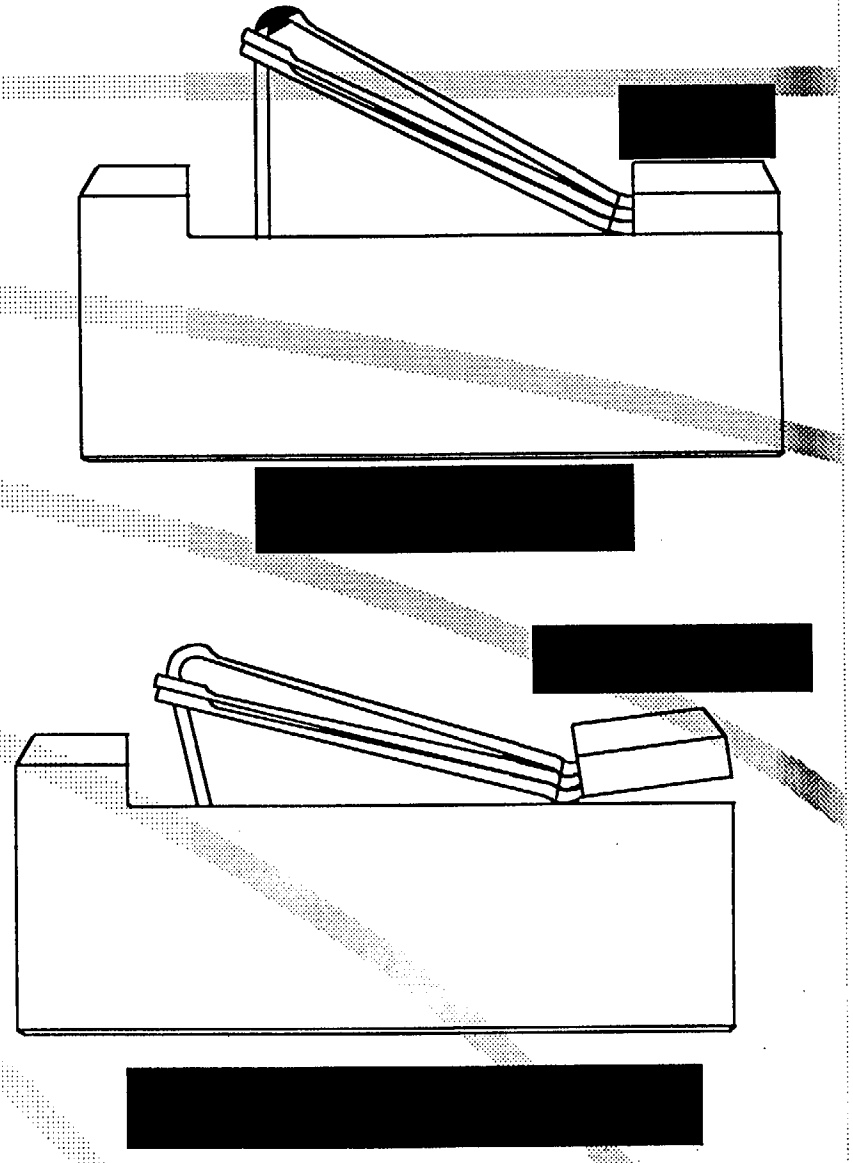
With USNRC

December 7, 1999

Presented by:
Don Rowland

Description





Background

- Joint Material/Mechanical Design in use since late 1970's (17x17).
- Early 1980s - [ ]$^{a, c}$ fuel assemblies with fractures in [ ]$^{a, c}$ fuel:
  - Improved and standardized screw design for all 12 foot fuel assemblies.
  - No design changes or issues since 1984.
- Mid-1998 - [ ]$^{a, c}$ fuel assemblies (foreign plant, licensee fabricated) with fractures observed:
  - Assemblies re-nozzled.
  - Presumed root cause was over-torque [ ]$^{a, c}$
- Late 1998 - [ ]$^{a, c}$ fuel assembly (14 foot design) with fractures observed:
  - Assembly discharged.
  - Root cause indeterminate.
- Early 1999 - Significant fracture rate found during outage inspections.

Background

- Status Prior to Fall 1999 Inspections:
  - Inspections based largely on visual exams.
  - Suspect population of fuel identified:
    - [ ]a, c.
    - May be limited by:
      - [ ]a, b, c,
      - [ ]a, b, c, and
      - [ ]a, b, c.
        - [ ]a, c.

Fall Inspection Results

- Approximately 1200 fuel assemblies were inspected during the fall outages for this condition.
- New spring screw inspection technique:
  - Provides greater discrimination of fractures compared to visual exams.
  - Uses a [ ]a, c.
- Repair activities have not affected critical path, to date.
- Fractures identified in fuel built prior to window:
  - Single fuel assemblies at [ ]a, b, c.
  - Multiple fuel assemblies at [ ]a, b, c.

Fall Inspection Results (cont.)

- Fractures observed in a 14x14 region:
  - Manufactured within window of susceptibility.
  - [ ]a, b, c to 17x17 fuel within window.
- No fractures detected in susceptible region at a 17x17 plant:
  - Screws used different [ ]a, b, c.
- No fractures observed in 1X fuel [ ]a, b, c.
- No fractures observed in 1X, 2X, or 3X fuel at a 14 foot design plant [ ]a, c.

Root Cause Status

- Outage information and current tests provide sufficient information to complete root cause report.

- Schedule:
  - Customer summary letter on root cause: November 30
  - Final root cause report: December 30

Root Cause

Root Cause Assessment Results:

- Operator/Manufacturing factors less significant than previously believed.

- Material [ ]$^{a, b, c}$ susceptibility identified as the key root cause; associated with change in [ ]$^{a, b, c}$:
  - Design does not accommodate variability of [ ]$^{a, b, c}$.
  - Material specification needed improvement.
  - Secondary factors include use of [ ]$^{a, b, c}$ and the need for more focused PIE exams.

Margin Improvements

- Improvements implemented since April 1999:
  - Manufacturing Operations:
    - Operator sensitivity.
    - QC over-check of [ ]$^{a, b, c}$.
    - [ ]$^{a, b, c}$.
    - Area practices.
  - Material Improvements:
    - [ ]$^{a, b, c}$ screws:
      - In place for all fuel manufactured since September 1999.
      - Planned tightening of process specifications & change of supplier.

Margin Improvements (cont)

- [ ]a, b, c screw change:
  - Key Issues that need to be addressed.
    - Design changes to improve screw performance.
    - [ ]a, b, c vary widely according to [ ]a, b, c.
    - Additional testing and analysis needed prior to implementation.
  - Design Team and Review Team working out plan to address issues.

Outage Support

- Continue anticipation and active support of Spring 2000 outages:
  - Expect fractures in several plants.
  - Plant-by-Plant inspection, repair/replacement, and contingency plans being developed.

- Working with WOG to develop contingency option to reinsert fuel assemblies with fractured screws provided that design & safety criteria are met.

Top Nozzle Screw Summary

- Root cause completed on schedule:
  - Customer Summary Letter — November 1999
  - Final Report — December 1999
- Fall outage inspections completed.
- Spring 2000 outage plans underway.
- Improvements with current material in place.
  - Next step modified [ ]$^{a, b, c}$ screw.

Top Nozzle Holddown Spring Screw Licensing Option

Fuel Performance Meeting

With USNRC

December 7, 1999

Presented by:

Sumit Ray

Licensing Option

- Two options currently available for assemblies with fractured screws:
  - Discharge from the core.
  - Re-nozzle and reuse.
- Westinghouse is developing another option that can be used:
  - Would permit re-insertion of assemblies with fractured screws, provided design and safety criteria are met.
- Utilities have expressed interest in this option.
- Westinghouse is in dialog with the WOG PI core team to seek guidance to further develop this position.

Licensing Option

- Westinghouse believes this option is needed to provide additional flexibility:
  - Expects to be applied on a plant specific basis depending on the situation.

Key Design/Safety Criteria to Support Licensing Option

- Detailed visual inspection of [ ]$^{a, c}$.
- No clamp gaps [ ]$^{a, b, c}$ allowed for re-inserted assemblies:
  - Ensures all parts are secured to the top nozzle.
  - Ensures no operations or handling concerns.
- A plant specific loose parts assessment will be performed to ensure that the specific nozzle design has been evaluated.
- A plant specific reactor internals holddown capability evaluation is performed to address loss of holddown force for the affected assemblies.
- Licensee tracks non-conforming condition in its internal deficiency tracking system as per Generic Letter 91-18, Revision 1.

Licensing Option Approach

- Use of Generic Letter 91-18 Revision 1 to support start-up.
- Will be subjected to a 10 CFR 50.59 evaluation:
  - Demonstrate that no USQ exists.

Westinghouse Improved Performance Analysis and Design Model (PAD 4.0)

Fuel Performance Meeting
with USNRC
December 7, 1999

Presented by:
William H. Slagle

The PAD topical report review and approval is currently viewed as the most critical topical report on Westinghouse's review agenda.

Agenda for Presentation

- Brief Chronological Overview
- Brief Overview of Final Submittal Package
- Review of RAI #9 (Typical Plots)
- Review of IFA-432 Modeling
- Conclusions
- Implementation & Legacy Fuel
- Schedules

Brief Chronological Overview

- 01/96: Hot Cell data indicates [
  ]a, b, c.
  - [
    ]a, b, c.
  - [
    ]a, c.
- 12/96: Higher corrosion measurements led to a new Zirc-4 corrosion model (ZrBA) which was presented to the NRC.
  - New corrosion model is incorporated into an interim PAD 3.4 version and tested during the period of 01/97 to 11/97.

Brief Chronological Overview

- 11/97: Incorporation of ZrBA into PAD 3.4 and its associated feedback affects result in further reduction to RIP margins, leading to projections of "Gap Re-Opening".
  - Westinghouse issues an Industry JCO to the NRC that addresses Gap Re-Opening.
  - Westinghouse's assessment states that the Safety Significance is considered low.
  - All reload analyses are done with the interim PAD model that incorporates ZrBA and gap re-opening methodology.
  - Westinghouse commits to update PAD to resolve gap reopening.

Brief Chronological Overview

- 01/98: NRC accepts Westinghouse's approach for Gap Re-Opening.
  - NRC accepts low safety significance position specified in the JCO.
  - Compliance with 10 CFR 50.46 must be demonstrated.

- 06/98: Westinghouse submits WCAP-15063-P, "Westinghouse In-Reactor Creep Model".
  - Revised In-reactor irradiation creep model.
  - [ ]a, c.
  - [ ]a, c.

Brief Chronological Overview

- 09/98: Westinghouse submits Calibration and V&V data package for the revised PAD model. A meeting is held with the Staff to present "Other Model Changes" that were made to PAD since the June submittal.

- 09/98: NRC issues RAIs for WCAP-15063-P and RAIs for the "Other Model Changes".

- 11/98: Westinghouse provides initial response to RAIs.

Brief Chronological Overview

- 01/99: Westinghouse provides supplemental response to RAIs.

- 06/99: Westinghouse provides a detailed presentation to the NRC on Westinghouse's [

  ]$^{a, c}$.

  – NRC requests that Westinghouse submits a re-write of the WCAP to include the original submittal and the other model changes.

  – NRC requests that Westinghouse propose [

    ]$^{a, c}$.

Brief Chronological Overview

- 08/99: Westinghouse proposes [ ]a, c.
- 09/99: Conference call with the NRC regarding [ ]a, c.
  - Reached agreement that all data for [ ]a, b, c be combined into a single [ ]a, b, c.
  - Concurrence was not obtained on the Westinghouse [ ]a, b, c. The NRC requested [ ]a, b, c to demonstrate overall model conservatism.

Brief Chronological Overview

- 11/99: Westinghouse submits final package for PAD 4.0 according to agreement established during 9/99 phone call.
  - Westinghouse complies with request to incorporate all the [ ]a, b, c into a single [ ]a, b, c.
  - Westinghouse complies with request to provide [ ]a, b, c.

- 12/99: Follow-up meeting with NRC to review final submittal package, discuss the review schedule and requested SER language with regards to "Legacy Fuel".

Brief Overview of Final Submittal Package

The final submittal package includes five attachments:

Attachment 1: Re-write of WCAP-15063-P, "Westinghouse In-Reactor Creep Model" to include "Other Model Changes".

Attachment 2: WCAP-15063-P Errata for corrections noted to the NRC in responses to other RAIs.

Attachment 3: Response to last outstanding question (RAI #9) on PAD Model Revisions submittal. Also included are five external independent assessments of Westinghouse's creep model by industry experts.

Brief Overview of Final Submittal Package

Attachment 4: Final PAD 4.0 Calibration and V&V Data Package based on the latest model revisions requested during the review process. Also included is the IFA-432 modeling comparison requested by the NRC reviewer.

Attachment 5: Discussion of PAD 4.0 implementation and approach on "Legacy Fuel".

Review of RAI #9

- Original request (9/98) covered typical performance areas: plots of corrosion vs burnup, clad OD vs burnup, centerline temperature vs power and burnup, rod pressure vs burnup, and power vs burnup.

- Significant additional information requested and transmitted:
  - Equivalent PAD 3.4 typical comparison plots (6/99);
  - Upper bound rod pressure vs burnup of (IFBA and Non-IFBA fuel) (6/99);
  - Typical fuel centerline temperatures used for nuclear safety analyses (6/99);
  - Input parameters used in the modeling of the typical plots that will be used to conduct an audit calculation with FRAPCON-3 (6/99); and
  - Overall swelling rate and creep rate model uncertainties (9/99).

Review of RAI #9

- Conclusions:
  - As demonstrated in the submittal, the PAD 4.0 results for RAI #9 are [

    ]a, c.
  - The interim PAD version would demonstrate overly conservative results.
  - PAD 4.0 has accomplished margin recovery.

[

]a, c

Review of IFA-432 Modeling

- Original request (11/98) for informal PAD 4.0 modeling of the IFA-432 fuel assembly, rods 1, 2, 3 and 5.
  - Used to help evaluate conservatism of fuel performance thermal models (fuel temperatures vs burnup).
  - These fuel rods have been modeled in the past by Westinghouse.
  - Generated a special version of PAD 4.0 for IFA-432 modeling and provided informal results (3/99).
  - In response to request to assume no fission gas leakage, and incorporate an alternate approach to creep model [ ]$^{a, b, c}$, IFA-432 analysis re-performed and presented to the NRC (6/99).
  - Final re-analysis provided in submittal to incorporate all PAD 4.0 model changes (11/99).

Review of IFA-432 Modeling

- Conclusions:
  - As expected, the PAD 4.0 modeling results are [ ]$^{a, b, c}$ with the previous licensed PAD versions (e.g,. the thermal model is unchanged).
  - Thus PAD 4.0 behaves in a [ ]$^{a, c}$ to the previous versions of PAD that were found to be conservative and bounding by the NRC.

Conclusions

- PAD 4.0 upgrade better reflects in-reactor performance and fuel material behavior.
  - The revised models have been calibrated to both the previous databases and new data.
  - The unchanged models have been re-calibrated to the previous databases (and revised IFA-432 data) and remain applicable.
  - Rod internal pressure margins improved as expected [ ]$^{a, b, c}$.
  - Unchanged models (i.e., fission gas and thermal) produce results consistent with previously licensed versions, as expected.

Conclusions

- The final submittal is the culmination of significant levels of information exchange/dialogue and numerous iterations with the NRC to ensure all requests were addressed.

- PAD 4.0 fulfills the commitment to the NRC to update the fuel performance analytic models.

Implementation & Legacy Fuel

- Proceed with implementation of PAD 4.0 on a forward-fit basis consistent with the plans being developed between Westinghouse and the WOG.
  - Establishing appropriate documentation and training.

- As noted in previous meetings with the NRC, PAD 4.0 may still predict some gap re-opening in "Legacy Fuel". Westinghouse will demonstrate that these assemblies will continue to meet all safety limits as well as 10 CFR 50.46 oxidation limits. Gap re-opening Legacy Fuel will continue to be covered by the JCO methodology until permanently discharged.

Schedules

11/19/99: Westinghouse's final submittal to NRC.

Based on previous verbal commitments, it was stated that the NRC's reviewer would be able to complete his review and issue a TER within 30 days after receiving the final submittal. It was further stated that the NRC should be able to issue an SER within 30 days after receiving the TER from the reviewer. It is extremely important to Westinghouse and our customers that the following schedules are met:

01/15/00: NRC reviewer issues Technical Evaluation Report (TER)

02/15/00: NRC issues Safety Evaluation Report (SER)

The PAD topical report review and approval is currently viewed as the most critical topical report on Westinghouse's review agenda.