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LTR-NRC-11-26

June 13, 2011

Subject: Fuel Criterion Evaluation Process (FCEP) Notification of the Robust Protective Grid (RPG) Design (Proprietary/Non-Proprietary)

Enclosed are Proprietary and Non-Proprietary copies of the Fuel Criterion Evaluation Process (FCEP) Notification of the Robust Protective Grid (RPG) Design. This submittal serves as Westinghouse notification to the NRC as required by the SER on Westinghouse Fuel Criteria Evaluation Process (FCEP). The NRC-approved process in WCAP-12488-A was used for validation of the RPG design.

Also enclosed is:

1. One (1) copy of the Application for Withholding Proprietary Information from Public Disclosure, AW-11-3179 (Non-Proprietary), with Proprietary Information Notice and Copyright 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 Proprietary Information from Public Disclosure and an Affidavit. The affidavit sets forth the basis on which the information identified as proprietary may be withheld from public disclosure by the Commission.

Correspondence with respect to the application for withholding or the Westinghouse affidavit should reference AW-11-3179 and should be addressed to J. A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company LLC, Suite 428, 1000 Westinghouse Drive, Cranberry Township, Pennsylvania 16066.

Very truly yours,

J. A. Gresham, Manager
Regulatory Compliance

Enclosures

cc: E. Lenning

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NRR

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AW-11-3179

June 13, 2011

APPLICATION FOR WITHHOLDING PROPRIETARY INFORMATION FROM PUBLIC DISCLOSURE

Subject: LTR-NRC-11-26 P-Enclosure, "Fuel Criterion Evaluation Process (FCEP) Notification of the Robust Protective Grid (RPG) Design" (Proprietary)

Reference: Letter from J. A. Gresham to Document Control Desk, LTR-NRC-11-26, dated June 13, 2011

The Application for Withholding Proprietary Information from Public Disclosure is submitted by Westinghouse Electric Company LLC (Westinghouse), pursuant to the provisions of paragraph (b)(1) of Section 2.390 of the 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-11-3179 accompanies this Application for Withholding Proprietary Information from Public Disclosure, 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-11-3179 and should be addressed to J. A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company LLC, Suite 428, 1000 Westinghouse Drive, Cranberry Township, Pennsylvania 16066.

Very truly yours,

J. A. Gresham, Manager
Regulatory Compliance

Enclosures

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF BUTLER:

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

Sworn to and subscribed before me
this 13th day of June 2011

Notary Public

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Cynthia Olesky, Notary Public
Manor Boro, Westmoreland County
My Commission Expires July 16, 2014
Member. Pennsylvania Association of Notaries

(1) I am Manager, Regulatory Compliance, 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 Proprietary Information from Public Disclosure accompanying this Affidavit.

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

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

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

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system 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 LTR-NRC-11-26 P-Enclosure, "Fuel Criterion Evaluation Process (FCEP) Notification of the Robust Protective Grid (RPG) Design" (Proprietary), dated June 13, 2011, for submittal to the Commission, being transmitted by Westinghouse letter, LTR-NRC-11-26, 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 the response to the FCEP notification of the RPG.

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

(a) Assist proper fuel performance of fuel operating in reactors.

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

Further this information has substantial commercial value as follows:

(a) Westinghouse can use this design change to further enhance their licensing position over competitors.

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 justification 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

Fuel Criterion Evaluation Process (FCEP) Notification of the Robust Protective Grid (RPG) Design (Non-Proprietary)

Westinghouse Electric Company LLC
1000 Westinghouse Drive
Cranberry Township, Pennsylvania 16066

Fuel Criterion Evaluation Process (FCEP)
Notification of the Robust Protective Grid (RPG) Design

1.0 Background

During the summer of 2007, a fiberscope examination at a plant found a missing dimple in a Protective grid (P-grid) and an extra detached dimple. This was initially considered an isolated event attributed to the removal and insertion of the fuel and stainless filler rods for various inspections.

Later in 2008, a foreign object search and retrieval (FOSAR) activity at another plant revealed [ ]a,c Photos of the foreign material taken during the FOSAR were analyzed and confirmed to be P-grid dimples. This issue was entered into the Westinghouse Corrective Action Program (CAPs) to determine the cause and provide recommended corrections. A root cause analysis (RCA) was initiated and reviews of older FOSARS revealed that visible P-grid dimples had been present, but had not been identified as grid parts at the time.

Dimple samples were obtained from the plant and sent to a hot cell for fracture surface analysis. The exam revealed that the dimple fractured due to [ ]a,c

Additionally, the RCA investigation uncovered another failure mechanism occurring in the P-grid. Vibration Investigation and Pressure-drop Experimental Research (VIPER) tested P-grids were found with [ ]a,c

Post irradiation exams (PIEs) at various 17x17 units have shown some level of degradation of the P-grid. A summary of PIEs for [ ]a,c

A project was initiated to review all aspects of the existing P-grid design and to develop changes that would address the fundamental issues. The result of this project was the development of the Robust Protective grid (RPG).

1.1 Description of Design Change

The RPG incorporates the following design features as compared to a typical P-Grid, which are also illustrated in Figures 1 and 3:

[ ]a,c

The design of the RPG addresses [

]^{a,c} Key issues evaluated were the debris filtering effectiveness, design loss coefficient, and the pressure drop for the fuel; however it has been confirmed that there are no changes to these parameters.

The RPG design includes the possibility to weld the RPG to the bottom grid inserts thus creating a combination grid or combo grid as shown in Figure 2. It is important to note that the individual RPG and the bottom grid designs remain unchanged. Creating a combination grid provides additional support as well as structural integrity and ensures proper alignment of the grids within the fuel assembly. The combo grid does not adversely affect the mechanical nor the thermal hydraulic performance of the RPG or the bottom grid components. Finally, the combo grid is not employed in fuel assembly designs with the tube-in-tube thimble design.

1.2 Summary of Tests Performed

VISTA Tests

Small-scale testing has been performed on the RPG to investigate the HFV of the inner straps. This small-scale testing was performed in the Vibration Investigation of Small-scale Test Assemblies (VISTA) hydraulic test loop. The results of this testing showed that the current P-Grid [

]^{a,c} A plot of the HFV response of the current P-Grid and RPG are shown in Figure 4. This figure shows that the production RPG follows the same trend as the prototype RPG (listed as RPG Baltec), thus providing confidence in the HFV response measured in VISTA for the RPG geometry.

With respect to vibration amplitude, Table 1 provides a comparison of the current P-grid design and the RPG. The RPG, both production and prototype versions, exhibited a large reduction in the peak amplitude relative to the current P-Grid. Thus, the RPG has been confirmed to provide the HFV reduction desired for this design.

Fuel Assembly Compatibility Test System (FACTS) Tests

The pressure loss coefficients of fuel assemblies utilizing the RPG shall be maintained such that:

a) excessive flow-induced vibration does not occur,
b) the hydraulic lift forces are acceptable to the top nozzle spring design,
c) the mixed core DNB penalty is minimized so that the predicted DNBR for the limiting design transients will be greater than the DNBR limit.

The fuel assembly utilizing the RPG must have acceptable vibration characteristics and top nozzle spring holddown force. Additionally, the design must be able to perform within the constraints of mixed core compatibility and have an acceptable impact on plant systems. A FACTS hydraulic test series was performed. This testing was performed using a confirmatory test assembly, to determine if there is a loss coefficient change for the RPG. The difference in inlet region loss coefficient was determined between (1) a test with the current P-Grid and (2) a test with the RPG. This test showed there was no assembly pressure drop difference for the RPG as shown in Figure 5.

Calculations were performed to determine if differences between the various 17x17 designs (OFA, RFA and XL) would have an impact on the loss coefficients. The conclusions of these calculations demonstrate that the RPG can be introduced to all 17x17 fuel assemblies without a change in the design loss coefficient of the protective grid.

Since there is no hydraulic loss coefficient change for the RPG, there will be no impact on the items a, b, and c listed above. Therefore, there is no impact of the RPG on any thermal-hydraulic criteria including the pressure drop and design loss coefficient.

FACTS-D Tests

Normal reactor operating debris mitigation effectiveness testing was performed in the FACTS hydraulic flow loop located in Columbia, SC. This test was conducted to verify that the debris mitigation effectiveness of the 17x17 RPG with Debris Filtering Bottom Nozzle (DFBN) was similar to the debris mitigation effectiveness of the standard P-Grid with DFBN. To perform the test, the FACTS loop was modified for debris testing by replacing the pressure vessel and flow housing with specialized inline debris filters and the debris test flow housing. FACTS testing in this configuration is called FACTS-D testing.

There were [

]^{a,c}

The results from debris testing shown in Table 2 indicate that the [

]^{a,c}

Dimple Formability

The dimple profile of the RPG was designed in order to [

]^{a,c} Checks were performed to ensure that cracking would not occur during production stamping. Dye penetrant testing was performed for the test component straps to ensure that parts made from the production die were not prone to cracking. Results of the die penetrant testing did not show cracking.

End of Life Spring Force

The Inconel bottom grid shall have a minimum of [ ]^{a,c} on the fuel rod at the end of life (EOL). Experience has shown that a design target of [ ]^{a,c} at EOL is adequate to prevent developing a gap at the bottom grid, preventing large amplitude fuel rod vibration that, in turn, would lead to fuel rod failure. The robust protective grid provides additional margin to the bottom grid in order to prevent the fuel rod from vibrating during operating. The protective grid is required to apply a [ ]^{a,c} at beginning of life (BOL) in order to provide adequate fuel rod support. Based on calculations, the [

]^{a,c}

Therefore, this criterion is met.

2.0 Design Categories

The following sections will address the design categories and associated parameters in the Westinghouse Fuel Criteria Evaluation Process (FCEP), WCAP-12488-A (Reference 1), to show that the RPG has insignificant impact on these parameters.

A. Fuel System Damage and Fuel Rod Failure Criteria

a.	Clad Stress	i.	Fuel Clad Fretting Wear
b.	Clad Strain	j.	Fuel Rod Clad Rupture (Burst)
c.	Clad Fatigue	k.	Fuel Pellet Overheating
d.	Clad Oxidation	l.	Non-LOCA Fuel Clad Temperature
e.	Zircaloy Clad Hydrogen Pick-up	m.	LOCA Fuel Clad Temperature
f.	Fuel Rod Axial Growth	n.	Departure from Nucleate Boiling (DNB)
g.	Clad Flattening	o.	Fuel Assembly Hold-Down Force
h.	Rod Internal Pressure	p.	Thermal-Hydrodynamic Stability

B. Fuel Coolability Criteria

a. Clad Embrittlement During Locked Rotor/Shaft Break Accident
b. Clad Ballooning and Flow Blockage
c. Violent Expulsion of Fuel (Rod Ejection)
d. Fuel Assembly Structural Response to Seismic/LOCA Loads

C. Nuclear Design Criteria

a.	Shutdown Margin	d.	Reactivity Feedback Coefficients
b.	Fuel Storage Sub-criticality	e.	Power Distribution
c.	Stability	f.	Maximum Controlled Reactivity Insertion Rate

3.0 Evaluation

Each of the parameters under each category listed above have been examined and those impacted by the design change to the RPG.

Category A: Fuel System Damage and Fuel Rod Failure Criteria

Parameters "a-h,", "j-m", and "o" in this category are not impacted by the RPG design change since the fuel rod, and pressure drop were not altered. Parameters "i", "n", and "p" are discussed below.

Item i: Fuel Rod Clad Fretting Wear

The dimple on the RPG is below the active fuel length, and is only in contact with the fuel rod below the top of the bottom end plug. Due to this there is no possibility for a fuel failure due to fretting wear.

Item n: ***Departure from Nucleate Boiling (DNB)***

Since the 17x17 RPG has no impact on any of the NSSS design parameters, nor does it have any effect on primary or secondary critical heat flux (CHF) correlations since it is below the active fuel region and below the bottom Inconel grid, and it does not have any effect on the design loss coefficient (pressure drop), the RPG design for 17x17 fuel has no impact on DNB.

Item p: ***Thermal-Hydrodynamic Stability***

Since the pressure drop of the revised RPG is the same as the original design, the assembly loss coefficient is also the same, such that thermal hydraulic stability characteristics are not changed (Figure 5).

Category B: ***Fuel Coolability Criteria***

Parameters "a-c" in this category are not impacted by the RPG design since the fuel rod and component pressure drops are unchanged as described in Section 1.2. Due to the change in the dimple geometry, the protective grid impact strength and stiffness may be affected, as discussed in Item "d" below.

Item d: ***Fuel Assembly Structural Response to Seismic/LOCA Loads***

Considering the close proximity to the bottom nozzle, the seismic/LOCA loads on the protective grid are [ ]^{a,c} However, condition I loading conditions are considered, namely the stresses induced due to [ ]^{a,c} Testing was performed on the P-Grid design with 24 inserts with a [

]^{a,c} Therefore there is no change to the seismic/LOCA Loads.

Category C: ***Nuclear Design Criteria***

The nuclear design, inclusive of BEACON, is not affected by the change to the 17x17 RPG since this grid is below the active fuel region and is not modeled by the nuclear design. In addition, the 17x17 RPG has no impact to the NSSS design parameters.

Additional Considerations: GSI-191Assessment of Debris Accumulation on Downstream Effects

Background

Pressurized water reactor (PWR) containment buildings are designed to both contain radioactive material releases and facilitate core cooling during a postulated loss-of-coolant-accident (LOCA) event. In some LOCA scenarios, to support long-term core cooling[1], water discharged from the break and containment spray is collected in a sump for recirculation by the emergency core cooling system (ECCS) and containment spray system (CSS).

[1] For the purposes of this evaluation, "long-term core cooling" is defined as that period following the realignment of the ECCS and CSS from injecting coolant from the Refueling Water Storage Tank/Borated Water Storage Tank (RWST/BWST) to recirculating coolant collected in the reactor containment building sump, out to a period of 30 days.

The coolant in the sump will contain debris from insulation, both particulate and fibrous, and protective coatings damaged by the jet formed by the release of coolant from the break and from the transport of residual containment debris from upper containment regions into the sump. Also, there will be chemical products from the interaction of boric acid, buffer agents and their interaction with other materials inside containment.

Following a LOCA, this debris mix could collect on the sump screen and create sufficient resistance to recirculating flow that provides long-term core cooling. This debris could be ingested into the ECCS and flow into the reactor coolant system (RCS) and eventually reach the core. These issues have been broadly grouped under Generic Safety Issue 191 (GSI-191) (Reference 2).

Significant work has been performed by the industry to address the issues associated with GSI-191. These have included a PWR Owners Group program which performed testing to assess effect of the collection of debris and chemical precipitates on core components on head loss across the core at flow rates representative of when ECCS is realigned to recirculation mode from the containment sump. This testing program utilized a partial length (4.5 foot) 17x17 OFA assembly (i.e., 0.360" OD fuel rod) as a bounding fuel assembly design. The results of this testing program are presented in WCAP-17057-P, *GSI-191 Fuel Assembly Test Report for PWOG*, dated March 2009 (Reference 3). This report provides an examination of the collection of debris loads evaluated from plant data on a fuel assembly at flow rates representative of both hot-leg and cold-leg break flow rates.

The resolution of GSI-191, while approaching closure, is not yet complete. Testing for the RPG to date has been consistent with the PWROG test protocol (Reference 3). The following section describes testing that was performed to specifically assess the RPG with respect to GSI-191, and to compare it with the current plant configuration to demonstrate that the RPG is equivalent to the existing P-Grid design from a GSI-191 Downstream Effects standpoint.

Testing Performed for the RPG

To support the evaluation of the RPG, a number of GSI-191 tests have been conducted following the approach detailed in WCAP-17057-P (Reference 3). The fuel assembly tested was the same partial length (4.5 foot) 17x17 OFA (V5) fuel assembly with the following components: a Debris Filter Bottom Nozzle (DFBN), the Robust Protective grid (RPG), a bottom Inconel grid, a mid-grid, an IFM grid, another mid-grid, a top Inconel grid, and a Reconstitutable Top Nozzle (RTN). Testing of both hot-leg breaks and cold-leg breaks were examined with limiting conditions with respect to the particulate-to-fiber (p:f) ratios. For the hot leg breaks, a p:f ratio of 1 to 1 was evaluated and for the cold-leg breaks, a p:f ratio of 45 to 1 was evaluated. Table 3 presents a summary of the pertinent parameters that were assumed for the test case runs. The results of the relevant cases for both the hot-leg break tests and for the cold-leg break tests are discussed below.

Hot Leg Break Test Results

The hot leg break tests were run with the standard protective grid replaced by the new Robust Protective Grid (RPG). Tests were run with various fibrous debris loadings until acceptable results were obtained. Multiple repeat tests were performed to ensure the accuracy of the test results. The final tests that were run with acceptable results had a debris loading of [

]^{a,c} The results of these cases are presented in Table 4. Thus, it is concluded that the RPG can support a debris loading of up to [ ]^{a,c} It should be noted that these cases were run with the SDFBN although given the margin to the criterion and the results of the cross-test revised limits, it is not expected that the use of the DFBN would be more limiting to the point where this debris loading would be unacceptable with the DFBN/RPG combination.

Cold Leg Break Test Results

Cold leg break tests were performed with a fiber loading of 18 grams at a flow rate of 3 gpm. The results from these cases were [ ]^{a,c} as shown in Table 4. These cases were run to demonstrate that the hot leg break cases remain the limiting cases with respect to the peak ΔP.

Conclusion and Summary

Based on the evaluation presented herein, the Robust Protective Grid (RPG) is shown to have no adverse impact on the results of the GSI-191 debris testing and the conclusions presented in WCAP-17057-P, provided that the fibrous debris loading per fuel assembly is not greater than [ ]^{a,b,c}

Finally, it is important to note that the GSI-191 issue is still an open issue with the NRC. As such, the conclusions presented herein should be reviewed and potentially re-evaluated when the final SER becomes available.

4.0 Safety Assessment

As part of the overall review of the RPG design, the changes associated with the design were reviewed by the various nuclear safety engineering groups and found to be acceptable. There is no increase in pressure drop, debris filtering effectiveness and design loss coefficient.

5.0 Conclusion

It is concluded that the design changes made to the RPG design will have no detrimental effect on the performance of the fuel assembly in the design categories listed above. The RPG design change may therefore be implemented under the Fuel Criteria Evaluation Process, which requires NRC notification.

References:

1. Davidson, S. L., (Ed.), et al., "Westinghouse Fuel Criteria Evaluation Process," WCAP-12488-A, Revision 0 October 1994.

2. Generic Safety Issue 191 (GSI-191), *Assessment of Debris Accumulation on Pressurized Water Reactor (PWR) Sump Performance*

3. Baier, S. and Andreychek, T., *GSI-191 Fuel Assembly Test Report for PWROG*, WCAP-17057, Revision 0, dated March 2009.

a, c

Figure 1: Comparison of Typical Values for P-Grid and RPG Design
(All dimensions are in inches and are typical)

a, c

Figure 2: Combination RPG/Bottom Grid Assembly

a, c

Figure 3: Number of P-Grid and RPG Supports

a, b, c

Figure 4: P-Grid and RPG HFV Response

a, b, c

Figure 5: Comparison of Pressure Drop for the P-Grid and RPG

a, c

Figure 6: Test Debris for FACTS Testing

Table 1: HFV Summary for P-Grid and RPG

a, b, c

[ ]

Table 2: Debris Test Results (% Efficiency Below Vulnerable Fuel Area (VFA))

a, b, c

[ ]

Table 3: Summary of Test Conditions

a, b, c

[ ]

Note *: [

]a,c

Table 4: Summary of Test Results for Relevant Hot and Cold Leg Break Cases [ ][a,c]

a, b, c

[ ]