



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
WASHINGTON, DC 20555 - 0001**

August 19, 2010

MEMORANDUM TO: ACRS Members

FROM: Sherry Meador **/RA/**  
Technical Secretary, ACRS

SUBJECT: CERTIFICATION OF THE MEETING MINUTES FROM  
THE ADVISORY COMMITTEE ON REACTOR  
SAFEGUARDS 551<sup>st</sup> FULL COMMITTEE MEETING  
HELD ON APRIL 10-12, 2008 IN ROCKVILLE, MARYLAND

The minutes of the subject meeting were certified on May 22, 2008 as the official record of the proceedings of that meeting. A copy of the certified minutes is attached.

Attachment:  
As stated



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
WASHINGTON, DC 20555 - 0001**

May 22, 2008

MEMORANDUM TO: Sherry Meador, Technical Secretary  
Advisory Committee on Reactor Safeguards

FROM: Cayetano Santos, Chief */RA/*  
Reactor Safety Branch  
Advisory Committee on Reactor Safeguards

SUBJECT: MINUTES OF THE 551<sup>st</sup> MEETING OF THE ADVISORY  
COMMITTEE ON REACTOR SAFEGUARDS (ACRS),  
April 10-12, 2008

I certify that based on my review of the minutes from the 551<sup>st</sup> ACRS Full Committee meeting, and to the best of my knowledge and belief, I have observed no substantive errors or omissions in the record of this proceeding subject to the comments noted below.

OFFICE	ACRS	ACRS:RSB
NAME	SMeador	CSantos/sam
DATE	05/ 22 /08	05/22/08

OFFICIAL RECORD COPY

CERTIFIED

Date Issued: 5/14/2008

Date Certified: 5/22/2008

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**APPENDICES**

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## REPORTS

Reports to Dale E. Klein, Chairman, NRC, from William J. Shack, Chairman, ACRS:

- Digital Instrumentation and Control Systems Interim Staff Guidance, dated April 29, 2008.
- Draft NUREG-1902, "Next Generation Nuclear Plant Licensing Strategy Report," dated April 30, 2008. [Official Use Only]
- Hope Creek Generating Station Extended Power Uprate Application, dated May 5, 2008.

## LETTER

Letter to Luis A. Reyes, Executive Director for Operations, NRC, from William J. Shack, Chairman, ACRS:

- Response to your April 7, 2008 Letter Regarding State-of-the-Art Reactor Consequences Analyses (SOARCA) Project, dated April 21, 2008.

## MEMORANDA

Memoranda to Luis A. Reyes, Executive Director for Operations, NRC, from Frank P. Gillespie, Executive Director, ACRS:

- Proposed Regulatory Guides/Withdrawal of Certain Regulatory Guides, dated April 23, 2008.
- Regulatory Guide 1.210, dated April 23, 2008.
- Proposed Stretch Power Uprate to Millstone Power Station, Unit 3, dated April 23, 2008.
- ACRS Review of Power Uprates, dated April 23, 2008.

MINUTES OF THE 551<sup>st</sup> MEETING OF THE  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
April 10-12, 2008  
ROCKVILLE, MARYLAND

The 551<sup>st</sup> meeting of the Advisory Committee on Reactor Safeguards (ACRS) was held in Conference Room 2B3, Two White Flint North Building, Rockville, Maryland, on April 10-12, 2008. Notice of this meeting was published in the *Federal Register* on March 26, 2008 (72 FR 16076) (Appendix I). The purpose of this meeting was to discuss and take appropriate action on the items listed in the meeting schedule and outline (Appendix II). The meeting was open to public attendance.

A transcript of selected portions of the meeting is available in the NRC's Public Document Room at One White Flint North, Room 1F-19, 11555 Rockville Pike, Rockville, Maryland. Copies of the transcript are available for purchase from Neal R. Gross and Co., Inc., 1323 Rhode Island Avenue, NW, Washington, DC 20005. Transcripts are also available at no cost to download from, or review on, the Internet at <http://www.nrc.gov/ACRS/ACNW>.

#### ATTENDEES

ACRS Members: Dr. William J. Shack (Chairman), Dr. Mario V. Bonaca (Vice-Chairman), Dr. Said Abdel-Khalik (Member-at-Large), Dr. George E. Apostolakis, Dr. Sam Armijo, Dr. Sanjoy Banerjee, Dr. Dennis Bley, Dr. Michael Corradini, Mr. Otto L. Maynard, Dr. Dana A. Powers, Mr. Jack Sieber, and Mr. John Stetkar. For a list of other attendees, see Appendix III.

#### I. Chairman's Report (Open)

[Note: Mr. Sam Duraiswamy was the Designated Federal Official for this portion of the meeting.]

Dr. William J. Shack, Committee Chairman, convened the meeting at 8:30 a.m. In his opening, he announced that the meeting was being conducted in accordance with the provisions of the Federal Advisory Committee Act. He reviewed the agenda items for discussion and noted that no written comments or requests for time to make oral statements from members of the public had been received. Dr. Shack also noted that a transcript of the open portions of the meeting was being kept and speakers were requested to identify themselves and speak with clarity and volume. He discussed the items of current interest and other administrative details for consideration by the full Committee.

#### II. Extended Power Uprate Application for the Hope Creek Generating Station

[Note: Ms. Zena Abdullahi was the Designated Federal Official for this portion of the meeting.]

The Committee met with representatives of the NRC staff, PSEG Nuclear LLC, "the licensee" and their respective consultants to discuss the Hope Creek Generating Station (HCGS) extended power uprate (EPU) application and the associated NRC staff's Safety Evaluation.

PSEG has applied for an EPU of approximately 15 percent above the current licensed thermal power of 3,339 megawatts thermal (MWt) to 3,840 MWt. This uprate also represents approximately a 17 percent increase from the original licensed thermal power of 3,293 MWt.

The Committee focused on the steam dryer performance, containment response, and analytical methods review. The steam dryer integrity was the key discussion topic. PSEG does not plan to replace the steam dryer and justified the basis for this decision citing: the merits of its main steam line configuration; the previous performance of the HCGS steam dryer in terms of acoustic vibration history and cracking; the predicted stress ratio, which showed sufficient margin; and the benefits of the deliberate power ascension testing and monitoring.

### III. Proposed Licensing Strategy for the Next Generation Nuclear Plant (NGNP)

[Note: Ms. Maitri Banerjee was the Designated Federal Official for this portion of the meeting.]

The Committee met with representatives of the NRC staff, Department of Energy (DOE), and Idaho National Laboratory (INL) to discuss Revision 15 of draft NUREG-1902, "Next Generation Nuclear Plant Licensing Strategy Report." NUREG-1902 is not publicly available at this time and will be published in conjunction with the submittal of the licensing strategy report to the Congress.

The NRC staff discussed the licensing strategy, prepared jointly by the NRC and DOE, for a full-scale prototype Next Generation Nuclear Plant (NGNP) to be built at the INL facility and operational by 2021. The Energy Policy Act of 2005 (EPAAct) mandated such preparation and submittal of the strategy to Congress by August 7, 2008. The NGNP must be able to provide process heat to an adjacent industrial facility for generation of hydrogen. The EPAAct also requires that the NRC and DOE identify how current light water reactor requirements could be adapted for the NGNP and the needed analytical tools, research and development, and infrastructure development.

The NGNP as currently envisioned by the DOE is a very high temperature, graphite moderated, gas-cooled reactor with TRISO-coated particle fuel. DOE and NRC established several Phenomena Identification and Ranking Table (PIRT) panels, comprised of subject matter experts that identified and ranked significant phenomena in five areas. The panel identified knowledge gaps and a need for data generation, models, analytical tools, and infrastructure for technical basis and licensing review.

The NRC staff discussed the licensing process options that were considered, key technical and program needs, as well as policy issues. Highlights of the PIRT findings were also discussed. The NRC staff described the technical and regulatory challenges and the next steps to be undertaken.

**[Note:** Given the predecisional nature of the licensing strategy report before its submittal to Congress, the ACRS report will not be made available to the public.]

#### IV. Digital Instrumentation and Controls (I&C) Interim Staff Guidance and Related Matters

[Note: Ms. Christina Antonescu was the Cognizant Engineer and Mr. Girija Shukla was the Designated Federal Official for this portion of the meeting.]

The Committee met with representatives of the NRC staff, Nuclear Energy Institute (NEI), and Electric Power Research Institute (EPRI) to discuss three new ISG documents issued by the NRC staff on Cyber Security, Review of New Reactor Digital I&C Probabilistic Risk Assessments (PRAs), and Digital I&C Licensing Process. The staff also discussed progress associated with the assessment of operating experience in the nuclear and other industries to obtain insights regarding potential failure modes to be used for inventory and classification of Digital I&C in nuclear power plants.

The ISG on Cyber Security clarifies the staff's guidance regarding the implementation of cyber security requirements and facilitates the licensing process when NEI 04-04, Revision 2, "Cyber Security Program for Power Reactors," is used in lieu of Regulatory Guide (RG) 1.152 Revision 2, "Criteria for Use of Computers in Safety Systems of Nuclear Power Plants." The staff plans to issue additional guidance on cyber-security to support a new rule 10 CFR 73.54. This will provide guidance for licensees and the applicants pertaining to the development of cyber security programs that meet the requirements of the proposed rule. In addition, it provides guidance to address the design basis threat of cyber attack to prevent radiological sabotage and the theft or diversion of formula quantities of strategic special nuclear material.

The draft ISG on the Review of New Reactor Digital I&C PRAs provides acceptable methods for evaluating risk assessments of Digital I&C systems. This guidance describes how NRC reviewers should evaluate Digital I&C system PRAs, including addressing inclusion of common-cause failures in PRAs and uncertainty analysis associated with new reactor digital systems.

The draft ISG on Digital I&C Licensing Process clarifies the licensing criteria that the staff will use for nuclear plant license amendments in confirming that a proposed design meets applicable requirements.

Representatives of EPRI and NEI addressed key issues of their evaluation research on operating experience to learn more about the failure modes of components and systems.

#### V. Executive Session

[Note: Mr. Frank Gillespie was the Designated Federal Official for this portion of the meeting.]

##### A. Reconciliation of ACRS Comments and Recommendations/EDO Commitments

- The Committee considered the EDO's response of April 7 2008, to comments and recommendations included in the February 25, 2008 ACRS report on the State-of-the-Art Reactor Consequence Analyses Project. The Committee decided that it was not satisfied with the EDO's response, and issued a letter to the EDO on this matter, dated April 21, 2008.

- The Committee considered the EDO's response of April 1, 2008, to comments and recommendations included in the February 28, 2008, ACRS letter concerning the Cable Response to Live Fire (CAROLFIRE) and Fire Model Improvements Program. The Committee decided that it was satisfied with the EDO's response.
- The Committee considered the EDO's response of March 27, 2008, to comments and recommendations included in the February 22, 2008, ACRS letter concerning the Draft Final Revision 1 to (RG) 1.45 (DG-1173), "Guidance on Monitoring and Responding to Reactor Coolant System Leakage." The Committee decided that it was satisfied with the EDO's response.

B. Report on the Planning and Procedures Subcommittee Meeting

Review of the Member Assignments and Priorities for ACRS Reports and Letters for the April ACRS Meeting

Member assignments and priorities for ACRS reports and letters for the April ACRS meeting were discussed. Reports and letters that would benefit from additional consideration at a future ACRS meeting were also discussed.

Anticipated Workload for ACRS Members

The anticipated workload for ACRS members through June 2008 was discussed. The objectives were:

- Review the reasons for the scheduling of each activity and the expected work product and to make changes, as appropriate
- Manage the member's' workload for these meetings
- Plan and schedule items for ACRS discussion of topical and emerging issues

Also during this session, the Subcommittee discussed and developed recommendations on items requiring future Committee action.

Proposed Topics for Meeting With the NRC Commissioners

The ACRS is scheduled to meet with the Commission on Thursday, June 5, 2008. The following topics, were discussed and approved by the Committee for the meeting, and forwarded to the Office of the Secretary requesting Commission feedback.



Chairman Klein and Commissioner Lyons approved the list of topics; however, Commissioner Lyons added a topic under Overview regarding “How the ACRS will handle future review of Materials and Waste Management Issues” along with Significant Accomplishments, License Renewal, Future Plant Activities, and Ongoing / Future Activities. Other topics include the Safety Research Program Report, Digital I&C Matters, State-of-the-Art Reactor Consequence Analyses, ESBWR Design Certification, and Extended Power Upgrades.

#### Annual Plant Visit and Meeting With the Regional Administrator

During its March 2008 meeting, the Committee decided to visit LaSalle Nuclear Plant and meet with the Region III Administrator. Subsequently, based on the input provided by members the week of July 21, 2008 has been tentatively selected for this visit. It was noted that La Salle will be conducting operator licensing examinations during that week, so the Chairman of the Plant Operations and Fire Protection Subcommittee recommended that the members visit the Byron plant.

#### Commission Approval of the Press Release and *Federal Register* Notice to Solicit Qualified Candidates for Appointment to the ACRS

In a Staff Requirements Memorandum, dated March 13, 2008, the Commission stated that it has approved the proposed Solicitation to fill a vacancy on the ACRS. The following comments were suggested as changes to the solicitation.

- “Since there is currently only one vacancy on the ACRS, the solicitation for a candidate for appointment to the ACRS should be one position in the area of nuclear materials and radiation protection. The staff should continue its current (and separate) effort to obtain additional expertise such as digital instrumentation and control for the ACRS as future openings permit.
- The *Federal Register* Notice and press release should be revised to state that the ACRS may be requested to provide advice on radiation protection, radioactive waste management and earth sciences in the agency’s licensing reviews for fuel fabrication and enrichment facilities, waste disposal facilities, and facilities related to the Department of Energy’s Global Nuclear Energy Partnership.”

The *Federal Register* Notice and Press Release have been changed to incorporate the Commission comments.

#### Commission Decision on the OIG Recommendation Regarding the Applicability of the Backfit Rule to License Renewal Applications

During its February 2008 ACRS meeting, the Committee was informed of the OIG recommendations for improving the License Renewal Program. One of the recommendations was that the Commission

“Affirm or modify the 1995 Commission’s Statement of Considerations Position regarding the applicability of the Backfit Rule to license renewal applicants.”

We informed the Committee that the staff and OIG disagreed regarding the applicability of the Backfit Rule to license renewal. The Commission was in the process of resolving this matter. The Committee requested to be kept informed of the resolution of this issue. In a March 25, 2008 Staff Memorandum **(OFFICIAL USE ONLY)**, the Commission stated the following:

“While the Report correctly observes that the backfit rule applies to operating license holders, the Report does not provide any new information that would justify applying the backfit rule to license renewal applicants. The Commission’s prior determinations that the backfit rule should not apply to license renewal applicants were well-justified. The relevant rulemaking history for both the backfit and license renewal rules made clear that the backfit rule was not intended to extend to prospective applicants, but only when the NRC was attempting to require a present licensee to meet new standards in order to remain in possession of a currently held license. Furthermore, a license renewal review is entirely prospective in nature, as it is aimed at a renewed license that has not yet been issued. There is no basis to alter the terms of a renewal applicant’s currently held license during the course of a renewal review. Therefore, the backfit rule applies to operating license holders insofar as they have currently held operating licenses, but not insofar as they are license renewal applicants voluntarily requesting renewed licenses. Accordingly, the Commission’s present policy on this issue remains valid and does not require formal reaffirmation or modification.”

Release of Status Reports for ACRS Meetings which are prepared by the ACRS Staff Engineers

The ACRS staff engineers prepare status reports for the Subcommittee and full Committee meetings. In these status reports, the engineers generally identify technical issues of concern that need to be explored by the members during the meetings. The status reports also provide personal views and technical insights for consideration by the members during the discussion of a specific matter. It has been the long-standing policy of the ACRS Office to treat these status reports, especially those that contain personal views of the engineers, as “Internal ACRS Use Only” documents. As such, these reports were not provided to the NRC staff. The staff rarely requests copies of these status reports. However, it happens occasionally. Under such circumstances, we need to maintain the current policy of not releasing the status reports, specifically those that contain personal views of the engineers, outside the ACRS Office. The Committee needs to decide whether the engineers should continue with the existing policy.

### Quadripartite Working Group Meeting

France's Groupe Permanent Réacteurs (GPR) will host the second Quadripartite Working Group (WG) meeting in France on October 9-10, 2008 on the general topic of "EPR". Drs. Bonaca and Powers, and Mr. Stetkar will be attending the meeting on behalf of ACRS. The proposed agenda was discussed. Japan's NSC and Germany's RSK have reviewed the Agenda and agree with the presentations listed for their respective countries.

Based on the topics that ACRS discussed, the proposed Agenda lists the following topics that will be discussed (1) EPR Certifications; (2) Fire as an Internal & External Hazard; (3) PSA; and (4) Thermal-hydraulics – Advanced Methods.

### Travel Request

Dr. Apostolakis has requested Committee approval and support to attend the Workshop on Updates to Existing PSHAs, scheduled to be held on May 6-7, 2008, at USGA in Menlo Park, CA.

The meeting adjourned on April 12, 2008 at 12:30 pm.



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**Appendix II**

**March 20, 2008**

**AGENDA  
551st ACRS MEETING  
APRIL 10 - 12, 2008**

**THURSDAY, APRIL 10, 2008, CONFERENCE ROOM T-2B3, TWO WHITE FLINT NORTH,  
ROCKVILLE, MARYLAND**

- 1) 8:30 - 8:35 A.M. Opening Remarks by the ACRS Chairman (Open) (WJS/CS/SD)
- 1.1) Opening statement
  - 1.2) Items of current interest

- 2) 8:35 - 11:30 A.M. Extended Power Uprate Application for the Hope Creek  
Generating Station (Open/Closed) (SAK/ZA)
- 10:00 – 10:15 A.M.**  
**\*\*\*BREAK\*\*\***
- 2.1) Remarks by the Subcommittee Chairman
  - 2.2) Briefing by and discussions with representatives of the NRC staff and the PSEG Nuclear Company regarding the Extended Power Uprate Application for the Hope Creek Generating Station and the associated NRC staff's Safety Evaluation.

**[Note: A portion of this session may be closed to discuss and protect information that is proprietary to PSEG Nuclear, LLC, and their contractors pursuant to 5 U.S.C. 552b(c)(4).]**

Members of the public may provide their views, as appropriate.

**~~11:30 – 12:30 P.M.~~**  
**12:00 – 1:00 p.m.** **\*\*\*LUNCH\*\*\***

- 3) ~~12:30 – 2:30 P.M.~~  
1:05 – 2:45 p.m. Preparation of ACRS Reports (Open/Closed)
- Discussion of proposed ACRS reports on:
- 3.1) Hope Creek Extended Power Uprate Application (SAK/ZA)
  - 3.2) Response to the EDO Response to the December 20, 2007 ACRS Report on the Susquehanna Power Uprate Application) (SB/ZA)
  - 3.3) Proposed Licensing Strategy for the Next Generation Nuclear Plant (NGNP) (MLC/MB) **(Closed)**

**2:30 - 2:45 P.M.** **\*\*\*BREAK\*\*\***

- 4) ~~2:45~~ – 4:45 P.M.  
2:50      Proposed Licensing Strategy for the Next Generation Nuclear Plant (NGNP) (Closed) (MLC/MB)  
4.1)    Remarks by the Subcommittee Chairman  
4.2)    Briefing by and discussions with representatives of the NRC staff and Department of Energy regarding the proposed licensing strategy for the Next Generation Nuclear Plant.

**[Note: This session will be closed to prevent disclosure of information the premature disclosure of which would be likely to significantly frustrate implementation of a proposed agency action pursuant to 5 U.S.C. 552b (c)(9) (b)]**

**4:45 - 5:00 P.M.      \*\*\*BREAK\*\*\***

- 5)      5:00 - 7:00 P.M.  
7:15 p.m.      Preparation of ACRS Reports (Open/Closed)  
Continued discussion of proposed ACRS reports from item #3.

**FRIDAY, APRIL 11, 2008, CONFERENCE ROOM T-2B3, TWO WHITE FLINT NORTH, ROCKVILLE, MARYLAND**

- 6)      8:30 - 8:35 A.M.      Opening Remarks by the ACRS Chairman (Open) (WJS/CS/SD)
- 7)      8:35 - 10:30 A.M.  
11:04 a.m.      Digital Instrumentation and Controls (I&C) Interim Staff Guidance and Related Matters (Open) (GEA/GSS/CEA)  
7.1)    Remarks by the Subcommittee Chairman  
7.2)    Briefing by and discussions with representatives of the NRC staff and Nuclear Energy Institute (NEI) regarding Digital I&C interim staff guidance on Cyber Security, Licensing Process, and Review of New Reactor Digital I&C PRAs, as well as assessment of Digital System Operating Experience Data and Digital Categorization Update, current status of Traditional Methods Digital Reliability Modeling research, and related matters.

Members of the public may provide their views, as appropriate.

**~~10:30 – 10:45 A.M.~~  
11:05 – 11:15 a.m.      \*\*\*Break\*\*\***

- 8)      ~~10:45 – 11:30 A.M.~~  
11:15 – 12:25 p.m.      Future ACRS Activities/Report of the Planning and Procedures Subcommittee (Open) (WJS/FPG/SD)  
8.1)    Discussion of the recommendations of the Planning and Procedures Subcommittee regarding items proposed for consideration by the full Committee during future ACRS meetings.  
8.2)    Report of the Planning and Procedures Subcommittee on matters related to the conduct of ACRS business, including anticipated workload and member assignments.

- 9) ~~11:30 – 11:45 A.M.~~ 11:30 – 11:40 A.M. Reconciliation of ACRS Comments and Recommendations  
 1:30 – 1:40 p.m. (Open) (WJS, et al. /CS, et al.)  
 Discussion of the responses from the NRC Executive Director for Operations to comments and recommendations included in recent ACRS reports and letters.
- 11:45 - 12:45 P.M. \*\*\*LUNCH\*\*\***
- 10) 12:45 - 7:00 P.M. Preparation of ACRS Reports (Open/Closed)  
 Discussion of proposed ACRS reports on:  
**2:45 – 3:00 P.M.**  
**\*\*\*Break\*\*\***
- 10.1) Hope Creek Extended Power Uprate Application (SAK/ZA)
  - 10.2) Digital I&C Interim Staff Guidance and related matters (GEA/GSS/CEA)
  - 10.3) PWROG Topical Report WCAP-16793-NP (SB/DEB)
  - 10.4) Response to the EDO Response to the December 20, 2007 ACRS Report on the Susquehanna Power Uprate Application) (SB/ZA)
  - 10.5) Proposed Licensing Strategy for the Next Generation Nuclear Plant (NGNP) (MLC/MB) **(Closed)**

**SATURDAY, APRIL 12, 2008, CONFERENCE ROOM T-2B3, TWO WHITE FLINT NORTH, ROCKVILLE, MARYLAND**

- 11) 8:30 - 4:00 P.M. Preparation of ACRS Reports (Open/Closed)  
 12:00 p.m. Continue discussion of proposed ACRS reports listed under Item 10.
- 10:30 – 10:45 A.M.**  
**\*\*\*BREAK\*\*\***
- ~~12) 1:00 – 1:30 P.M. Miscellaneous (Open) (WJS/FPG)~~  
~~Discussion of matters related to the conduct of Committee activities and matters and specific issues that were not completed during previous meetings, as time and availability of information permit.~~

**NOTE:**

Presentation time should not exceed 50 percent of the total time allocated for a specific item. The remaining 50 percent of the time is reserved for discussion.

One (1) electronic copy and thirty-five (35) hard copies of the presentation materials should be provided to the ACRS.

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
551<sup>ST</sup> FULL COMMITTEE MEETING

April 10, 2008

### NRC Attendees

	<u>NAME</u>	<u>NRC ORGANIZATION</u>
1	J. Lamb	NRR
2	P. Yarsky	NRR
3	F. Eltawila	RES
4	Y. Orechwa	NRR
5	S. Basu	RES
6	J. Joliceur	RES
7	S. Rubin	RES
8	J. Wilson	NRO
9	K. Tene	RES
10	N. Su	RES
11	D. Heltow	RES
12	P. Lee	NSIR
13	E. Baker	NRO
14	D. Dube	NRO
15	W. Smith	NMSS
16	L. Gibson	RES
17	M. Bogg	RES
18	N. Kadambu	RES
19	N. Hudson	RES
20	B. Vaidya	NRR
21	T. Kenyon	NRO

### Outside Attendees

	<u>NAME</u>	<u>NRC ORGANIZATION</u>
1	P. Duke	PDEG
2	J. Keenan	PSEG
3	P. Davison	PSEG
4	R. Vemluis	DOE
5	T. Cook	DOE
6	M. Holbrook	INL
7	D. Petti	INL

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
551<sup>ST</sup> FULL COMMITTEE MEETING  
April 11, 2008

**NRC Attendees**

	<b><u>NAME</u></b>	<b><u>NRC ORGANIZATION</u></b>
1	G. Kelly	NRO
2	J. Robinson	NRR
3	S. Arndt	NRR
4	R. Syndnor	RES
5	P. Hiland	NRR
6	B. Kemper	NRR
7	J. Vail	NRR
8	D. Dube	NRO
9	P. Loeser	NRR
10	S. Bailey	NRR
11	M. Franovich	NRR
12	T. Hipschman	OCM/GBJ
13	M. Waterman	RES
14	A. Kuritsky	RES
15	M. Ganen	NRO
16	C. Ader	NRO
17	D. Desonlineks	NRO
18	D. Rahn	NMSS
19	P. Yairsky	NRR
20	J. Lamb	NRR
21	T. Kenyon	NRO
22	J. Joliceur	RES

**Outside Attendees**

	<b><u>NAME</u></b>	<b><u>NRC ORGANIZATION</u></b>
1	G. Clefton	NEI
2	R. Torok	EPRI
3	B. Gedeke	EPRI
4	J. Riley	NEI
5	J. Keenan	PSEG
6	P. Davison	PSEG
7	P. Duke	PSEG





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**Appendix V**

**April 17, 2008**

**SCHEDULE AND OUTLINE FOR DISCUSSION  
552nd ACRS MEETING  
MAY 8-10, 2008**

**THURSDAY, MAY 8, 2008, CONFERENCE ROOM T-2B3, TWO WHITE FLINT NORTH,  
ROCKVILLE, MARYLAND**

- 1) 8:30 - 8:35 A.M. Opening Remarks by the ACRS Chairman (Open) (WJS/CS/SD)
  - 1.1) Opening statement
  - 1.2) Items of current interest
  
- 2) 8:35 - 10:30 A.M. Selected Chapters of the SER Associated with the ESBWR Design Certification Application (Open/Closed) (MLC/DEB)
  - 2.1) Remarks by the Subcommittee Chairman
  - 2.2) Briefing by and discussions with representatives of the NRC staff and General Electric – Hitachi Nuclear Energy (GEH) regarding selected Chapters of the NRC staff's Safety Evaluation Report (SER) With Open Items associated with the Economic Simplified Boiling Water Reactor (ESBWR) design certification application.

**[Note: A portion of this session may be closed to protect information that is proprietary to GEH and its contractors pursuant to 5 U.S.C. 552b ( c ) (4).]**

Members of the public may provide their views, as appropriate.

**10:30 - 10:45 A.M. \*\*\*BREAK\*\*\***

- 3) 10:45 - 12:30 P.M. Insights from PHEBUS – FP Tests (Open) (JSA/DEB/HPN)
  - 3.1) Briefing by and discussions with representatives of the NRC staff regarding the findings of the large-scale integral tests conducted in connection with the PHEBUS – FP Program and their implications on containment iodine behavior.

Representatives of the nuclear industry and members of the public may provide their views, as appropriate.

**12:30 - 1:30 P.M. \*\*\*LUNCH\*\*\***

- 4) 1:30 - 3:30 P.M. Draft NUREG/CR Report on PRA Methods for Digital Systems (Open) (GEA/CEA)  
4.1) Remarks by the Subcommittee Chairman  
4.2) Briefing by and discussions with representatives of the NRC staff and Brookhaven National Laboratory (BNL) regarding draft NUREG/CR – XXX Report on Approaches for Using Traditional PRA Methods for Digital Systems and other related matters.

Representatives of the nuclear industry and members of the public may provide their views, as appropriate.

**3:30 - 3:45 P.M. \*\*\*BREAK\*\*\***

- 5) 3:45 - 7:00 P.M. Preparation of ACRS Reports (Open)  
Discussion of proposed ACRS reports on:  
5.1) Selected Chapters of the SER Associated with the ESBWR Design Certification Application (MLC/DEB)  
5.2) Insights from PHEBUS – FP Tests (JSA/DEB/HPN)  
5.3) Draft NUREG/CR Report on PRA Methods for Digital Systems (GEA/CEA)  
5.4) Response to the EDO Response dated January 17, 2008, to the December 20, 2007 ACRS Report on the Susquehanna Power Uprate Application) (SB/ZA)

**FRIDAY, MAY 9, 2008, CONFERENCE ROOM T-2B3, TWO WHITE FLINT NORTH, ROCKVILLE, MARYLAND**

- 6) 8:30 - 8:35 A.M. Opening Remarks by the ACRS Chairman (Open) (WJS/CS/SD)
- 7) 8:35 - 9:15 A.M. Future ACRS Activities/Report of the Planning and Procedures Subcommittee (Open) (WJS/FPG/SD)  
7.1) Discussion of the recommendations of the Planning and Procedures Subcommittee regarding items proposed for consideration by the full Committee during future ACRS meetings.  
7.2) Report of the Planning and Procedures Subcommittee on matters related to the conduct of ACRS business, including anticipated workload and member assignments.
- 8) 9:15 - 9:30 A.M. Reconciliation of ACRS Comments and Recommendations (Open) (WJS, et al. /CS, et al.)  
Discussion of the responses from the NRC Executive Director for Operations to comments and recommendations included in recent ACRS reports and letters.
- 9) 9:30 – 10:00 A.M. Subcommittee Report (Open) (JWS/PW)  
Report by and discussions with the Chairman of the ACRS Subcommittee on Plant License Renewal regarding the license renewal application for the Shearon Harris Nuclear Power Plant that was discussed during the Subcommittee meeting on May 7, 2008.

**10:00 – 10:15 A.M.    \*\*\*BREAK\*\*\***

- 10)    10: 15 – 12:00 P.M.    Preparation for Meeting with the Commission on June 5, 2008  
(Open) (WJS, et al. /FPG, et al.)  
Discussion for meeting with the Commission on June 5, 2008.

**12:00 - 1:30 P.M.    \*\*\*LUNCH\*\*\***

- 11)    1:30 – 6:30 P.M.    Preparation of ACRS Reports (Open)  
Discussion of proposed ACRS reports on:  
11.1)    Selected Chapters of the SER Associated with the ESBWR  
Design Certification Application (MLC/DEB)  
11.2)    Insights from PHEBUS – FP Tests (JSA/DEB/HPN)  
11.3)    Draft NUREG/CR Report on PRA Methods for Digital  
Systems (GEA/CEA)  
11.4)    Response to the EDO Response dated January 17, 2008,  
to the December 20, 2007 ACRS Report on the  
Susquehanna Power Uprate Application) (SB/ZA)

**SATURDAY, MAY 10, 2008, CONFERENCE ROOM T-2B3, TWO WHITE FLINT NORTH,  
ROCKVILLE, MARYLAND**

- 12)    8:30 - 1:00 P.M.    Preparation of ACRS Reports (Open)  
**(10:30-10:45 A.M. BREAK)** Continue discussion of proposed ACRS reports listed under  
Item 11.
- 13)    1:00 - 1:30 P.M.    Miscellaneous (Open) (WJS/FPG)  
Discussion of matters related to the conduct of Committee  
activities and matters and specific issues that were not completed  
during previous meetings, as time and availability of information  
permit.

**NOTE:**

Presentation time should not exceed 50 percent of the total time allocated for a specific item. The remaining 50 percent of the time is reserved for discussion.

One (1) electronic copy and thirty-five (35) hard copies of the presentation materials should be provided to the ACRS.

LIST OF DOCUMENTS PROVIDED TO THE ACRS COMMITTEE  
DURING THE 551<sup>st</sup> MEETING ON APRIL 10-12, 2010

Agenda Item 2:

Extended Power Uprate Application for the Hope Creek Generating Station

1. Purpose
2. Overview
3. Committee Meeting Summary
4. Conclusions
5. Key Core Parameters
6. Subcommittee Status Report
7. Member / Consultant Reports (Chairman Shack, Consultant Wallis, Consultant Kress and Consultant Pierce)
8. March 20-21<sup>st</sup>, 2008 Subcommittee Meeting Slides

Agenda Item 3:

Pressurized Water Reactor Owners Group (PWROG) Topical Report WCAP-16793-NP,  
"Evaluation of Long-Term Cooling Considering Particulate, Fibrous, and Chemical Debris in the  
Recirculating Fluid"

9. Table of Contents
10. Proposed Meeting Agenda
11. Status Report

Agenda Item 4:

Proposed Licensing Strategy for the Next Generation Nuclear Plant (NGNP)

12. Table of Contents
13. Proposed Meeting Agenda
14. Status Report

Agenda Item 7:

Digital Instrumentation and Controls (I&C) Interim Staff Guidance and Related Matters

15. Table of Contents
16. Proposed Meeting Agenda
17. Status Report
18. DI&C-ISG-01, "Cyber Security," including the following:
  - Appendix A, "RG 1.152 (Rev 2) and Draft NEI 04-04 (Rev 2) Cross-Correlation Table"
  - Appendix B, "NEI 04-04 (Rev 2), "Cyber Security Program for Power Reactors" (please note that Appendices A and B are restricted documents, "need to know")
19. Draft DI&C-ISG-06, "Digital I&C Licensing Process," including the following:
  - "Documents Needed for Review of Different Complexities"
20. Draft DI&C-ISG-03, "Review of New Reactor Digital I&C"
21. Draft White Paper, "Assessment of Digital System Operating Experience Data & System Inventory and Classification Structure"

22. Draft NUREG/CR "Approaches for Using Traditional PRA Methods for Digital Systems", including the following:
- Appendix A, "Summary Report of the External Review Panel Meeting on Reliability Modeling of Digital Systems (May 23–24, 2007)"
  - Appendix B, "Detailed FMEA of the DFWCS at Different Levels"
  - Appendix C, "Modeling of Software Failures"
  - Appendix D, "Other Methods for Modeling Digital Systems"

# Hope Creek Cycle 14 Fuel Failures

- General
  - Mixed core; GE-14 and SVEA 96+
  - Three assemblies failed; all SVEA 96+
    - Three cycles of operation
- WQ0534
  - Identified and suppressed during Power Suppression Testing (PST)
  - 30738.19 MWD/ST exposure
  - Debris (visual observation)
- WQ0657
  - Identified during RF14 In-mast sipping
  - No indication of defect during PST
  - 32515.42 MWD/ST exposure
  - Manufacturing (elimination of other causes)
- WQ0582
  - Identified during RF14 In-mast sipping
  - No indication of defect during PST
  - 32350.86 MWD/ST exposure
  - Manufacturing (elimination of other causes)



# Hope Creek Generating Station Extended Power Uprate

Advisory Committee on Reactor Safeguards

April 10, 2008





# Probabilistic Safety Assessment

E.T. Burns

Hope Creek Risk Management Team





## **ACRS Subcommittee presentation (March 21)**

- Scope and quality
- Quantitative results for Internal Events
- Qualitative assessment of External Events
- Conclusion: Risk change resulting from EPU implementation is very small

**ACRS Subcommittee requested additional detail regarding disposition of individual fire and seismic accident sequences affected by EPU implementation**

# Risk Evaluation Methods

- Identify plant configuration and procedural changes due to EPU
- Use updated PRA models for internal events consistent with ASME PRA standard
- Use available IPEEE fire and seismic PRA models
- Identify PRA elements affected by changes
- Incorporate hardware and procedure changes in PRA model
- Use realistic success criteria and limits
- Compare results with Reg. Guide 1.174 guidelines

**Scoping analysis from IPEEE available**

**Conservatism bias results of Fire Scoping Study**

**EPU effects**

- No increase in combustible loading
- No new fire initiating events or increased fire frequency

**Quantitative fire PRA model calculations:**

- Examine critical fire scenarios from IPEEE
- Loss of equipment or access to equipment leads to CDF regardless of EPU implementation
- Negligible impact on decay heat removal scenario HEPs because of long times available for response/recovery actions

# Fire Quantitative Results

## Examine the 16 fire induced core damage scenarios (95% of fire CDF)

- Dominant EPU effect related to reduced time available for manual actions
- Results:  $\Delta\text{CDF} = 7.0\text{E-}8/\text{yr}$

## Bound the residual fire induced CDF (5% of fire CDF)

- Use worst case effect of decrease in allowable time for crew action
- Results:  $\Delta\text{CDF} = 3.0\text{E-}8/\text{yr}$

## Total risk change due to fire induced CDF

- Results:  $\Delta\text{CDF} = 1.0\text{E-}7/\text{yr}$

## EPU has very small impact on fire risk profile

**Seismic PRA scoping model available**

**89.6% of contributors are hardware failures**

**EPU effects**

- No change in seismic qualification for SSCs
- No significant change in equipment mountings or anchorages
- No new seismic vulnerabilities identified
- Dominant contributors to seismic risk (89.6%) are related to equipment failures with no operator actions credited

# Bounding Calculation: Seismic

## Dominant contributors

- 89.6% of seismic sequences result in CDF due to direct hardware failure
  - No operator response can be credited therefore, no  $\Delta$ CDF results for these sequences

## Residual contributors

- 10.4% of the seismic sequences may involve some crew failure to lead to core damage.
- Sequence No. 3 (SDS-26) at 1.97E-7/yr contributes 1.4E-8/yr to  $\Delta$ CDF due to changes in time available for manual action
- Assume all other residual seismic sequences (5.1%) have impact associated with reduced time available for crew response:

$$\begin{aligned}\Delta\text{CDF}_{\text{Residual Seismic}} &= \text{CDF}_{\text{Seismic}} \times 0.051 \times 0.072 \\ &= 3.6\text{E-}6/\text{yr} \times 0.051 \times 0.072 = 1.3\text{E-}08/\text{yr}\end{aligned}$$

# Bounding Calculation: External Events

## Quantitative Summary

Hazard	$\Delta$ CDF (per yr)
Seismic	2.7E-8
Fire	1.0E-7
Internal	6.8E-7
Total	8.1E-7

**Result: Region III - very small risk [Compared with RG 1.174 Acceptance Guideline]**

## Summary of EPU Risk Impact

**Risk impact evaluated using standard PRA methods and incorporated seismic and fire scoping analyses**

**Quantified risk impact is a small percentage of current plant risk**

**$\Delta$ CDF is a very small risk change per Reg. Guide 1.174**





# Containment Analysis

Paul Davison

Site Engineering Director



# Containment Analysis Overview

**DBA LOCA Containment Analyses**

**Containment Analyses Comparison**

**ECCS NPSH Determination**

## Analyses

- Analyses at or above 102% of 3840 MWt
- Decay heat by ANS/ANSI 5.1-1979 with  $2\sigma$  uncertainty
- Passive heat sinks credited in long term analysis

## Results

- All containment parameters remain below design limits

# Containment Analyses Comparison

## Hope Creek DBA LOCA Containment Performance Results

Parameter	EPU Results	Design Limit
Peak Drywell Air Space	50.6 psig	62 psig
	298°F	340°F
Peak Bulk Pool Temp	212.3°F	218°F
Peak Wetwell Air Space	27.7 psig	62 psig
	212.2°F	310°F

## RHR and Core Spray NPSH-Available Assumptions

- Bulk pool temperature = 218°F
- Containment pressure = 14.7 psia

## NPSH-Required Based on Maximum Tested Flows

**NPSH-Available > NPSH-Required**

**Containment Overpressure Not Credited**



# Fuel Dependent Response & Methods

Donald V Notigan

Nuclear Fuels Manager – BWR Design & Analysis



# Fuel Dependent Response & Methods

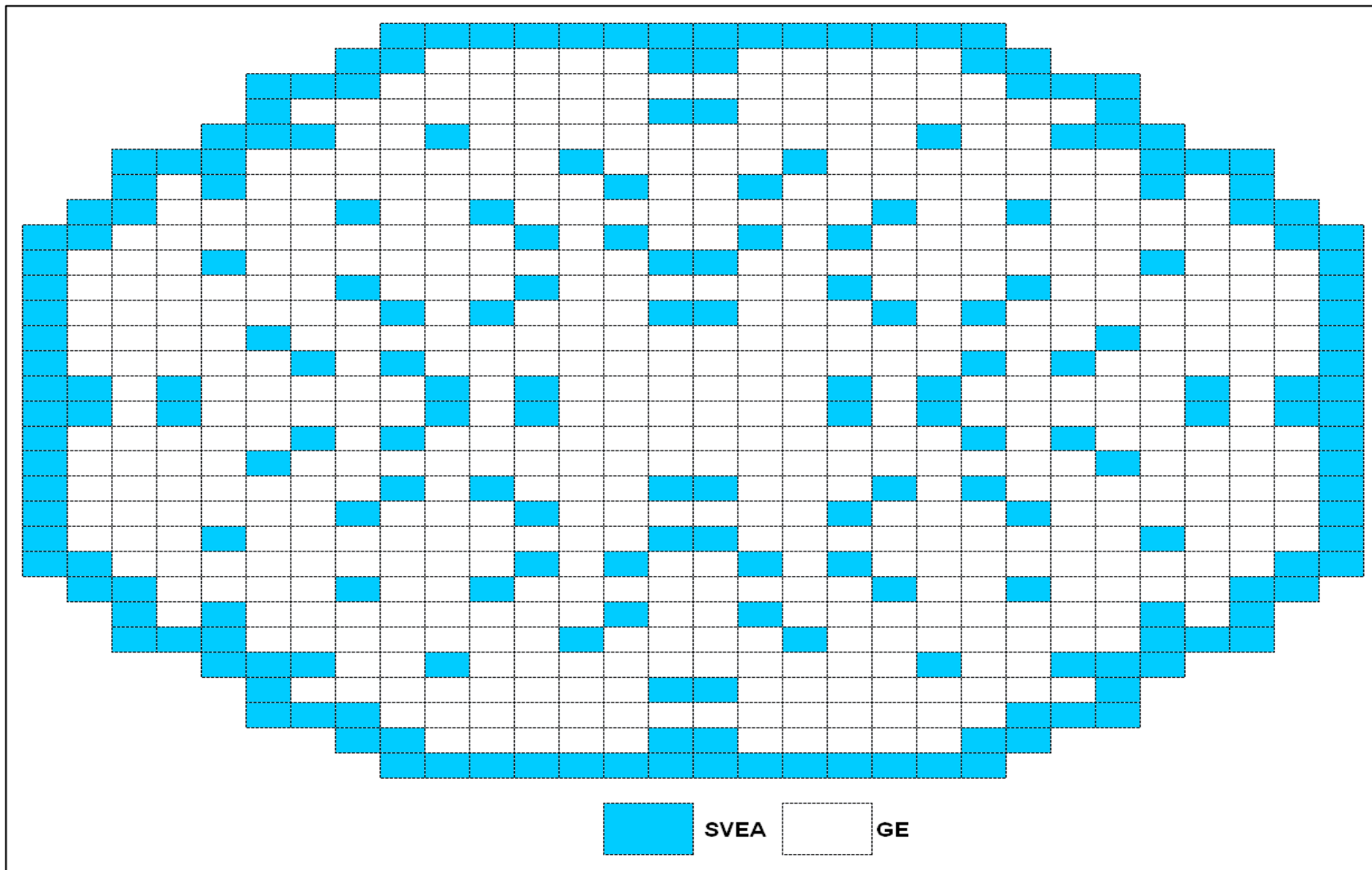
**Core Loading Map for EPU Operation**

**Fuel Performance and Core Design**

**Safety Analysis**

**Conclusions**

# Hope Creek EPU Core Loading Map





# EPU Core Design

- All fuel assemblies have PCI resistant design (barrier liner clad) and integrated debris filter features
- SVEA fuel is low reactivity fuel and in non-limiting core locations
- SVEA fuel will operate with maximum bundle powers below pre-EPU levels
- GE fuel delivers 81% of EPU core thermal power
- All EPU core design calculations and reload safety evaluations are complete

# Safety Analysis

- All thermal limits were met with margin remaining for GE & SVEA fuel (MFLCPR, MAPLHGR and MFLPD)
- SVEA fuel does not contribute to core Safety Limit MCPR
- Key safety analysis parameters will remain consistent with EPU reference plant operating experience base
- All applicable limitations, conditions and adders from NRC approved Licensing Topical Report NEDC-33173P were fully incorporated into EPU safety analysis

# Conclusion

- Applied NRC approved GE nuclear analysis methods
- All EPU cycle specific core design calculations and reload evaluations are complete
- Incorporated all applicable limitations, conditions & adders from NRC approved Licensing Topical Report NEDC-33173P
- SVEA fuel is non-limiting in EPU core operation
- Fuel performance is consistent with EPU reference plant operating experience base for key parameters important to safety

**Safe Operation of Fuel for Hope Creek 115% Extended Power Uprate Confirmed**



# Steam Dryer & Power Ascension Testing

Paul Davison

Site Engineering Director



# **Steam Dryer Overview**

**Robust Steam Dryer Design**

**Quiet Plant**

**Dryer Analysis**

**Results**

**Steam Dryer Power Ascension**

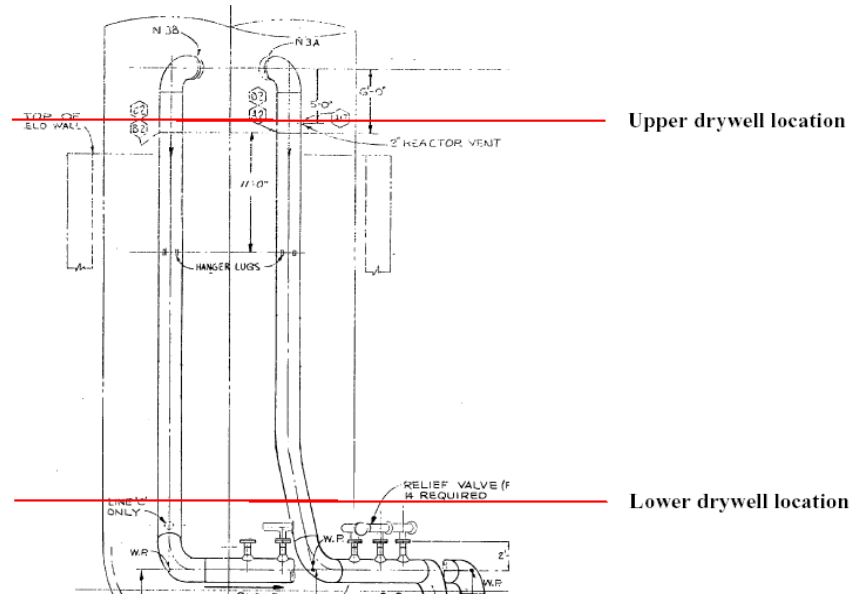
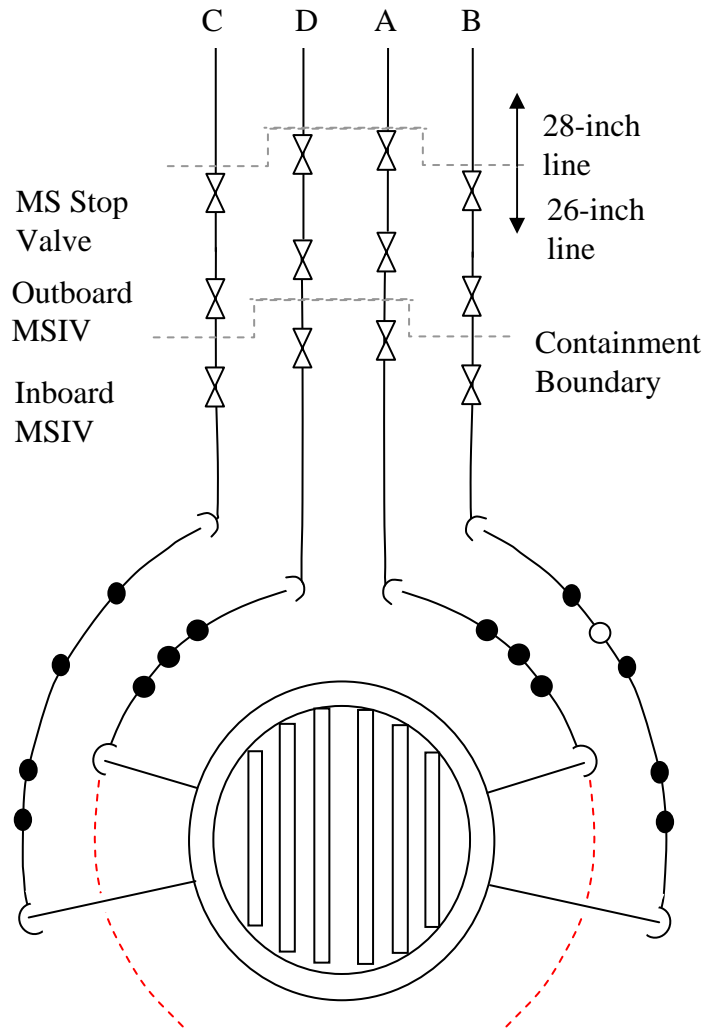
## Curved Hood

- 3rd generation of GE steam dryer design
- Modified on-site prior to operation

## Baseline Inspections Done

- Per BWR VIP recommendations
- No fatigue cracking identified

# Hope Creek Main Steam Lines



Dashed red-lines show location of SSES 26-inch MSL dead branches, which do not exist at HCGS.

## Acoustic Circuit Model Revision 4

- 0 Hz - 60 Hz - Incorporation of additional source to improve low frequency loading

**Revision 4 identical to Revision 2 for 60 Hz – 200 Hz**

## Revision 4 Validation

- Based on benchmark of Quad Cities data at Hope Creek's EPU Mach number
- Blind benchmark of Quad Cities completed at higher Mach number
  - ACM predictability same at both power levels



## Finite Element Modeling

- Standard code ANSYS 10.0
- Independently validated CDI's capability to model a complex structure
- Mesh convergence study completed
- Independent third party review

## Results

- Lowest alternating stress ratio is 2.18
- All bias and uncertainty at EPU conditions

# Steam Dryer Power Ascension

## Monitoring

- MSL strain gages
- MSL accelerometers
- MSL moisture carryover

## Evaluation

- Strain gage limit curves
- Power ascension rate of  $\leq 1\%$  CLTP/hr
- Collection of strain gage data at every 1% increase
  - Used for trending
- Evaluation every 2.5% power
- Power plateaus at each 5% power step and final EPU power

## Reporting

- Provide data for NRC review at each plateau (5% power)

# Power Ascension Test Matrix

% Power	MSL Strain Gage	Moisture Carryover	RW Level	MSL Accel	SRV Accel	FW Accel	Ext Steam Accel	Recirc Accel	Non Critical FIV	Rad Survey	Core Perform	Chem Data	FW Run-Out	DEHC Press Change	Sys Perf Mont	FW Step Change
90	X	X	X	X	X	X	X	X			X		X	X	X	X
100	X	X	X	X	X	X	X	X			X		X	X	X	X
101	X		X	X	X	X	X	X								
102	X		X	X	X	X	X	X								
102.5	X	X	X	X	X	X	X	X							X	
103.5	X		X	X	X	X	X	X								
104.5	X		X	X	X	X	X	X								
105	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
106	X		X	X	X	X	X	X								
107	X		X	X	X	X	X	X								
107.5	X	X	X	X	X	X	X	X							X	
108.5	X		X	X	X	X	X	X								
109.5	X		X	X	X	X	X	X								
110	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
111	X		X	X	X	X	X	X								
111.5	X	X	X	X	X	X	X	X			X				X	
111.5 CF	X	X	X	X	X	X	X	X	X	X	X	X	X		X	
112.5	X	X	X	X	X	X	X	X							X	
113.5	X		X	X	X	X	X	X								
114.5	X		X	X	X	X	X	X								
115	X	X	X	X	X	X	X	X			X				X	
115 CF	X	X	X	X	X	X	X	X	X	X	X	X	X		X	

CF – Cross Flow Applied



# Steam Dryer & Power Ascension Testing - Closed Session

Paul Davison

Site Engineering Director



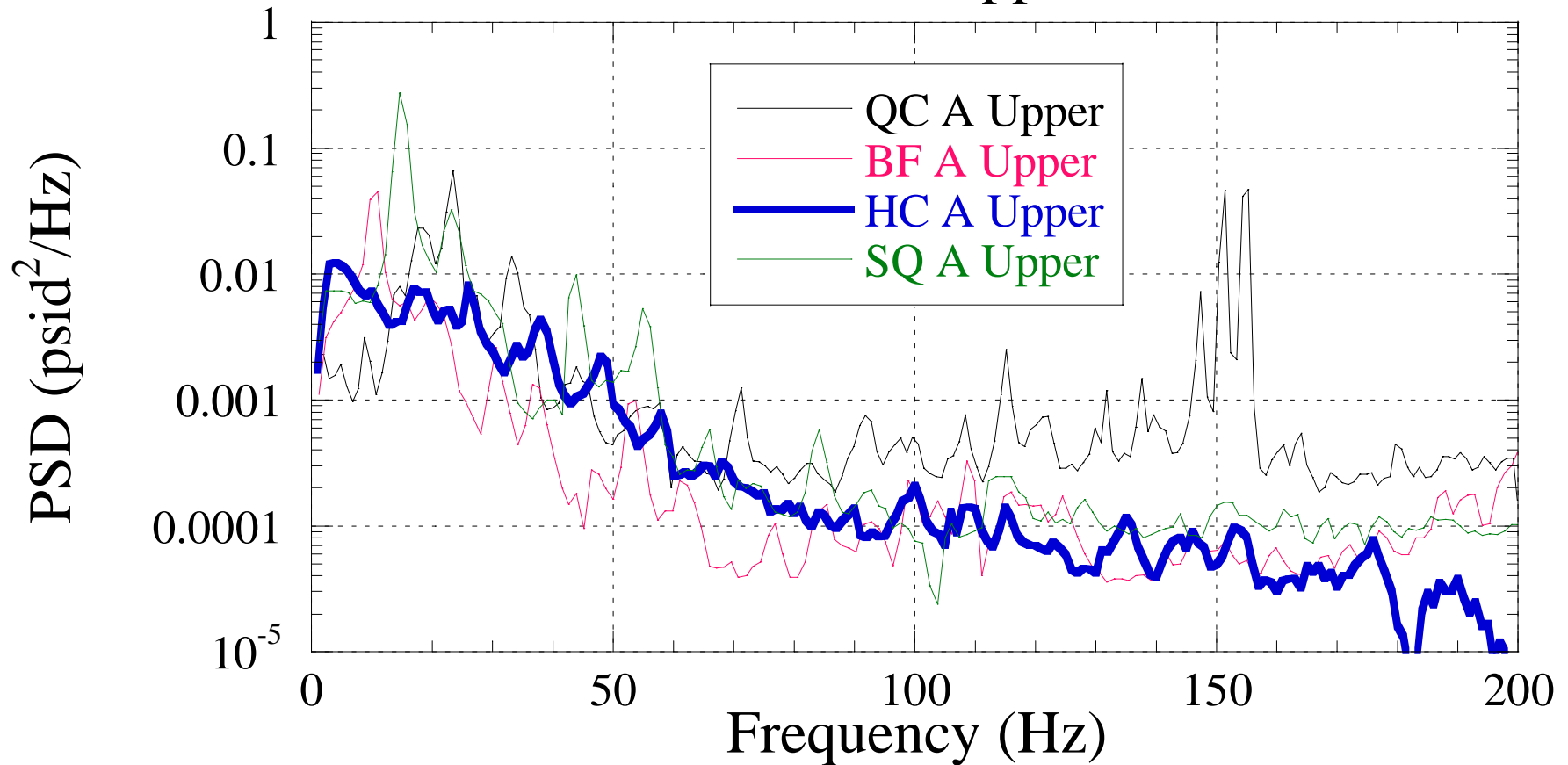
# Steam Dryer Overview

**Quiet Plant**

**Steam Dryer Power Ascension**

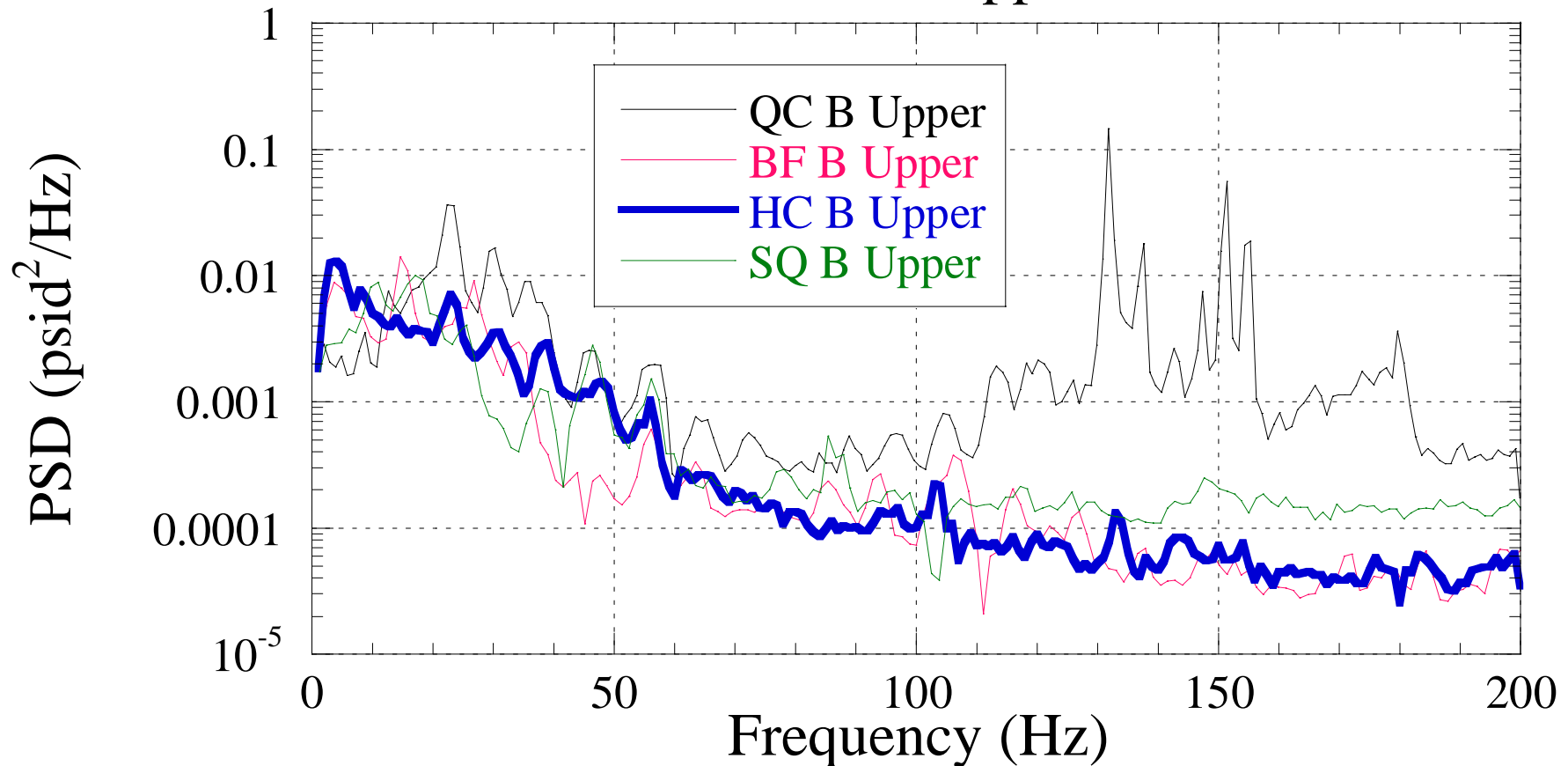
# Strain Gage Data Comparison With Other Plants

## MSL A Upper



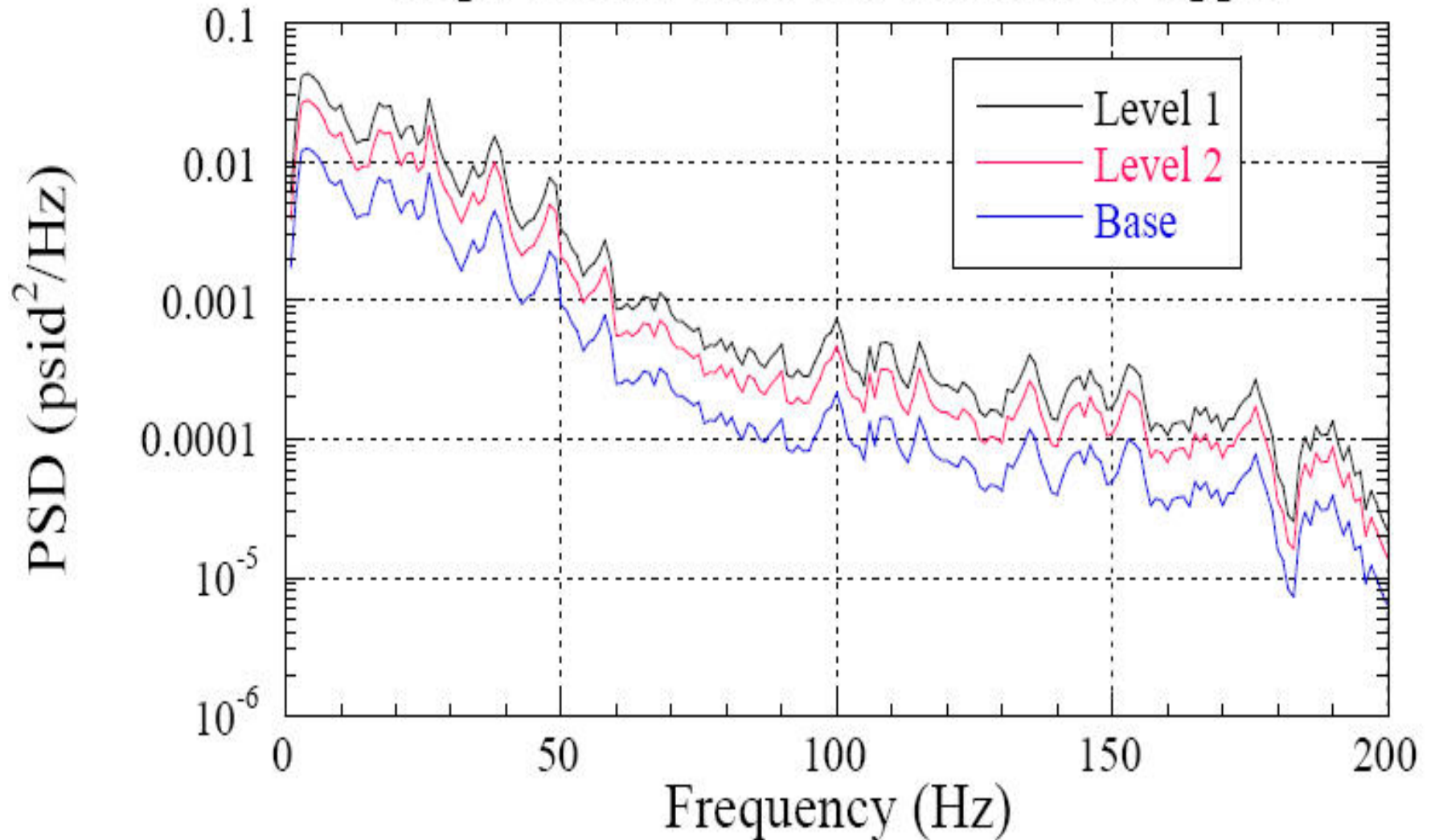
# Strain Gage Data Comparison With Other Plants

## MSL B Upper



## MSL Performance Criteria (Limit Curves)

Hope Creek Limit Curve: MSL A Upper





# Conclusions

- Robust Steam Dryer Design
- Low MSL Acoustic Signature
- Improved & Benchmarked Modeling That Contain Biases & Uncertainties
- Dryer Stress Ratios Above 2.0
- Comprehensive Power Ascension Test Plan
- High Confidence in Considerable Margin Against Steam Dryer Fatigue

## **ACRS Licensing Condition**

### **SRV Licensing Condition:**

The following measures are in place at Hope Creek to ensure that action is taken in response to issues associated with SRV leakage:

- The SRV Tailpipe temperature and Acoustic Monitoring is performed to detect thru-seat leakage.
- Procedure limits are established to detect and act upon elevated tailpipe temperatures.
- Temperature limits established to prevent self actuation. Temperature limits reflect appropriately 100 lbsm/hr.
- Vendor limit of 200 lbsm/hr for self-actuation.
- 100 lbm/hr limit is extremely small in comparison to the average steam line flow of 4,000,000 lbm/hr.
- Acoustic resonance and its resultant increased on the dryer builds incrementally and the minute change of 100-200 lbm/hr in comparison to the appropriate 4,000,000 lbm/hr will not adversely affect the dryer in light of the 65% bias and 10% uncertainty already factored into the analysis and the 120% margin built in with the 2.18 stress ratio.

Based on the foregoing controls, the licensee believes adequate means are established to detect, address and remedy issues before dryer loading issue would arise.

## **Bump-up Factors Condition:**

- Limits were established such that actual plant data would need to match exactly on top of the Level 1 limit curve at every frequency range for the 13,600 psi limit to be achieved at the dryer location with the lowest alternating stress ratio.
- Singular exceedances will not result in 13,600psi being exceeded, but will require us to stop, analyze and resubmit new limit curves.
- In order to prevent the numerous level 2 limit curves exceedances at Vermont Yankee during their power ascension, we utilized small scale testing to predict the frequency range and magnitude of resonance (approximately 118 Hz and a factor of 15). The information was used to alter the Hope Creek limit curves to preclude falsely exceeding the limit at 118Hz by increasing the limits in the 116 Hz to 120 Hz range by a factor of 15 (Still retains the 65% Bias, 10% Uncertainty and SR >2).
- Further, in between the 105, 110 and 111.5% power hold points we will be trending the data to ensure that we stop and analyze the limit curves before the next power increase if we predict that a Level 1 or 2 Limit Curve will be exceeded.
- In summary, we are assessing margin to limit curves exceedances at each power increase.
- Therefore, the power ascension trending already prescribed and the methodology of how the limit curves were established ensures that the dryer will not undergo excessive loading and the suggested licensing condition is already captured in the Staff's Licensing Condition of the SER.