NMC
Committed to Nuclear Excellence

Point Beach Nuclear Plant
Operated by Nuclear Management Company, LLC

November 3, 2003

NRC 2003-0101
10 CFR 50.90

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

Point Beach Nuclear Plant Units 1 and 2
Dockets 50-266 and 50-301
License Nos. DPR-24 and DPR 27
Response To Request For Additional Information Regarding
License Amendment Request 231, Technical Specifications SR 3.1.4.1,
Rod Group Alignment Limits

References:
1) Letter from NMC to NRC dated November 20, 2000 (NPL 2000-0511)
2) Letter from NMC to NRC dated May 3, 2001 (NRC 2001-029)
3) NRC Safety Evaluation Report dated May 8, 2001
4) Letter from NMC to NRC dated March 27, 2003 (NRC 2003-0027)

In Reference 4, Nuclear Management Company, LLC (NMC) submitted a request for an amendment to the Technical Specifications (TS) for Point Beach Nuclear Plant (PBNP), Units 1 and 2. The proposed amendment would revise TS Surveillance Requirement (SR) 3.1.4.1, Rod Group Alignment Limits, to change the allowable alignment limits of individual rods in Mode 1 when greater than 85% power. NRC issued Amendments 200/205 for PBNP Units 1 and 2, respectively, on May 8, 2001 (Reference 3). These related amendments increased the allowable alignment limits of individual rods for operation at less than or equal to 85% power (References 1 and 2).

During subsequent conference calls between NMC representatives and NRC staff, the NRC requested additional information in support of their review of Reference 4.

Enclosed with this letter are proprietary and non-proprietary versions of Westinghouse document, "Responses to RAIs for WCAP-15432, Point Beach Units 1 and 2 Rod Misalignment Relaxation". Also enclosed are a Westinghouse authorization letter, CAW-03-1715, accompanying affidavit, Proprietary Information Notice, and Copyright Notice.

APO1

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As enclosure 2 contains information proprietary to Westinghouse Electric Company, it is supported by an affidavit signed by Westinghouse, the owner of the information. The affidavit sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of Section 2.790 of the Commission's regulations.

Accordingly, it is respectfully requested that the information that is proprietary to Westinghouse be withheld from public disclosure in accordance with 10 CFR 2.790.

Correspondence with respect to the copyright or proprietary aspects of the items listed above or the supporting Westinghouse Affidavit, should reference CAW-03-1715 and should be addressed to H. A. Sepp, Manager of Regulatory Compliance and Plant Licensing, Westinghouse Electric Company, P.O. Box 355, Pittsburgh, Pennsylvania 15230-0355.

No changes to the initially proposed license amendment request result from this additional information.

This letter contains no new commitments or changes to existing commitments.

I declare under penalty of perjury that the foregoing is true and correct.
Executed on October 31, 2003.

A. J. Cayia
Site Vice-President, Point Beach Nuclear Plant
Nuclear Management Company, LLC

Enclosures

cc (with enclosures 1 & 2):
Project Manager, Point Beach Nuclear Plant, USNRC

cc (w/o enclosures):
Regional Administrator, Region III, USNRC
Resident Inspector - Point Beach Nuclear Plant, USNRC
PSCW

ENCLOSURE 1

Westinghouse Document, "Responses to RAIs for WCAP-15432 Point Beach Units 1 and 2 Rod Misalignment Relaxation" (Non-Proprietary)

Westinghouse Non-Proprietary Class 3

Responses to RAIs for WCAP-15432 Revision 2
Point Beach Units 1 and 2 Rod Misalignment Relaxation

Westinghouse Electric Company LLC
Energy Systems
P.O. Box 355
Pittsburgh, PA 15230-0355

Responses To RAIs for WCAP-15432 Revision 2
Point Beach Units 1 and 2 Rod Misalignment Relaxation

1) **On page 4 of the submittal, the licensee states that two types of static rod misalignment analyses are performed. With control banks at their respective rod insertion limits, one analysis considers any one rod completely inserted into the core, and the other analysis considers any one rod completely withdrawn from a bank. The licensee states that satisfying the limits on departure from nucleate boiling ratio (DNBR) in both of these cases bounds the situation when a rod is misaligned from its group by up to 36 steps. The licensee does not provide any technical discussion to justify this conclusion. Please discuss the assumptions made in these analyses and whether they are limiting, and provide the technical justification for this conclusion. Include the DNBR values for these analyses to demonstrate that the acceptance limits are satisfied.**

   The allowable increase in the indicated rod misalignment is based on the licensee demonstrating sufficient margin to the Technical Specification (TS) $F_{\Delta H}$ and F_Q limits. The amount of margin is determined by routine incore flux map surveillance as required by the TS. If sufficient margin cannot be demonstrated, increased rod misalignment beyond the current licensed specification is not permitted. Therefore, the core will not exceed the current normal operation (Condition I) $F_{\Delta H}$ and F_Q limits with increased rod misalignment. Since the core will continue to meet normal design peaking factor limits while increasing the permitted rod misalignment, the design basis DNBR will still be met under normal operation (Condition I) and accident conditions (Condition II).

2) **On page 5 of the submittal, the licensee indicates that proposed control rod misalignments are indicated by the RPI system within one hour after control rod motion. Please provide a discussion regarding the one hour time limit. TS Surveillance Requirement 3.1.4.1, which is being modified, has a 12 hour frequency for verifying that the proposed rod alignment limits are satisfied. What is the significance of the one hour time limit, and are there any administrative controls or actions associated with the one hour? How does the one hour relate to the 12 hour TS surveillance frequency?**

   The one hour time internal is to allow for thermal equilibrium of the control rod drive shaft and RPI coil stack as it is moved into and out of the core. The RPI coils are affected by temperature, and can give inaccurate indications of control rod position for a period of time until thermal equilibrium is reestablished following rod movement. The one-hour time interval is intended to not require entry into the action statement for a misaligned rod for up to one hour following the time of misalignment due to this temperature affect. There is no relationship between the one-hour interval and the 12-hour surveillance interval. The 12-hour surveillance will always be performed as scheduled, and within the normal grace period allowances for performing surveillances.

   It should be noted that this TS amendment does not change or modify this aspect of the TS. Both the one-hour interval and the 12-hour surveillance frequency already exist in the PBNP TS. They were added with NRC approval of Amendments 200/205 on May 8, 2001 (Reference 3) and ***should not have been mentioned*** in this application.

3) **The licensee states that the proposed rod misalignment TS changes are applicable to all shutdown and control rods (of all banks) over the range of 0 to 230 steps withdrawn inclusive. Please provide the technical basis for this broad applicability.**

The licensing basis for the increased rod misalignment as documented in WCAP-15432 assumes that the licensee will maintain the existing control rod overlap and follow the existing rod insertion limits versus power level as shown in Figure 3.2 of WCAP-15432. For example, at hot full power (HFP), control bank D can be inserted to 185 steps withdrawn while all other banks remain at the all rod out (ARO) position. Therefore, misalignments that are permitted by the proposed TS revision are limited based on the current rod insertion limits. Also, the licensee does not intend to revise the current rod insertion limit TS.

The statement that this TS change applies to the range of 0 to 230 steps is meant to be applied to the entire TS, and not just the parts changed by this amendment. It was originally included as part of the previous submittal, and makes more sense there. Since this proposed change applies to operation above 85% power, the control rods could never be placed below the rod insertion limits for the corresponding power level. At 85% this is approximately Bank D at 145 steps, with all the other banks fully withdrawn. Therefore this statement would be more properly written to say the proposed change is applicable to Bank D from the position corresponding to the insertion limit at 85% power to fully withdrawn, and for the other banks fully withdrawn.

4) **The licensees submittal discusses the impacts of the increased rod misalignment limits on the misaligned rod transient. The proposed TS change to increase rod alignment limits could potentially change the limiting axial power shapes assumed in FSAR Chapter 15 transient analyses. Please discuss the analysis performed to evaluate whether the current limiting axial power shapes remain bounding considering the possible spectrum of axial power shapes created by the proposed increase in rod alignment limits. Include a discussion of any differences and provide plots comparing the current to the proposed axial power shapes profiles. If new axial power shapes are not bounded, please provide results of UFSAR Chapter 15 reanalyses and demonstrate that all acceptance criteria remain satisfied.**

Indicated misalignments that are permitted by the proposed TS revision are considered Condition I events. The reactor operator will control the core axial offset to a prescribed target that is within the relaxed axial offset control (RAOC) bands, regardless of whether a control rod or group of rods is misaligned as permitted by the TS. The Condition I RAOC analysis performed each cycle generates thousands of axial power shapes which will bound any minor perturbation caused by rod misalignment. These Condition I RAOC shapes are then compared to a set of standard thermal-hydraulic design axial power shapes to confirm that Condition I DNB limits are met. This Condition I check is performed as part of every reload analysis.

The RAOC Condition I shapes are then used as the initial condition axial power shapes for the Condition II transients modeled as part of the RAOC analysis. The resulting Condition II shapes are then compared to a reference set of Condition II shapes used to confirm that Condition II DNB limit is met. Therefore, the proposed TS change to the rod misalignment limits will not introduce more limiting axial power shapes than those currently being used.

5) **Technical justification for the proposed rod misalignment values is based on the margin between measured values of F_Q and $F_{\Delta H}$, and their corresponding limits. The licensee states that the margin will be determined based on the latest incore flux map performed per the recommended surveillance intervals of TS 3.2.1 and 3.2.2. The margin calculation and its accuracy will depend upon when the last flux map was performed. Please quantify the impacts on the margin calculations stemming from the use of a flux map performed at the maximum possible surveillance interval. Include a discussion of the factors which could influence the accuracy of the peaking factor calculations and how these factors, such as detector calibration and drift, are accounted for.**

   The basis for and details of the standard Westinghouse peaking factor measurement uncertainties is defined in WCAP-7308-L-P-A. From this reference, the F_Q measurement uncertainty is [ ]^{a,c}, which has been rounded to the TS value of 5% and the $F_{\Delta H}$ measurement uncertainty is [ ]^{a,c}, which has been rounded to the TS value of 4%. These uncertainties include such factors as detector calibration and drift.

   In addition to the standard F_Q measurement uncertainty of 5% PBNP is also required to apply a V(z) term to the measured $F_Q(z)$. The V(z) function accounts for the maximum possible change from the steady state reference $F_Q(z)$ of the flux map to the load follow $F_Q(z)$ that can occur as part of the permitted RAOC operation during the maximum surveillance interval (30 EFPD). Also, if the maximum $F_Q(z)$ is projected to increase during the surveillance interval, than an additional burnup correction term is also required. The final maximum $F_Q(z)$ is then used to determine the amount of margin available to offset an increase in the permissible indicated rod misalignment.

6) **Table 3.1 of WCAP-15432, Revision 2, lists the characteristics of the two fuel cycles used in performing the rod misalignment analyses. The two cycles considered include Unit 1, Cycle 26 and a "future" or "bounding" cycle core design. Please discuss how the assumptions used in the bounding core analyses are controlled such that the rod misalignment analyses remain valid. What actions will the licensee take in the event that future cycle characteristics change such that the analyses in WCAP-15432, Revision 2 are no longer valid?**

   The "future" cycle design parameters listed in Table 3.1 of WCAP-15432 represent the planned direction of future cycles for PBNP Units 1 and 2, including a transition to the 422V+ fuel product. This also includes anticipated cycle lengths and feed fuel enrichment and burnable absorber requirements. The licensee has already committed to comparing these design parameters in Table 3.1 to those of the actual reload design. This will take place as part of the standard reload design process via the Reload Safety and Licensing Checklist (RS&LC), which is completed and reviewed by the entire Westinghouse and NMC design team prior to the start of the reload safety evaluation. If it is determined that the current reload design parameters fall outside the design parameters in Table 3.1, then the results and conclusions of WCAP-15432 will be evaluated to determine if they remain applicable to the current design, or if a reanalysis based on the current design is required.

7) **The licensees analyses found that an increase of 2.8% in rod ejection FQ and 3.0% in the ejected rod worth, EJ, must be included in the safety analyses to bound the projected effects when a cycle specific analysis is not performed. Please discuss the administrative controls in place which ensure that this adjustment is applied on future reload designs.**

The administrative control will take place as part of the standard reload design process via the Reload Safety and Licensing Checklist (RS&LC), which is completed and reviewed by the entire Westinghouse and NMC design team prior to the start of the reload safety evaluation.

8) **The proposed TS changes would allow an increased deviation from demand position, the magnitude of which depends on bank demand position being greater or less than 215 steps. Please provide a discussion of the significance of 215 steps and why this value was selected. Also, when applying the maximum allowed deviations, a rod position can fall below the rod insertion limits. For example, consider Bank D insertion at 210 steps withdrawn and 100% of rated power. Applying the proposed 18 step deviation (for < 215 steps) and an additional 12 steps to account for indication accuracy, the rod position could be 180 steps withdrawn. Figure 3.2 of WCAP-15432, Revision 2 shows that the rod insertion limit at these conditions is 185 steps withdrawn. How is shutdown margin ensured in this situation?**

The rod position of 215 steps withdrawn corresponds to the position where the control rods begin to have a significant reactivity effect. This is sometimes referred to as the "bite" position. It was also the bank position that was originally found in the PBNP custom TS where there was a change in RPI uncertainty allowed from one value to another.

From the TS Bases 3.1.1 and the FSAR Chapter 3.1, Criterion 3.1.2.5, the shutdown margin is required to be met assuming the most reactive rod cannot be tripped into the core. Compliance with shutdown margin requirements is demonstrated by following the LCOs 3.1.5 and 3.1.6 of the TS, using the demand position indicator to confirm that the shutdown and control rod insertion limits are met.

[

][a,c] Therefore, the proposed changes to the rod misalignment TS do not adversely effect the available shutdown margin.

9) **WCAP-15432-P, Revision 2, is used as the basis for the current license amendment request (LAR) and was also used as the basis for LAR's 200 and 205, which increased the rod alignment limits for RTP less than 85%. All references to power level in this WCAP are given as either a percentage of rated thermal power (% RTP) or stated as hot full power (HFP). Please provide the 100% RTP level (MWth) used in the analyses performed in WCAP-15432-P, Revision 2. Does this assumed RTP, and thus the analyses in WCAP-15432-P, Revision 2, bound all future power uprate plans for Point Beach Units 1 and 2 (margins to F H and FQ limits are usually lower at higher power**

levels). If not, does Point Beach have a mechanism in place to reevaluate these analyses at the higher power levels as part of a future power uprate LAR?

The analysis documented in WCAP-15432 assumed the power level consistent with Point Beach operation at the time of the analysis, 1518.5 MWth. This analysis is considered to be independent of any future changes to the core power level, since any anticipated uprates will not significantly alter the radial or axial power shapes of the core. As a result, the peaking factor differences between the current and increased rod misalignment cases used to determine the required peaking factor margins are not expected to significantly change due to an uprate.

This assumes that the PBNP units would continue to operate with the +9% / -8% RAOC bands as described in Section 3.1 of WCAP-15432 as part of the uprated condition. If these RAOC bands were to be expanded as part of an uprate or other LAR, then the analysis of WCAP-15432 would have to be evaluated to determine if reanalysis is required.

Since the analyses supporting WCAP-15432-P were performed, the Unit 1 and 2 cores have been uprated to 1540 MWth, while maintaining the same peaking factor limits. Therefore, the recent 1.4% uprate did not effect the peaking factor margins. If future uprates result in a decrease in the allowable peaking factor limits, the revised limits would be accounted for in the determination of margin available for increased rod misalignment.

10) **The proposed TS changes are based on adequate margin to F H and FQ limits. WCAP-15432-P provides the margins necessary for the proposed rod alignment limits. However, the WCAP does not clearly discuss the methodology applied to determine the necessary margins. Please provide a discussion of how the F H and FQ margins are calculated and include the following items in the discussion:**

a) **How the F H and FQ margins ensure that the acceptance criteria of NUREG-0800, Standard Review Plan, Section 15.4.3 (Control Rod Misoperation) are satisfied for the proposed rod misalignment limits? These acceptance criteria include DNBR and fuel centerline temperature.**

b) **Were the rod misalignment analyses performed in accordance with the approved reload design methodology for Point Beach, including all conservative assumptions of that methodology?**

c) **Please provide the DNBR and fuel centerline temperature results vs. limits for the limiting rod > 85% power misalignment cases.**

The methodology for determining the required $F_{\Delta H}$ and F_Q margins for increased rod misalignment is described in Sections 2 and 3 of WCAP-15432. To summarize:

a) [

]a,c

b) [

]a,c

c) [

]a,c

d) [

]a,c

e) [

]a,c

The above analysis was performed following standard Westinghouse design procedures for the calculation of power distribution data, using the approved PHOENIX-P / ANC design system as discussed in Section 3.1 of WCAP-15432.

The allowable increase in the indicated rod misalignment is based on the licensee demonstrating sufficient margin to the TS $F_{\Delta H}$ and F_Q limits. The amount of margin is determined by routine incore flux map surveillance as required by the TS. If sufficient margin cannot be demonstrated, increased rod misalignment beyond the current licensed specification is not permitted. Therefore, the core will not exceed the current normal operation (Condition I) $F_{\Delta H}$ and F_Q limits with increased rod misalignment. Since the core will continue to meet normal design peaking factor limits while increasing the permitted rod

misalignment, the design basis DNBR and fuel centerline temperature limits will still be met under normal operation (Condition I) and accident conditions (Condition II).

11) **WCAP-15432-P does not include any discussion regarding the statistical analysis performed to determine the 95/95 F H and FQ margin requirements. Please provide a discussion of the methodology applied, including:**
   a) **Justification that sample sizes for the HFP cases are adequate**
   b) **Determination and effect of the distribution function selected**
   c) **For the HFP cases, provide plots of the F H and FQ data points used, including a curve (superimposed) of the distribution function selected.**

Westinghouse employs a widely used commercial software program to evaluate the data and determine the appropriate probability distribution function. This software has the capability to evaluate 26 distribution types, the majority being continuous distributions and includes some discrete functions. Examples of the distributions are: Beta, Binomial, Exponential, Extreme Value, Gamma, Logistic, Normal, Poisson, Student's t, Uniform and Weibull. The software performs fitting tests and compares against three widely used goodness-of-fit criteria, Chi-Square, Kolmogorov-Smirnov and Anderson-Darling. The Anderson-Darling places more emphasis on tail values, which is of more importance when attempting to determine coverage on one side to assure enveloping a reasonable margin allocation. The distribution functions are ranked where the function with the highest combination of goodness-of-fit confidence levels is ranked as the best fit. Once a distribution function is selected, Westinghouse evaluates several parameters to determine a conservative margin allocation. [

]^{a,c}

It should be recognized that Westinghouse evaluates a conservative set of data to begin with. Historical data strongly suggests that indications of RCCA misalignment with the Analog Rod Position Indication (ARPI) system are due to errors in indication, not actual RCCA misalignment. In addition, a failure modes effects analysis limits the type and number of misalignments for evaluation. The evaluation process is predicated on extensive evaluation of misalignment at 18 steps and confirmation of the assumption of error/margin allocation linearity from 15 to 24 steps misalignment. Therefore, the largest quantity of data evaluated is at 18 steps. The number of cases (164) is large enough and covers a significant degree of D Bank positions to assure the validity of the results. Smaller samples are evaluated at 15 and 24 steps misalignment, 20 cases and 12 cases respectively. However, these samples are constructed from the most limiting HFP cases evaluated at 18 steps. This process biases the linearity confirmation in the most conservative direction.

The results of the evaluation process are conservative. The distribution functions selected for 18 steps misalignment result in a conservative over-prediction of the required margin, when compared to an assumption of a normal distribution. The distribution functions selected for 15 and 24 steps misalignment result in a confirmation of the assumption of error/margin linearity that has been identified in evaluations performed for other plants. Attached are the requested histograms, with the superimposed selected distribution function.

Comparison of Input Distribution and Normal(0.44,0.23)

a,b,c

Comparison of Input Distribution and Weibull(4.49,1.74)

a,b,c

Comparison of Input Distribution and ExtremeValue(0.37,0.27)

a,b.c

Comparison of Input Distribution and ExtremeValue(1.29,0.80)

a,b.c

Comparison of Input Distribution and Beta(0.59,0.65) * 3.18 + 0.17

a,b.c

Comparison of Input Distribution and Logistic(6.72,0.72)

a,b.c

12) Do the proposed TS changes introduce any impacts of needed adjustments on rod withdrawal interlocks or rod stops in either manual or automatic mode?

The rod withdrawal interlocks or rod stops are based on demand positions. No hardware adjustments or changes are required.

13) Assuming the proposed TS changes are implemented, the licensee could find itself in a position where the rod alignment exceeds the current TS limit of ±12 steps at HFP. In accordance with the proposed TS changes, the licensee would then need to verify that the F H and FQ margins do not exceed the values in the proposed TS Tables. Should the licensee find that and adequate peaking factor margin does not exist, what is an acceptable amount of time to be in this condition? Please justify that the 12 hour surveillance frequency to verify rod position is acceptable.

As discussed in the response to Question 5, the licensee is required to perform an incore flux map surveillance at least once every 30 EFPD. The peaking factor results from the flux maps are modified by applying the appropriate measurement uncertainties. In addition, a V(z) term is applied to the measured $F_Q(z)$ to account for the maximum possible change from the steady state reference $F_Q(z)$ of the flux map to the load follow $F_Q(z)$ that can occur as part of the permitted RAOC operation during the maximum surveillance interval (30 EFPD). Also, if the maximum steady state $F_Q(z)$ is projected to increase during the surveillance interval, than an additional burnup correction term is also required.

The resulting peaking factors are then used to determine the amount of margin available to offset an increase in the permissible indicated rod misalignment. Once the margin is determined, then the allowable amount of rod misalignment is set. Therefore, the licensee will not find itself in a situation of intentionally operating with rod misalignment beyond the permissible amount determined at each surveillance interval. If a rod or group of rods were to misalign beyond the amount permissible during the surveillance interval, then action will be taken to correct the situation in accordance with the current TS.

This is a question about the implementation of the proposed changes. The increased uncertainty allowed by the proposed changes will not be applied until after the monthly flux maps are completed and analyzed. At that point, reactor engineering will communicate the allowed uncertainty to operations. This will remain in effect until the next flux map is performed and analyzed. If a situation arises where the next flux map reduces the allowed uncertainty and an RPI becomes outside of the allowed range, the LCO will be considered to not be met, and the associated action conditions will be entered. This will be done regardless of when the 12-hour surveillance is due. In other words, the requirement to maintain the RPIs within the specified limits is in effect at all times. Appropriate actions will be taken when a condition is discovered, due to either an equipment problem or a change to the limits as a result of a new flux map analysis, which indicates an RPI has exceeded the alignment limits.

14) WCAP-15432-P, Section 4.0, "Safety Analysis Impacts", states that, "Therefore, one does not need to assume a rod misalignment from the [ ]^{a,c} as a precondition to one of the above mentioned Condition II rod misalignment transients; such an assumption would be beyond the current Westinghouse licensing basis and overly conservative. As such, the proposed changes to the rod misalignment TS do not have an adverse impact on the safety analysis inputs for these accidents, or the DNB results." The staff does not

agree with this statement. The proposed TS changes to increase alignment limits can introduce more adverse initial conditions, which must be considered in the transient analyses. Also, the licensees submittal states that, "Shutdown and control rod operability and alignment are directly related to power distributions and SDM, which are initial conditions assumed in safety analyses." Please provide qualitative technical justification for excluding single / multiple rod misalignment in conjunction with other FSAR Chapter transients.

The analysis methodology for the Condition II misaligned rod transients listed in Section 4.0 of WCAP-15432 is described in the Westinghouse reload safety evaluation methodology, WCAP-9272-P-A. The Condition II analysis assumes an RCCA or group of RCCAs fully misaligned in or out of the core. Such a misalignment is a single failure of the rod control system as described in Section 2.0 of WCAP-15432.

Peaking factor calculations are performed for these misalignment conditions to demonstrate that the design basis DNB and fuel centerline temperature are not violated. Prior to these calculations, the core is preconditioned with control rods either at the full out or rod insertion limit position, and with the axial offset skewed to the extremes of the permitted RAOC bands. WCAP-9272-P-A does not require the preconditioning of the Condition I core assuming a single failure of the rod control system prior to initiating a Condition II event based on another failure of the rod control system. As discussed in Section 4.0 of WCAP-15432, series of different single failures or simultaneous failures do not need to be considered.

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 2.790 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).

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Westinghouse

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Our ref: CAW-03-1715

October 1, 2003

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: Responses to RAIs for WCAP-15432, "Point Beach Units 1 and 2 Rod Misalignment Relaxation" (Proprietary)

The proprietary information for which withholding is being requested in the above-referenced report is further identified in Affidavit CAW-03-1715 signed by the owner of the proprietary information, Westinghouse Electric Company LLC. The affidavit, which accompanies this letter, sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of 10 CFR Section 2.790 of the Commission's regulations.

Accordingly, this letter authorizes the utilization of the accompanying affidavit by Nuclear Management Company.

Correspondence with respect to the proprietary aspects of the application for withholding or the Westinghouse affidavit should reference this letter, CAW-03-1715 and should be addressed to the undersigned.

Very truly yours,

J. S. Galembush, Acting Manager
Regulatory Compliance and Plant Licensing

Enclosures

cc: J. Dyer
D. Holland
B. Benney
E. Peyton

CAW-03-1715

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF ALLEGHENY:

Before me, the undersigned authority, personally appeared J. S. Galembush, 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. S. Galembush, Acting Manager
Regulatory Compliance and Plant Licensing

Sworn to and subscribed
before me this 2nd day
of October, 2003

Sharon L. Fiori
Notary Public

SHARON L. FIORI
COMMONWEALTH OF PENNSYLVANIA
NOTARY PUBLIC

Notarial Seal
Sharon L. Fiori, Notary Public
Monroeville Boro, Allegheny County
My Commission Expires January 29, 2007
Member, Pennsylvania Association Of Notaries

(1) I am Acting Manager, Regulatory Compliance and Plant Licensing, in Nuclear Services, Westinghouse Electric Company LLC ("Westinghouse"), and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rule making proceedings, and am authorized to apply for its withholding on behalf of the Westinghouse Electric Company LLC.

(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 LLC 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 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 2.790, 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 in "Responses to RAIs for WCAP-15432, Point Beach Units 1 and 2 Rod Misalignment Relaxation" (Proprietary), being transmitted by the Nuclear Management Company letter and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted for use by Westinghouse Electric Company LLC for Point Beach Units 1 and 2 is expected to be applicable for other licensee submittals in response to certain NRC requirements for justification of rod misalignment relaxation.

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

(a) Modify Technical Specifications for bank demand allowable rod misalignment.

(b) To minimize disruptions to normal plant operations due to frequent and erroneous indications of rod misalignment.

(c) Assist the customer to obtain NRC approval.

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to sell the use of similar information to its customers for purposes of meeting NRC requirements for licensing documentation.

(b) Westinghouse can sell support and defense of rod misalignment relaxation.

(c) The resulting required margins will be determined that they are cycle independent for Point Beach Units 1 and 2 and plant safety will not be compromised.

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 documentation 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.

November 3, 2003

NRC 2003-0100
GL 96-06

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

Point Beach Nuclear Plant, Units 1 and 2
Dockets 50-266 and 50-301
License Nos. DPR 24 and DPR 27
Response to Request for Additional Information Regarding Generic Letter 96-06

References: (1) Letter from NMC to NRC dated July 30, 2002 (NRC 2002-0063)
(2) Letter from NMC to NRC dated March 27, 2003 (NRC 2003-0025)

The Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 96-06 on September 30, 1996. Wisconsin Electric Power Company (WEPCO), then licensee for the Point Beach Nuclear Plant (PBNP), provided its assessment of the waterhammer and two-phase flow issues for PBNP in letters dated January 28, June 25, and December 18, 1997, and related submittals dated September 9, September 30, and October 30, 1996. Responses to NRC requests for additional information were provided on September 4, 1998, and October 12, 2000. With these submittals, the GL 96-06 two-phase flow issues were fully addressed.

Actions to fully address the waterhammer issues had been deferred pending completion of the Electric Power Research Institute (EPRI) project and review and approval of it by the NRC. EPRI Report TR-113594 was issued in December 2000, and NRC accepted the report on April 3, 2002.

In Reference 1, Nuclear Management Company, LLC, (NMC) submitted updated information regarding actions to address the resolution of GL 96-06 waterhammer issues at PBNP.

On August 14, 2002, the NRC requested additional information regarding Reference 1. During a conference call held on August 20, 2002, the NRC staff, NMC staff, and Fauske & Associates (FAI) discussed the additional information requested by the NRC to support their review. NMC proposed to provide sample cases and additional basis for the rationale that the FAI analyses for PBNP bound the EPRI methodology. On September 10, 2002, NRC staff agreed to review the additional information as proposed by NMC.

Reference 2 provided the response to the NRC questions. The enclosure to Reference 2 provided the FAI calculation note generated to calculate the waterhammer loads for the PBNP containment fan coolers using the EPRI Technical Basis Report (TBR) methodology and comparing those results against the results generated previously using TREMOLO. As indicated in the comparison results of the enclosure, FAI concluded that the TREMOLO produced forcing functions used in the PBNP piping stress analyses generally bound the EPRI TBR forcing functions. The FAI calculation note demonstrated that the PBNP analyses are conservative with respect to the EPRI methodology. NMC agrees with FAI's conclusions.

During subsequent conference calls between NMC representatives and NRC staff, the NRC requested additional information in support of their review of PBNP GL 96-06 issues. Enclosure 1 of this letter contains the NMC response to the staff's questions. The Enclosure 2 to this letter contains PBNP FSAR Table A.5-3 and the relevant revised pages to the FAI calculation note, which are provided in support of the response to the staff's questions.

This letter contains no new commitments or changes to existing commitments.

A. J. Cayia
Site Vice President, Point Beach Nuclear Plant
Nuclear Management Company, LLC

Enclosures

cc: Administrator, Region III, USNRC
Project Manager, Point Beach Nuclear Plant, USNRC
Resident Inspector, Point Beach Nuclear Plant, USNRC
PSCW

ENCLOSURE 1
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION (RAI)
REGARDING GENERIC LETTER 96-06

The following information is provided in response to the Nuclear Regulatory Commission (NRC) staff's request for additional information (RAI) regarding Reference 2.

The NRC staff's questions are restated below, with the NMC response following.

NRC Question 1:

Table 5-1 provides the results of the EPRI model for calculating the pressure pulse in CFC units 1A, 1C, 2B and 2D. No comparisons with TREMOLO results are given except in Figure 5-6. Figure 5-6 shows the TREMOLO prediction of the pressure profile for a service water piping element giving a peak pressure of approximately 95 psi. This peak pressure is much lower than those calculated using EPRI methodology in Table 5-1. Please justify that results using TREMOLO are consistent with those obtained using EPRI methodology.

NMC Response:

The figure-of-merit for comparing the results obtained by using the EPRI methodology to those obtained using TREMOLO is the forcing function history experienced by the piping segments in the supply and return piping for the containment fan cooler (CFC) units. Thus, no explicit comparison is provided of the waterhammer pressure pulse magnitudes. Table 5-1 documents the amplitude of the waterhammer pressure pulses as prescribed by the EPRI methodology but the values in this table do not include the effect of flow area attenuation due to pressure pulse transmission and reflection in the piping segments. Figure 5-6 is for the Unit 2 'D' CFC. Per the EPRI methodology (see page D-16), the transmitted pressure pulse for the Unit 2 'D' CFC piping including flow area attenuation has a similar magnitude (89 psi) as that obtained with TREMOLO.

The nodal pressure profile provided in Figure 5-6 includes pressure transmission and reflection effects. This is not intended to be used for direct comparison with the Table 5-1 waterhammer pressure pulse values. Rather, Figure 5-6 is intended to show the nature of the dynamic nodal pressure profile including pressure pulse transmissions and reflections as characterized by the detailed TREMOLO solution versus the idealized nodal pressure pulse as obtained using the EPRI methodology including wave transmission effects.

NRC Question 2:

Tables 5-2a, 5-3a, 5-4a and 5-5a provide comparisons of TREMOLO and EPRI methodology for calculating maximum forces following waterhammer. The actual force-time history calculated by TREMOLO is given for one case in Figure 5-7 which shows the maximum force calculated by TREMOLO to be approximately 1300 lbf. This force is much lower than maximum values given in the force comparison tables. Please explain this apparent inconsistency.

NMC Response:

Tables 5-2a, 5-3a, 5-4a and 5-5a provide the comparison of the maximum piping segment forces following waterhammer and the transmission of the pressure pulse through the several piping systems. These tables provide a direct comparison between the maximum forces obtained by the two methodologies. Figure 5-7 is not provided for the maximum force profile. It is included to provide an example of the nature of the dynamic load obtained by the detailed TREMOLO calculation as compared to the application of the simplified waterhammer pressure pulse obtained by the EPRI methodology.

NRC Question 3:

Tables 5-2b, 5-3b, 5-4b and 5-5b provide comparisons of TREMOLO predictions with those of the EPRI methodology for maximum impulse. The tables show that TREMOLO calculates impulses higher in magnitude than the EPRI methodology. Appendices A, B, C and D provide the detailed calculations using the EPRI methodology including the values of maximum calculated impulse. The maximum calculated impulses using the EPRI methodology is given on pages A-15, B-15, C-15 and D-15. The values of impulse in the appendices are much greater than those presented in the tables and much greater than those calculated by TREMOLO. Please discuss this apparent inconsistency.

NMC Response:

The comparisons provided in Tables 5-2b, 5-3b, 5-4b and 5-5b provide the intended comparisons between the TREMOLO predictions and the EPRI methodology predictions for the maximum impulse for the forcing function on the piping segments. The values for the EPRI methodology predictions in these tables were derived as documented in Appendices F, G, H and I. The impulses documented in Appendices A, B, C and D were not used in this comparison nor were the piping and supports assessments, as they do not represent the impulses imparted to the piping segments. The impulse quantifications presented in Appendices A through D are simply the integral of the waterhammer pressure pulse as characterized by the simplified methodology. These integrals are not part of the EPRI methodology, nor do they represent the forcing function impulses experienced by the piping segments. They should not have been included in Appendices A through D. FAI calculation note 03-07 has been revised to delete this confusing information (relevant revised pages enclosed). The integrals presented in Appendices A through D have been removed.

NRC Question 4:

Discuss the load combinations that were used for analyzing the adequacy of pipe supports, and confirm that the assumed load combinations satisfy UFSAR design-basis requirements.

NMC Response:

Required design basis pipe support load combinations are documented in Table A.5-3, page A.5-25 of the FSAR (enclosed).

Per section 4.5.3 of Reference A, water hammer loads (hydraulic loads) need not be combined with seismic loads. Since the water hammer loads are a result of an accident condition, water hammer loading was considered in the faulted condition. Typical loading combinations are as follows:

Normal	deadweight
Upset	deadweight + seismic OBE
Faulted	Max (deadweight, deadweight + thermal) + seismic SSE or Max (deadweight, deadweight + thermal) + hydraulic transient

The load combinations above are in agreement with Table A.5-3 of the PBNP FSAR.

Reference A: Diagnosis of Condensation-Induced Waterhammer, NUREG/CR-5220, Creare TM-1189, Vol. 1, R4, October 1988.

NRC Question 5:

The March 27, 2003 letter indicates that NMC recently replaced all eight containment fan cooler (CFC) units at Point Beach Units 1 & 2, and that the two-phase flow issue discussed in GL 96-06 was factored into the CFC replacement. Summarize the previous analyses and conclusions that were reached for addressing two-phase flow, and explain why additional analyses are not needed for the replacement CFCs and related service water (SW) piping.

NMC Response:

The analyses for two-phase flow at the exit of the CFCs was explained in a letter from NMC to NRC, Reply to Request for Additional Information to GL 96-06, dated October 12, 2000 (NPL 2000-0451). The information contained in that submittal will be summarized below.

Each CFC consists of eight individual coils with two and six inch piping connecting the discharges together. For conservatism, the SW flowstream is evaluated at the exit of each coil to ensure that single phase flow is maintained at the exit of the cooler. The analysis postulates a given number of partially occluded tubes in each coil and then calculates the enthalpy of the effluent flowstream from that coil. The system pressure at the outlet of each coil is determined from the SW Hydraulic Analysis. Acceptable performance requires the exit enthalpy to be below the value corresponding to the

saturation temperature at the analyzed pressure. The analyzed number of partially occluded tubes then becomes part of the acceptance criteria for determining operability of the CFCs.

This analysis is contained in calculations 98-0172 (which determines acceptable performance as a function of SW pressure and flow) and 2002-0003 (which determines SW pressure and flow for the limiting cases). Both calculations were revised to accommodate the new CFCs, using supplier test performance data for heat transfer parameters and field test results for hydraulic considerations. The inter-pass mixing undergone by the replacement CFCs was factored into the analysis. Therefore, the new CFCs and related SW piping were adequately analyzed for this condition.

ENCLOSURE 2

Point Beach Nuclear Plant FSAR Table A.5-3, Loading Conditions and Stress Limits
FSAR Page A.5-25

Fauske & Associates Calculation Note FAI/03-07, "Comparison of Point Beach TREMOLO – Calculated Waterhammer Loads with the EPRI TBR Methodology", Revision 2, cover sheet and pages A-15, B-15, C-15, and D-15, dated June 3, 2003

Fauske & Associates Calculation Note FAI/03-07, "Comparison of Point Beach TREMOLO – Calculated Waterhammer Loads with the EPRI TBR Methodology", Revision 3, cover sheet and page 23, dated October 2, 2003

TABLE A.5-3
Page 1 of 4
LOADING CONDITIONS AND STRESS LIMITS

Definitions*

1. "Normal Conditions." Any condition in the course of system start-up, operation in the design power range, and system shutdown, in the absence of Upset, Emergency, or Faulted Conditions.

2. "Upset Conditions." Any deviations from Normal Conditions anticipated to occur often enough that design should include a capability to withstand the conditions without operational impairment. The Upset Conditions include those transients which result from any single operator error or control malfunction, transients caused by a fault in a system component requiring its isolation from the system, transients due to loss of load or power, and any system upset not resulting in a forced outage. The estimated duration of an Upset Condition shall be included in the Design Specifications -- The Upset Conditions include the effect of the specified earthquake for which the system must remain operational or must regain its operational status.

3. "Emergency Conditions." Any deviations from normal conditions which require shutdown for correction of the conditions or repair of damage in the system. The conditions have a low probability of occurrence but are included to provide assurance that no gross loss of structural integrity will result as a concomitant effect of any damage developed in the system. The total number of postulated occurrences for such events shall not exceed twenty-five (25).

4. "Faulted Conditions." Those combinations of conditions associated with extremely low probability postulated events whose consequences are such that the integrity and operability of the nuclear energy system may be impaired to the extent where considerations of public health and safety are involved. Such considerations require compliance with safety criteria as may be specified by jurisdictional authorities.

* Summer 1968 Addenda to the ASME B&PV Code, Section III.

FAUSKE & ASSOCIATES, INC.

CALCULATION NOTE COVER SHEET

SECTION TO BE COMPLETED BY AUTHOR(S):

Calc-Note Number FAI/03-07 Revision Number 2

Title Comparison of Point Beach TREMOLO - Calculated Waterhammer Loads with the EPRI TBR Methodology

Project Point Beach TREMOLO versus EPRI TBR Comparison Project Number or Shop Order WEP015A

Purpose: The purpose of this calculation is to calculate the waterhammer loads for the Point Beach Containment Fan Coolers (CFCs) using the EPRI TBR methodology (EPRI Report #1006456) and comparing these results against the results generated previously using TREMOLO. Revision 1 of this report was issued to address owners acceptance comments. These comments had no bearing on the final conclusions. However, the format of result tables changed slightly. Revision 2 was issued to address NRC discussion points (TAC M96852/3) on the Point Beach Responses to Generic Letter 96-06.

Results Summary: See Section 5.0 for comparison results of TREMOLO versus the EPRI TBR methodology. It is concluded that the TREMOLO produced forcing functions generally bound the EPRI-TBR forcing functions.

References of Resulting reports, Letters, or Memoranda (Optional)

Author(s): Name (Print or Type)	Signature	Completion Date
R. W. Reeves	R.W. Reeves	6/4/03

SECTION TO BE COMPLETED BY VERIFIER(S):

Verifier(s): Name (Print or Type)	Signature	Completion Date
W. E. Berger	W. E. Berger	6-11-03

Method of Verification: Design Review _____, Independent Review or Alternate Calculations X, Testing
Other (specify)

SECTION TO BE COMPLETED BY MANAGER:

Responsible Manager: Name (Print or Type)	Signature	Approval Date
R. J. Hammersley	R. J. Hammersley	June 13, 2003

7.4.11 PRESSURE PULSE SHAPE

The pulse shape is then characterized by four points.

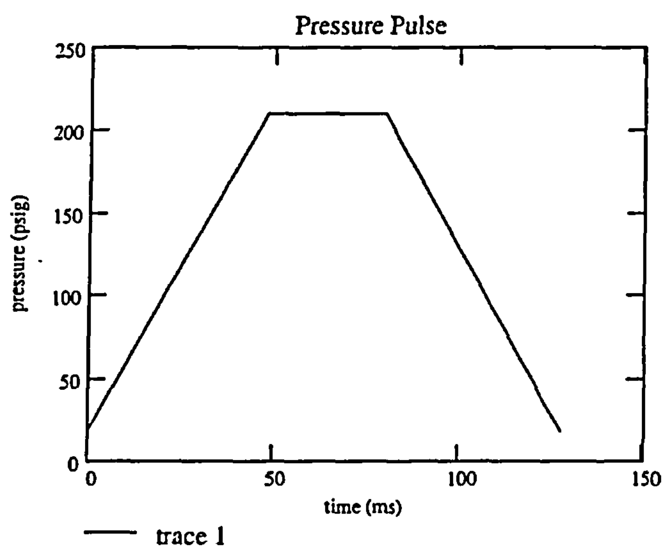
$Psys := 19psi$ this is the steady state system pressure [Ref. FAI/97-60 Rev. 3]

Using an index, i=0,1,2,3 $i := 0..3$

$time_i :=$	$pressure_i :=$
0ms	Psys
TR	ΔP + Psys
TD − TR	ΔP + Psys
TD	Psys

This provides the following values, which are plotted below.

$$time = \begin{pmatrix} 0 \\ 0.048 \\ 0.08 \\ 0.127 \end{pmatrix} s \qquad pressure = \begin{pmatrix} 19 \\ 210 \\ 210 \\ 19 \end{pmatrix} psi$$



7.4.11 PRESSURE PULSE SHAPE

The pulse shape is then characterized by four points.

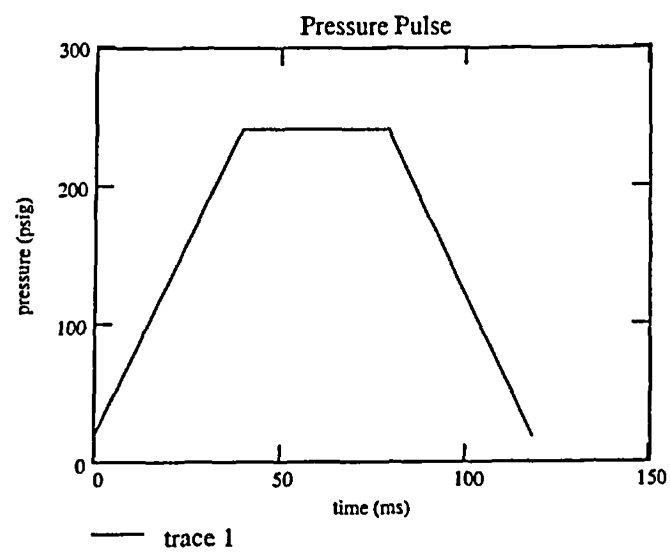
$Psys := 19psi$ this is the steady state system pressure [Ref. FAI/97-60 Rev. 5]

Using an index, i=0,1,2,3 $i := 0..3$

$time_i :=$	$pressure_i :=$
0ms	Psys
TR	ΔP + Psys
TD − TR	ΔP + Psys
TD	Psys

This provides the following values, which are plotted below.

$$time = \begin{pmatrix} 0 \\ 0.039 \\ 0.079 \\ 0.118 \end{pmatrix} s \qquad pressure = \begin{pmatrix} 19 \\ 241 \\ 241 \\ 19 \end{pmatrix} psi$$



7.4.11 PRESSURE PULSE SHAPE

The pulse shape is then characterized by four points.

$Psys := 19psi$ this is the steady state system pressure [Ref. FAI/97-60 Rev. 2]

Using an index, i=0,1,2,3 $i := 0..3$

$time_i :=$

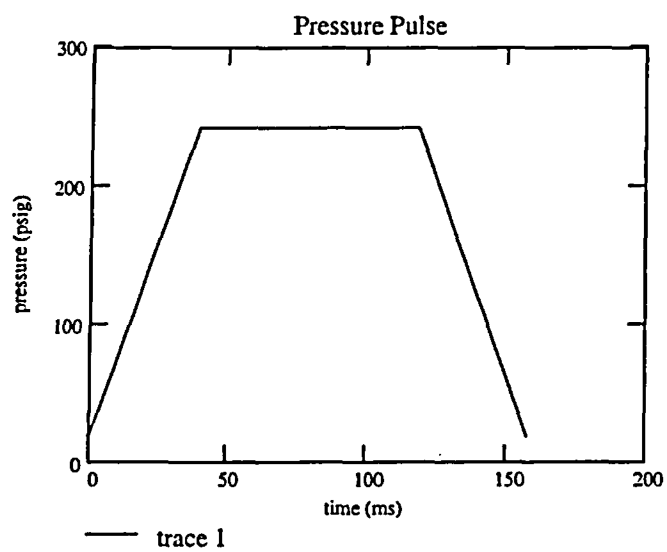
0ms
TR
TD − TR
TD

$pressure_i :=$

Psys
ΔP + Psys
ΔP + Psys
Psys

This provides the following values, which are plotted below.

$$time = \begin{pmatrix} 0 \\ 0.039 \\ 0.118 \\ 0.157 \end{pmatrix} s \qquad pressure = \begin{pmatrix} 19 \\ 242 \\ 242 \\ 19 \end{pmatrix} psi$$



7.4.11 PRESSURE PULSE SHAPE

The pulse shape is then characterized by four points.

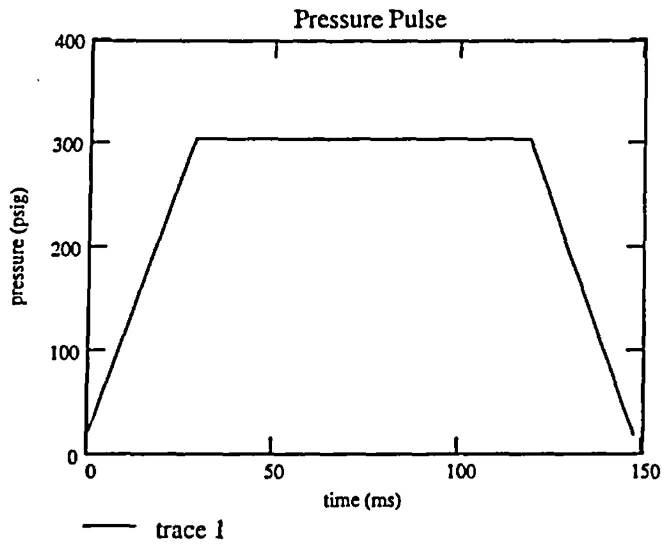
$Psys := 19psi$ this is the steady state system pressure [Ref. FAI/97-60 Rev. 2]

Using an index, i=0,1,2,3 $i := 0..3$

$time_i :=$	$pressure_i :=$
0ms	Psys
TR	ΔP + Psys
TD − TR	ΔP + Psys
TD	Psys

This provides the following values, which are plotted below.

$$time = \begin{pmatrix} 0 \\ 0.028 \\ 0.119 \\ 0.147 \end{pmatrix} s \qquad pressure = \begin{pmatrix} 19 \\ 305 \\ 305 \\ 19 \end{pmatrix} psi$$



FAUSKE & ASSOCIATES, INC.

CALCULATION NOTE COVER SHEET

SECTION TO BE COMPLETED BY AUTHOR(S):

Calc-Note Number FAI/03-07 Revision Number 3

Title Comparison of Point Beach TREMOLO - Calculated Waterhammer Loads with the EPRI TBR Methodology

Project Point Beach TREMOLO versus EPRI TBR Comparison Project Number or Shop Order WEP015A

Purpose: The purpose of this calculation is to calculate the waterhammer loads for the Point Beach Containment Fan Coolers (CFCs) using the EPRI TBR methodology (EPRI Report #1006456) and comparing these results against the results generated previously using TREMOLO. Revision 1 of this report was issued to address owners acceptance comments. These comments had no bearing on the final conclusions. However, the format of result tables changed slightly. Revision 2 was issued to address NRC discussion points (TAC M96852/3) on the Point Beach Responses to Generic Letter 96-06. Revision 3 was issued to address NRC comments on the draft responses to the NRC RAI (page 23 was revised).

Results Summary: See Section 5.0 for comparison results of TREMOLO versus the EPRI TBR methodology. It is concluded that the TREMOLO produced forcing functions generally bound the EPRI-TBR forcing functions.

References of Resulting reports, Letters, or Memoranda (Optional)

Author(s): Name (Print or Type)	Signature	Completion Date
R. W. Reeves	R. W. Reeves	10/3/03

SECTION TO BE COMPLETED BY VERIFIER(S):

Verifier(s): Name (Print or Type)	Signature	Completion Date
W. E. Berger	W E Berger	10/03/03

Method of Verification: Design Review ____, Independent Review or Alternate Calculations X, Testing Other (specify)

SECTION TO BE COMPLETED BY MANAGER:

Responsible Manager: Name (Print or Type)	Signature	Approval Date
R. J. Hammersley	R J Hammersley	October 3, 2003

The resulting force (d) begins to rise once the pressure pulse reaches P_1 and continues to rise until the pressure pulse reaches P_2. When the pressure pulse reaches P_2, the resulting force levels out until the pressure pulse at P_1 reaches its peak at which time the resultant force turns around and goes to zero when the pressure pulse at P_2 reaches its peak. The force in the pipe remains balanced until the pressure pulse begins to exit P_1. The resulting force then goes in the negative direction until the pressure pulse begins to exit P_2. At this time the forces balance until the pressure pulse completely exits P_1. The resultant force then goes to zero as the pressure pulse completely clears P_2.

The maximum forces and impulses are tabulated in Tables 5-2 through 5-5 for the four Point Beach CFCs. The peak forces and impulse calculation for each of the fan CFCs analyzed are attached as Appendices F through I. The maximum force and impulses were calculated by assuming a single pressure pulse calculated for each CFC (with the EPRI methodology) is propagated through the SW piping. The point of collapse for the calculation was assumed to be at the same location of final void collapse calculated by TREMOLO for each CFC. As shown in these Appendices and Figure 5-5, the peak force is limited by the length of piping between two sequential elements (i.e., elbow). Once the pressure pulse reaches one elbow it begins to exert a force on the section of piping between the two elements. However, when the pressure pulse is transmitted to the next elbow, which is length of pipe divided by the sonic velocity of the pulse, the force on the second element counteracts the first force, thus limiting the peak force on the piping due to the relatively short length of piping between the various elements within the system (typically less then 20 ft). The pipe section peak forces and corresponding impulses (calculated as the rise time of the pressure pulse x the peak resultant force) are summarized in Tables 5-2 through 5-5 for each of the four CFCs analyzed.

5.2 TREMOLO Peak Force/Impulse Calculations

The TREMOLO peak forces were taken from the previously performed TREMOLO analyses [FAI, 2000, 2001a and 2001b] on the Point Beach CFCs. The corresponding impulse for these forces was not directly calculated in the TREMOLO analyses referenced above, rather they were determined separately by conservatively estimating the area under the peak force pulses.