RAS M-423

May 26, 2009

UNITED STATES OF AMERICANUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
Entergy Nuclear Vermont Yankee, LLC	)	Docket No. 50-271-LR
and Entergy Nuclear Operations, Inc.	)	ASLBP No. 06-849-03-LR
	)	
(Vermont Yankee Nuclear Power Station)	)	

NEW ENGLAND COALITION'S REPLY
TO
NRC STAFF AND ENTERGY OPPOSITIONS
TO
NEC'S MOTION TO FILE A TIMELY NEW CONTENTION

I. INTRODUCTION

New England Coalition ("NEC") respectfully submits this Reply to Applicant Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operations, Inc. (collectively "Entergy") Opposition and NRC Staff Opposition to NEC's Motion for Leave to File a Timely New Contention.

This Reply is submitted pursuant to 10 C.F.R. § 2. 309(h)(1) and the provisions in the Board's November 24, 2008 Partial Initial Decision in this proceeding[1] and in the Board's March 9, 2009 Order (Clarifying Deadline for Filing New or Amended Contentions) ("March 9, 2009 Order"), to New England Coalition, Inc.'s ("NEC") Motion For Leave to File a Timely New Contention and Motion to Hold in Abeyance Action on this Proposed Contention Until Issuance of NRC Staff Supplemental Safety Evaluation Report, dated April 24, 2009 ("NEC Motion").

11. NEC REPLIES

Template Secy-037

DS-03

NEC is represented Pro Se and cannot bring to bear the time and resources to reply in detail to each argument made in the voluminous Answers of Entergy and NRC Staff. Therefore NEC must rely on NRC's commitment and pursuit of its stated goals of providing a fair hearing on genuine issues of public health and safety.

1. In the main, both Entergy and NRC Staff argue that NEC's proposed contention is inadmissible because, they say, it contravenes the Board's admonitions that any new contention must not "rehash or renew any technical challenges that have already been raised and resolved in this proceeding".

They are both quite wrong. NEC does not rely on a "rehash" any of technical issues that it raised with respect to the feedwater nozzle and upon which the Board has ruled.

2. Entergy and NRC Staff allege that NEC fails to specifically state how the new analyses are not consistent with the legal requirement and the calculations performed for the feedwater nozzle.

In fact NEC has pointed to specific regulation, standards, and guidance which the new analyses fail to meet and NEC has attached to its Motion, the Declaration of Dr. Joram Hopenfeld, which points out specific and related technical application failings that invalidate the results of the new analyses LBP-08-25 at 67 n.95; see also March 9, 2009 Order at 3.

3. Entergy claims that NEC's criticisms are vague and are not supported by the opinion of a technically competent witness. In fact Dr. Hopenfeld's credentials are of the highest order with respect to metal fatigue and the other physical phenomena which must be consider in aging analysis or aging management of reactor internal components. It is hardly timely or appropriate for Entergy to now challenge Dr. Hopenfeld's credentials in as much as they were submitted

together with NEC's original Petition for Leave to Intervene; three years ago.

4. There is nothing vague about NEC's criticisms and concerns. NEC's statement of its contention is an articulation of a requisite concise statement of the factual or legal issue for which it requests a hearing. NEC's Motion attaches and incorporates a Declaration of its expert witness, Dr. Joram Hopenfeld, which spells out in precise and clear detail the discrete issues contained in and underlying NEC's proffered contention. NEC does not argue with Entergy's math, but rather with the values assumed (scientific judgements) and entered into its calculations. In the Partial Initial Decision of November 24, 2008, the Board pointedly reminded the parties that the required reanalyses were not merely a "ministerial" exercise but involved a considerable amount of technical and scientific judgment and is not a minor or ministerial task. NEC challenges what are new and erroneous scientific judgments used by Entergy in the reanalyses. These judgments are significantly different than those used in the feedwater nozzle analysis.

> Assuming Entergy still wishes to pursue this license renewal, it must (1) recalculate the CUFen analyses for the CS and RR outlet nozzles, in accordance with the ASME Code, NUREG 6583 and 5704, and all other regulatory guidance, (2) resubmit these results to the NRC Staff and serve them on the other parties herein, and (3) either demonstrate that the TLAAs are less than unity or submit an adequate AMP for these components. At that point we presume (but do not and cannot order) that the NRC Staff will evaluate Entergy's submissions. Presumably NEC will do the same.
>
> If the CUFen analyses are (1) done in accordance with the above stated guidance and the basic approach used in the Confirmatory CUFen Analysis for the FW nozzle, (2) contain no significantly different scientific or technical judgments, and (3) demonstrate values less than unity, then this adjudicatory proceeding terminates. If not, NEC may file a new or amended contention challenging the adequacy of the CUFen calculation,[95] or, if Entergy chooses to proceed under the AMP route, NEC may revitalize dormant Contention 2 (as to the adequacy of Entergy's AMP).
>
> PID Page 68

5. Entergy claims that NEC's Contention is fatally flawed because the issues that NEC raises were introduced far back in this proceeding; thus cannot be new information and therefore are untimely raised.

Entergy's claim in this regard is spurious.

No confirmatory CUFen analysis of the RO AND CS Nozzles (absent Green's Function) preceded the reanalyses under discussion, the issues that NEC raises are raised with respect to the judgments made in the context of the reanalyses most recently submitted. The issues are timely raised.

6. Entergy claims the the issues that NEC has raised are immaterial to the final decision of the Board.

Not so.

7. The issues that NEC has raised are embodied in judgments that are "significantly different than those used in the feedwater nozzle analysis" and are thus shown to be material to the final decision the Board will make with respect to this much litigated issue.

8. NRC Staff and Entergy both claim that NEC seeks to litigate issues already settled. This is not true. In as much as phenomena upon which the Board opined, such as local rates of dissolved oxygen and length of pipe to uniform flow are considered in the technical guidance and in the reanalyses, Dr. Hopenfeld's Declaration included for reference selections from basis engineering texts and other industry materials uniformly accepted illustrations of the general principals involved. Dr. Hopenfeld makes no representation regarding the exceptions developed by Entergy and accepted by the Board regarding these phenomena in regard to the feedwater nozzle or otherwise. Dr. Hopenfeld's Declaration focuses largely on judgments regarding component and surface geometries.

9. Entergy argues that NEC's proposed contention fails to demonstrate a genuine dispute on a material issue. Entergy then forges forward to dispute Dr. Hopenfeld's assertions on

technically defensible judgments regarding natural convection, diameter effects on heat transfer, and certain design inputs and methodology for fatigue usage, for example, by citing at length its own calculations and the opinions of its experts.

Entergy's arguments are by no means dispositive (please see attached Hopenfeld Declaration)

In Fact, Entergy's detailed arguments on NEC's issues most firmly establish that sufficient information has been provided to show that a genuine dispute exists with the applicant/licensee on a material issue of law or fact. (10 C.F.R. § 2.309(f)(1)(vi).

10. NRC Staff's Answer repeats throughout much of what Entergy claims in its Answer.. For all the same reasons given above NRC Staff's claims are also entirely without merit.

II. DR. JORAM HOPENFELD'S DECLARATION ATTACHED AND REQUEST FOR INCORPORATION IN NEC's REPLY

Attached is Dr. Joram Hopenfeld's Declaration in Support of NEC'S Reply to the Answers of Entergy and NRC Staff. In his Declaration, Dr. Hopenfeld replies to the technical and scientific subject content of Entergy and NRC Staff Answers in detail. Dr. Hopenfeld provides more than enough detailed information so as to put the licensee on notice as to the nature of the technical dispute. NEC respectfully requests that in considering NEC's proposed new contention, the Board incorporate Dr. Hopenfeld's Declaration into this pleading

II. CONCLUSION

NEC has dutifully jumped through every increasingly constricted hoop and cleared every raised bar put in its path to obtaining adequate assurance of public health and safety in

and it has done so at no little expenditure of effort and resources, while Entergy and NRC Staff needlessly protracted this now three year proceeding by doggedly refusing to implement a technically competent and scientifically defensible reactor component aging analysis.

Further, admission of NEC's contention would not significantly and unreasonably delay this proceeding, especially if compared to Entergy's foot-dragging on the issue repeatedly and ever since NEC raised the issue of Entergy's failure to credibly ascertain and propose an aging management program for metal fatigue in May of 2006.

.NEC's proposed fatigue contention (1) reasonably and directly meets the conditions set by the Board for the submittal of contentions challenging the Confirmatory CUFen Analyses of the RO and CS nozzles; (2) plainly meets the admissibility standards in 10 C.F.R. § 2.309 ; and (3) is timely in that it has been presented within the 45 day time limit set by the Board's Partial Initial Decision of November 24, 2008. . For these reasons, NEC's proposed contention should be accepted for litigation.

In sum, Entergy has failed to demonstrate that its Confirmatory CUFen Analyses have been done in accordance with the guidance cited in the Board's Partial Initial decision and the basic approach used in the Confirmatory CUFen Analysis for the FW nozzle. Its reanalysis does , in fact, contain significantly different scientific and technical judgments that cannot validly demonstrate values less than unity. (LBP-08-25 at 67).

New England Coalition, having amply fulfilled all of the requirements for a timely new contention under 10 CFR 2.309 and the Board's Partial Initial Decision, respectfully requests that this Board accept and validate this contention for adjudication; scheduling preliminary oral argument on admission of this contention at the Board's earliest opportunity.

Respectfully Submitted,

/Original Signed by Raymond Shadis

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Dated: May 26, 2009

Pro Se Representative For New England Coalitio

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CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing " NEC's Reply to Entergy's and NRC Staff's Opposition to NEC's Motion to File a Timely New Contention" were served on the persons listed below by deposit in the U.S. Mail, first class, postage prepaid, and where indicated by an asterisk by electronic mail, this 26th day of May 2009.

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DECLARATION OF DR. JORAM HOPENFELD
IN SUPPORT OF NEW ENGLAND COALITION'S REPLY
TO
NRC STAFF AND ENTERGY OPPOSITIONS
TO
NEC'S MOTION TO FILE A TIMELY NEW CONTENTION

INTRODUCTION

My name is Joram Hopenfeld. New England Coalition, Inc. has retained me as an expert witness.

I have provided numerous declarations and testimony in support of New England Coalition, Inc.'s (NEC) contentions throughout this (above captioned) proceeding.

I am a mechanical engineer and hold a doctorate in mechanical engineering. My curriculum vitae was attached to my first declaration in support NEC's Petition to Intervene, filed May 26, 2006. The purpose of my Declaration is to provide technical in support of NEC's Motion for Leave to File a Timely New Contention.

I have structured my Declaration in the form of Comments; each containing an assertion by Entergy or NRC Staff regarding NEC's Motion and my Reply.

REPLY TO ENTERGY COMMENTS

Comment 1

Entergy Claims that:

"it has already been established that "entrance effects" are insignificant for high Reynolds number conditions; therefore the heat transfer coefficients do not change"

REPLY

The ASLB agreed with Entergy that entrance effects were not significant in the case of the feedwater nozzle. The RO geometry, the flow conditions are entirely different for the RO convergent nozzle and therefore even if it is true that entrance effects are not significant for the FW the same does not apply to the RO nozzle. The NEC contention clearly points out that that the flow in a convergent nozzle behaves differently than the flow at the entrance to a pipe of a uniform diameter. Entergy provided no data to support its assertion that the same laws that govern the heat transfer in coefficient in straight pipes govern the heat transfer coefficient in a convergent nozzle with an aspect ratio of 1.4 (36/26). Because of the flow acceleration along the convergent nozzle the heat transfer coefficient is expected to much less uniform in comparison the a flow in a pipe where no acceleration exists.

Comment 2

Entergy claims that Hopenfeld conceded that oxygen effect are not important:

"When asked about his concerns regarding the dissolved oxygen issue, he testified: "First of all, I would like to comment that this is not a major concern." Tr. at 959 (Hopenfeld). See also, LBP-08-25 at 39."

REPLY

Entergy's claim misrepresents Hopenfeld's because to quote was taken out of context. Hopenfeld's comment referred to the issue of using Electrochemical Potential vs. direct oxygen measurements. The record contradicts Entergy's assertion, Hopenfeld emphasized the importance of dissolved oxygen to the calculations of the CUF:

In reply to Judge Karlin question regarding the importance of oxygen (Tr. p.1323, " you think oxygen is in the top three? Hopenfeld said "Yes , Oh , absolutely"

Comment 3

Entergy claimed (P. 24) that Hopenfeld's mathematics are incorrect:

"Dr. Hopenfeld's analysis is based on obviously incorrect mathematics. He quotes equation "1" from Entergy's Calculation 0801038.301, page 9, which reads: h = C(GrPr)n k/x, where x is the inside diameter of the nozzle, and using Entergy's value for "n" of 0.25, he concludes that the heat transfer coefficient for the RO nozzle would vary with the vertical distance as 1/x0.25, causing a the heat transfer coefficient to "vary by a factor of 2.5 (36/1) 0.25 around the circumference of the RO nozzle, i.e. 240% variation vs. 140% for the FW nozzle." Id. at A13.

However, in equation "1," the "n" exponent applies only to the parenthetical term (GrPr). Dr. Hopenfeld's analysis is invalid on its face."

REPLY

Not only is it that Entergy incorrect in the above statement, it also clearly demonstrates that Entergy is unfamiliar with the most fundamental aspects of heat transfer. Entergy should be required to demonstrate use of its incorrect equations to refute NEC's contention that there is significant difference in the variation of the heat transfer between the FW and the RO nozzle.

It is true that n applies to the mathematical term (Gr Pr), however it is universally accepted that the Grashoff number is defined in terms of X^3 and not in terms of X as stated by Entergy. (See 0801038.301 page 10.) Hopenfeld derivation, as shown below is based on the correct definition of Gr

h is Proportional to $(X^3)^{0.25}$ Times (1/X) . Therefore h is proportional to $X^{3/4 -1}$ which equals $1/X^{0.25}$. This proportionality was used by Hopenfeld to show that the effects of heat transfer variation around the circumference of the RO nozzle are significantly larger than those around the circumference of FW nozzle. Therefore the effect on the CUF is also expected to be considerably larger.

Comment 4

On P. 24, Entergy claims the Hopenfeld addressed the wrong nozzle :

"Apart from the fact that the calculation he cites is for the wrong nozzle"

REPLY

` Entergy's statement is incorrect,, Hopenfeld cited the correct nozzle, the same natural convection have been used for both nozzles the CS and the RO nozzle. Hopenfeld focused attention on the RO nozzle because of its larger diameter. The same Grashoff correlation that was used for the for the CS nozzle was also used for the R O nozzle, 0801038.304 " Design Methodology for ASME Code Usage Analysis of Reactor Recirculation Outlet Nozzle" ,. See Page 16, Bottom of Table 7, note that the Grashhoff number is defined in the same manner as for the CS nozzle.

Comment 5

On Page 21 Entergy describes that the FW nozzle and the RO nozzle represent entire two different situations and therefore the manner how the oxygen is treated must also be different. Entergy's justification for using the same oxygen content at both end of the RO nozzle is also described on the same page.

"In the case of the feedwater nozzle, the flow direction is inward toward the reactor pressure vessel and a thermal sleeve separates the safe end fluid flow from the nozzle corner fluid flow. Tr. at 955-56 (Stevens). For those conditions, it is appropriate and conservative to use different water chemistries for each of the two nozzle locations." "However, in the case of the RO nozzle, flow is outward from the reactor pressure vessel and there is no thermal sleeve present as in the feedwater nozzle. Accordingly, both the nozzle corner and safe end locations of the RO nozzle are exposed to the same water with the same dissolved oxygen content. Because of their exposure to the same dissolved oxygen concentrations, Entergy used the same concentration of dissolved oxygen in the recirculation line at both locations of the RO nozzle."

REPLY

NEC agrees that the FW and RO nozzles must be treated different with respect of dissolved oxygen calculations. Entergy's method of how the oxygen was calculated for the RO nozzle is not consistent with experimental data, and as discussed in the NEC contention it disregards the specifications of what oxygen concentrations should be used in the calculations of the CUF.

Experimental data in NUREGS NUREG 6583 and 5704, show that stainless steel and carbon steel respond differently to dissolved oxygen. For stainless steel, low oxygen

concentrations increases the CUF while for, carbon steel high oxygen concentrations increase the CUF. Since during a typical oxygen concentrations vary from high to low or low to high, if both stainless steel an and carbon steel are exposed to the same oxygen concentrations during the transient as is the case with RO nozzle, different oxygen concentrations must be applied to the different ends of the nozzle. NEC Contention on clearly restates ANL specification in this regard:

"For carbon and low-alloy steels, the dissolved oxygen content, DO, associated with a stress cycle is the highest oxygen level in the transient, and for austenitic stainless steels, it is the lowest oxygen level in the transient."

The above statement is true and is independent whether one uses the ANL recommended value of oxygen concentration of 0.4 or not. This condition did not exist for the FW because both ends of nozzle were of the same material.

Because of the variation of the oxygen during startup and shutdown transients it impossible for Entergy to use a single value of oxygen for both ends of the RO nozzle and at the same time comply with ANL's instructions. This is a new material issue that has not previously been discussed. Using different oxygen concentration could significantly affect the calculated CUF values.

Comment 6

On pages 25 and 26 Entergy claimed that NEC failed to challenge the oxygen and heat transfer issues as related to the RO nozzle even though Entergy performed such calculations in the Confirmatory CUFen Analysis.

REPLY

It is very curious for Entergy to accuse NEC for not challenging the above RO issue because the issues relating to the CS and RO nozzles were taken off the table at Entergy's insistence before April 2008 when NEC submitted their final position to the ASLB. I t would be useful to remind Entergy their insistence that the CUF calculations for the RO and the CS nozzle be not included at the VY hearings.

After strongly arguing in public hearings that Entergy's analysis was very conservative, NRC's audit found that the only reason that the analysis was conservative was because Entergy selected an arbitrary methodology to make it so. When the NRC requested that the analysis for the RO and the CS nozzles be repeated Entergy promised to do so in some unspecified future time. The SER did not discuss the new CS and RO results because they were not available in March 2008 when the SER was released.

Accordingly, the methodology for determining the CUF for the CS and the RO nozzles were not discussed in details when NEC formulated its position for the VY hearings.

In his Declaration, to the ASLB April 28, 2008, A9, Hopenfeld made it very clear that the Analysis of the RO and CS could not be discussed at that time because it was incomplete:

" Even if I could agree that the Applicant used a valid methodology in its so-called "confirmatory" analysis of the feed water nozzle, I still could not consider the CUFen analysis complete, because the analysis of the feedwater nozzle is not bounding for other components."

Consequently, as a result of Entergy's refusal to provide the ASLB their final calculations on the RO and CS nozzle that the detail of the heat transfer and oxygen, calculations for these specific components were not discussed at the hearings.

Comment 7

On page 26 Entergy stated, as discussed it NEC contention, that a uniform heat transfer coefficient was used around the circumference of the RO nozzle. Entergy did not question NEC's argument that disregarding the large temperature distribution around the transfer would affect the CUF. Entergy's stated that the assumptions of constant heat transfer around and along the FW nozzle was made previously and therefore the same assumptions can be now repeated.

REPLY

At the VY hearings Entergy's witness Mr. Steven admitted, p.1117 that the temperature distribution could introduce additional shear stress for the FW nozzle. He added, however, that that such stresses were not included in the calculations.

The RO nozzle diameter is much larger than the FW diameter. The RO nozzle has a convergent (non uniform diameter) shape while the FW has a uniform diameter.

Therefore the effect varying temperature field on the RO nozzle is much more pronounced than it would be for the FW nozzle.

As discussed in Comment 10, the heat transfer coefficients in convergent nozzle are governed by different equations than those for the FW nozzle. Entergy is using incorrect heat transfer equations for the RO nozzle.

Comment 8

On Page 10 Entergy asserted that since the ASLB accepted Entergy's argument that entrance effects were not significant for the FW nozzle it would follow that they must also be insignificant for the RO nozzle.

REPLY

There are two reasons why Entergy is wrong regarding the entrance effect on heat transfer especially for the RO nozzle:

1. The NEC contention makes it very clear that a flow in a pipe of constant diameter such as the FW nozzle is considerably different than the flow in the steeply convergent RO nozzle (36 inches to 26 inches). The NEC Contention clearly made the distinction between these two cases as is repeated below:

"The flow through the RO nozzle is commonly classified as boundary layer type flow in a convergent channel. The velocity distribution is considerably different in the convergent channel than the velocity distribution in a pipe of constant diameter as shown in NEC Motion Attachment 2.

Since the data in NEC Motion Attachment 1, shows flow in straight pipe is not applicable to the RO nozzle Entergy's entire argument of refuting the existence of non uniform temperature distribution in the RO nozzle is invalid. NEC Motion Attachment 2 clearly demonstrates that the flow in divergent or convergent channels is considerably different than the flow in straight pipes. The differences in the gradients at the walls of the nozzle relate yo the heat transfer coefficient. So even if the issue of entrance effect has been resolved at the hearing for the FW nozzle, its resolution does not include how heat transfer is calculated in the RO nozzle. It is preposterous for Entergy to claim that resolution of the corner effects for a straight pipe is universal and is applicable to all

geometries. Such a conclusion is refuted by the enormous amount of work in the past 100 years in studying the effects **different geometries** on heat transfer, and mass transfer controlled corrosion. For this reason in the related issue of local corrosion Entergy testifies that nozzles and discontinuities behave differently than flow in a constant diameter pipe.

Even if the convergent nozzle was a straight pipe of a uniform diameter of 36 inch and NEC Attachment 1 data was applicable, Entergy argument is flawed. Entergy refers to Mr. Steven testimony out of context and misstates what he said. A very rudimentary review of NEC Motion Attachment 1 clearly shows that below a length to diameter ratio of about 4 the heat transfer strongly depends on the Reynolds number. Only when the diameter is larger than 4 the heat transfer coefficient becomes less and less sensitive to the Reynold's number as pointed out by Mr. Stevens. It is not possible to interpret that data any other way. There is no indication that, it is not sensitive, it is only less sensitive.

Since the corner effect in the case of the FW nozzle extends to 40 inches 4x10)" and to 144 inches (4x 36) for the RO nozzle it becomes clear why the issue of flow mal distribution is much more important for the R O nozzle than for the FW nozzle even if one assumes as did Entergy that the flow in an a straight pipe is the same as the flow in a convergent nozzle

Because of its large diameter, the entire length of the RO nozzle is affected by the non uniformity of the heat transfer. Entergy's application of the axis symmetrical model for stress calculations is not applicable to the RO nozzle.

Comment 9

On page 16 Entergy claimed that they have performed a sensitivity study showing that the heat transfer effect on the CUFen is minimal. This study was based on the declaration of Stevens which was provided in NEC Motion Attachment 4 .

REPLY

The material in NEC Motion Attachment 4 constitutes a new information that NEC had no opportunity to examine previously. NEC Motion Attachment 4 does not support Mr. Stevens conclusion that the CUF is not sensitive to the heat transfer coefficient for the following reasons.

The material in the Attachment is based on three data points showing that the CUF under these conditions is not sensitive to the heat transfer coefficient. Mr. Stevens does not describe under what conditions this comparison was made.

More specifically, one must know what transients were included in this comparison?

How was the sensitivity test conducted, i.e. by how much was the heat transfer varied?

How was the azimuthal distribution of the heat transfer coefficient varied ?

What data was used to support the contention that the CS nozzle results are applicable to the RO nozzle ?

Mr. Stevens apparently reversed his previous position when he agreed that the magnitude and the uncertainty in the heat transfer coefficient had a major effect on the CUFen.

At a public meeting devoted to the CUF calculations, January 2008, SIA stated that the CUF was very sensitive to the heat transfer coefficient. At that meeting, SIA

presented data on the effect of velocity on the stress during transients. Because of the almost linear relation between the heat transfer coefficient and the velocity this data is relevant to the present discussion. At the VY ASLB hearing in Newfane, Vermont , NEC's witness clearly stated , p. 1103 that " the results were very sensitive to the heat transfer coefficient" . Mr. Stevens had plenty of opportunities to dispute this fact but he did not. In reply to Judge Reed's question, Mr. Steven even admitted that the assumption of non uniformity of the heat transfer coefficient is important P1117. The data that SIA presented at the January meeting was also discussed at the VY hearing , it demonstrated the sensitivity of the stress to the heat transfer coefficient as a function of time during transients.

At the beginning of the transient the effect of the heat transfer coefficient in the stress is insignificant but it becomes pronounced, 75%, during the later part of the transient. This indicates that the sensitivity is a variable number which can not be discussed without a presentation of the underlying conditions. Mr. Stevens does not provide any information how the sensitivity studies were conducted.

The assertion that the heat transfer coefficient both in absolute terms and in its non uniformity is a new information that must be explored because it could significantly effect the CUF.

Comment 10

On page 22, Entergy stated that the heat transfer coefficients for the RO nozzle differed appropriately from the feed water nozzle including the use of a "different equation for forced flow"

"As discussed in Section 3.4 of Calculation 0801038.304, Revision 1, the methods and equations used for calculating the heat transfer coefficients for the RO nozzle differ appropriately from those used for the feedwater nozzle, including the use of a different equation for forced flow heat transfer coefficient, as well as different geometry inputs specific for each nozzle."

REPLY

NEC agrees that the calculations of the heat transfer require different equations than those for the FW nozzle. However, the cited document shows that Entergy used the same equation they used for the FW nozzle with an adjustment for the differences in diameters between the FW and the RO nozzle. The following explains why Entergy is patently wrong in using the equations which were described in Section 3.4 of Calculation 0801038.304.

The equation on page 6 of the above Reference is easily recognized as the Dittus and Boelter equation. This equation was empirically derived for a fully developed flow in **straight pipe of a uniform diameter**. It has been used successfully in numerous engineering applications for the last 80 years. However, the Dittus –Boelter equation is **not applicable** to flow in **convergent nozzles.** There is no physical justification for applying the above equations to a highly convergent nozzle where the core flow is continuously changing as opposed to a constant diameter pipe where the core flow is uniform. It can be expected that the use of correct equation for the RO nozzle would result in higher heat transfer rates, rendering the present analysis non conservative because small heat transfer coefficients would lead to non conservative CUF values.

Entergy is wrong in stating that they use the appropriate equations to calculate heat transfer in the RO nozzle.

Comment 11

On Page 8 Entergy stated that the newly discovered cracks at Fitzpatrick and Oyster Creek were not due to fatigue and

"Therefore, these incidents are irrelevant to the potential vulnerability of the RO and CS nozzles at VY to environmentally assisted fatigue"

REPLY

Entergy is wrong that the newly discovered cracks at the above plants are not relevant. Since the possibility that these cracks grow by fatigue has not been dismissed, calculations were made to predict crack growth rates under fatigue loads for two cycles at Oyster Creek.

It does not matter whether the above cracks were introduced during fabrication or they resulted from stress corrosion cracking, preexisting cracks would facilitate failure by fatigue irrespective of crack pedigree.

The discovery of the cracks demonstrates that the fatigue analysis may have not be conservative because of preexisting cracks. This point was discussed at the hearing in connection with the FW nozzle.

The discovery of the cracks is new information which was not available to the ASLB previously. As can seen page 1131 of the VY hearings, the ASLB was left with the impression that large cracks were never seen in BWRs:

JUDGE REED: Even if I accept your point,
21 that it doesn't fall apart, just major cracking
22 occurs, **we have not seen major cracking in any of**
23 these components in 30-something years of operation.

Thus the discovery of the cracks in the above plants is relevant to the assessment of the validity of Entergy's claim that their analysis for the RO nozzle is conservative

I!. REPLY TO NRC COMMENTS

COMMENT 1

On page 7 the NRC stated that the same cracks that were found at Oyster Creek would not impact the CUF. NRC is also misleading the ASLB by stating,

"NEC maintains that, in calculating the final CUFen analyses for the RO nozzle, Entergy erroneously assumed that no cracks existed in the RO nozzle.'

" Entergy's witness established that ASME Code Section III governs fatigue analyses and does not require the analyst to postulate cracks in conducting such analyses."

REPLY

The NRC misunderstood Hopenfeld's discussion regarding the recent discoveries of cracks at two plants. Hopenfeld did not say that the same exact crack could exist in the RO nozzle at VY **nor** did he contend that " Entergy erroneously " did not consider cracks.

The purpose of the discussion regarding the Oyster Creek and the Fitzpatrick cracks was to indicate that,

1. Entergy's contention that their CUF analysis is conservative is not supported by plant experience. Given the history of cracking in BWR nozzles the possibility of cracks in the RO nozzles can not be excluded. The fact that the large crack at Oyster Creek has gone **undetected since 1991** illustrates this point very clearly.

2. Entergy and the NRC left the ASLB with the impression, at the VY hearings, that large cracks do not exist in BWRs. The record shows otherwise.

3. Entergy's witness did not establish that the ASME code does not require postulating cracks in analysis. This is true in general, but not when plant experience clearly indicates that the component which is being analyzed already contain cracks. One should be reminded that the Fen equation was derived for specimen with smooth surfaces without cracks.

COMMENT 2

On page 10 the NRC stated,

"Given that the flow velocity through the RO nozzle is significantly greater than the velocities depicted, NEC's attachment supports Entergy's decision to assume a uniform flow throughout the RO nozzle

On Page 19 NRC stated

In this case, the velocity of flow in the RO nozzle, like the velocity of the flow in the CS and FW nozzles, far exceeds the values depicted in Figure 8-9. Calculation 304 at 6-7. As a result, Entergy's assumption of a fully developed flow in the RO nozzle is justified. The Board has already ruled on this issue in a similar context.

REPLY

The NRC completely misunderstood the data in Attachment 3. The absolute velocity is not the relevant parameter which would determine whether one can assume , as Entergy did that the heat transfer is uniform throughout the channel. Secondly the data in the attachment is given in terms of the Reynolds number, and convergent angle.

The analogy between heat transfer and flow dictates that the relevant parameter to consider in comparing flow velocities to heat transfer is **shear or skin friction** at the wall which is described by the local velocity gradient at the wall and the heat transfer coefficient which is described by the temperature gradient at the wall, and not by the velocity as implied by the NRC. As the velocity increases the gradient at the wall increases, Attachment 3 shows that the velocity gradient (shear or skin friction) varies long the nozzle. The discussion on the analogy between heat transfer and flow can be found in any elementary text on heat transfer.

Since the flow area in the RO nozzle varies continuously, from 36 inches to 26 inches, it would be physically impossible for the velocity to be uniform throughout the nozzle. It apparent that the NRC does not understand the issue that is involved (effect of non uniform temperature on stress) but they also do not understand what Entergy did.

In contrast to NRC assertion the BOARD could not have ruled on this issue because the FW issue is entirely different than the RO issue.

COMMENT 3

On Page 9 the NRC stated,

"The equation quoted in the Hopenfeld Declaration that Entergy relied on to calculate the heat transfer coefficient for natural convection flow is an empirical equation referenced in J. P. Holman, "Heat Transfer", 8th edition, McGraw-Hill, 1997. It pertains to transient natural convection heating or cooling in *closed* vertical or horizontal cylinders, in the range $0.75<L/D<2.0$ (L is the cylinder length and D is the cylinder diameter)."

REPLY

The NRC is wrong, there is no indication in the material available before the Board that the free convection equations employed by Entergy were obtained under transient conditions. The opposite is true.

Entergy did not indicate anywhere, (Table 7, 08011038,304 and page 9 of 0801038.301) that the equations were obtained under transient conditions.

An earlier edition of the NRC cited text, gives no indication that the natural convection used by Entergy, with or without condensation, were obtained under transient conditions. Eq. 9-29 of the Fifth Edition of the J. P. Holman's text (NEC-JH-31) clearly implies that these equations were obtained under steady state conditions.
"Chato (38) obtained the following expression for condensation of refrigerants at low vapor velocities inside horizontal tubes."

There are no indications that such tests were run under transient conditions, if there were, the transient time for the tests would have been prescribed. Holman also states that the free convection phenomena inside the tubes are extremely complicated. Equation 9-29 represents the average heat transfer in tube which is adequate for calculating overall heat transfer performance of engineering systems. It is inappropriate to use average heat transfer values when local differences in temperature could introduce stresses.

The reason that Entergy can claim that such stresses do not exist is because they assumed that such stresses do no exist in the first place.

COMMENT 4

On Page 13 the NRC claimed that issues relative toe the heat transfer and dissolved oxygen for the RO and CS nozzles were previously available and should have been discussed at the VY hearings.

REPLY

NRC is wrong in stating that the NEC should have challenging the RO and CS nozzle issues previously because these issues were taken off the table at Entergy's and NRC insistence prior to April 2008 when NEC submitted their final position to the ASLB. I t would be useful to remind NRC that they insisted that the CUF calculations for the RO and the CS nozzle not be included at the VY hearings.

In his Declaration, to the ASLB April 28, 2008, (A9), Hopenfeld made it very clear that the Analysis of the RO and CS could not be discussed at that time because it was incomplete: " Even if I could agree that the Applicant used a valid methodology in its so-called "confirmatory" analysis of the feed water nozzle, I still could not consider the CUFen analysis complete, because the analysis of the feedwater nozzle is not bounding for other components."

Consequently, as a result of Entergy's and NRC refusal to provide the ASLB and the public their final calculations on the RO and CS nozzle that the detail of the heat transfer and oxygen calculations for these specific components were not discussed at the hearings. It would have been ludicrous to the discuss the heat transfer and oxygen issue as if they were independent of the final CUFen analysis. In anyway it was made very clear to all participants that the CS and RO related issues were off the table for the VY hearings.

Q. . Does this complete your testimony at this time?

A. . Yes

DECLARATION

I declare under penalty of perjury that the foregoing is true and correct.

Executed this 26th day of MAY , 2009 at Rockville, Maryland.

Joram Hopenfeld, PhD

New England Coalition

VT . NH . ME . MA . RI . CT . NY

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May 26, 2009

Office of the Secretary
Attn: Rulemaking and Adjudications Staff
Mail Stop: O-16C1
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

RE: Docket No. 50-271-LR, ASLBP No. 06-849-03-LR, Vermont Yankee Nuclear Power Station

Dear Rulemaking and Adjudications Staff,

Please find enclosed for filing before the Atomic Safety and Licensing Board in the above captioned proceeding:

New England Coalition's Reply To NRC Staff And Entergy Opposition To New England Coalition's Motion For Leave to File a New Contention

Thank you for your kind attention,

/RS

for New England Coalition, Inc.

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