



From: Rick Ennis *ME*
To: Allen Howe; Brenda Mozafari; Brian Sheron; Brooke Poole; Chris Miller; Cliff Anderson; Cornelius Holden; Diane Screnci; Donald Florek; Donna Skay; Edwin Hackett; James Lyons; John Stang; Lawrence Doerflein; Marisa Higgins; Michael Johnson; Michael Tschiltz; Neil Sheehan; Ralph Caruso; Richard Lobel; Robert Bores; Robert Dennig; Robert Jasinski; Robert Weisman; Rosetta Virgilio; Scott Burnell; Suzanne Black; Tad Marsh; Tae (TJ) Kim; Thomas Madden; Wayne Lanning; William Ruland
Date: 9/17/04 11:02AM
Subject: Fwd: Request to NRC ACRS

fyi - see attached letter from State of Vermont to ACRS requesting ACRS to specifically review the containment overpressure issue as part of the Vermont Yankee EPU review.

68-3

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Subject: Fwd: Request to NRC ACRS
Creation Date: 9/17/04 11:02AM
From: Rick Ennis

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Date: 9/17/04 10:34AM
Subject: Request to NRC ACRS

Yesterday, the Department requested that the NRC Advisory Committee on Reactor Safeguards (ACRS) review Vermont Yankee's request to change its design basis to take credit for containment overpressure to demonstrate the adequacy of emergency core cooling pumps. The ACRS is will already review Vermont Yankee's request to increase its power level by 20%. We asked ACRS to specifically focus on the overpressure credit issue.

Attached for your information is the Department's September 17, 2004 letter.

<<ACRSLtr9-17-04FINAL.pdf>> <<ACRS-Attachment A.pdf>> <<ACRS-Attachment B.pdf>> <<ACRS-Attachment C.pdf>> <<ACRS-Attachment D.pdf>>

September 17, 2004

Dr. Mario V. Bonaca, Chairman
Advisory Committee on Reactor Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

RE: State of Vermont Request to Consider the
Containment Overpressure Credit Policy

Dear Chairman Bonaca:

On behalf of the State of Vermont, by this letter I am requesting that the ACRS ("the Committee") specifically review, as part of Entergy's request for extended power uprate for the Vermont Yankee nuclear plant, Entergy's request to change Vermont Yankee's design basis to take credit for containment overpressure to demonstrate the adequacy of its emergency core cooling and containment spray pumps, and the NRC staff's ("the staff") policy of granting such requests. The reasons for the State of Vermont request are presented below.

We have reviewed Entergy's request for extended power uprate for Vermont Yankee. We question the prudence of removing the safety margin for the adequate functioning of emergency core cooling and containment cooling pumps provided by containment overpressure. That safety margin was established with good basis in the first Regulatory Guide, then Safety Guide 1.

From December 2003, we have conducted correspondence with the staff regarding the proposed removal of this important safety margin, but we have not yet received satisfactory answers to our questions, nor have we seen a convincing reason why such overpressure credit should be granted. Therefore, on August 30, 2004, we petitioned NRC for a hearing on the issue as it relates to Vermont Yankee. The technical contentions from our petition are included as Attachment A. Our letter to the staff of December 8, 2003, and the staff's answer on June 29, 2004 are provided as Attachment B and C, respectively.

At an early Vermont Yankee power uprate meeting at NRC headquarters, NRC staff asserted that the basis for considering containment overpressure credit was Regulatory Guide 1.82, Rev.

3 (then Draft Regulatory Guide 1107), which, in a very small portion, addresses the containment overpressure credit. I will now recount the history leading up to the overpressure credit statements in Regulatory Guide 1.82, Rev. 3. For most of this history, the NRC, industry and the Committee were adamant about retaining the defense-in-depth safety margin provided by not linking emergency core and containment cooling functions with containment performance. In the late-1990's, overpressure credit began to be granted selectively for a few cases based on need related to strainer debris loading. And then, with the advent of extended power uprates, it appears the NRC began granting overpressure credit whenever an Applicant asked for such credit.

- From the early 1970's, and before, until the mid-1990's, the principle expressed in Regulatory Guide 1.1 of not allowing containment overpressure credit for net positive suction head (NPSH) calculations seems to have been upheld.
- Vermont Yankee's design basis does not allow containment overpressure credit for demonstration of adequate NPSH.
- In the mid-1990's, as a result of ECCS suction strainer fouling at a number of boiling water reactors (BWRs), regulatory actions were taken to cause BWRs to modify suction strainers and recalculate the adequacy of NPSH for emergency core cooling and containment spray pumps. The Committee was highly involved in this review and Regulatory Guide 1.82, Rev. 2 (May 1996), was one of the regulatory products of this review¹.
- In 1996, all parties (industry, NRC staff, ACRS) agreed that overpressure credit should not be granted for NPSH calculations. Regulatory Guide 1.82, Rev. 2, is clear regarding no containment overpressure credit. Section 2.3.3.4 states:

¹ In its recommendation of Regulatory Guide 1.82, Rev. 2, the Committee faulted the industry and the staff: "Finally, we continue to believe that the response of the staff and the BWR licensees to this important nuclear safety issue has been unacceptably slow." ACRS Letter of February 26, 1996, *Proposed Final NRC Bulletin 96-XX, "Potential Plugging of Emergency Core Cooling Suction Strainers by Debris in Boiling Water Reactors" and an associated Draft Revision 2 of Regulatory Guide 1.82, "Water Sources for Long-Term Recirculation Cooling following a Loss-of-Coolant Accident."*

The NPSH available to the ECC pumps should be determined using conditions specified in the plant's licensing basis (e.g., Regulatory Guide 1.1).

The BWR strainer regulatory actions in the mid- and late-1990's are summarized by Los Alamos National Laboratory (LANL) in the NRC sponsored research paper, "*BWR ECCS Strainer Blockage Issue: Summary of Research and Resolution Actions*," LA-UR-01-1595, March 21, 2001. The following are quotations from the LANL report regarding containment overpressure credit and uncertainty:

Note that the BWROG does not recommend crediting containment overpressure in calculating NPSH margins. (page 4-2).

The staff concurs that additional containment overpressure (other than an amount already approved by the staff for the existing licensing basis) should not be used as part of the resolution of this issue. (page 4-3).

Some licensees discovered that they must take new credit for containment overpressure to meet the NPSH requirements of the ECCS and containment heat removal pumps and the overpressure being credited by licensees may be inconsistent with the plant's respective licensing basis. The staff further evaluated its position on use of containment overpressure in calculating NPSH margin and recommended that licensing basis changes not be used as a resolution option due to the substantial uncertainty associated with determining NPSH margin. (page x).

The staff also noted that a good practice would be to maintain defense-in-depth because of the uncertainties associated with any resolution of this issue. (page 4-4).

The Advisory Committee on Reactor Safeguards (ACRS) agreed with the BWROG. In a letter from the ACRS to the NRC Executive Director for Operations (EDO) explicitly stated, "We believe that allowing some level of containment

overpressure is not an acceptable corrective action because adequate overpressure may not be present when needed.” (page 1-14).

However, due to incomplete guidance and inadequate supporting documentation or analysis in several areas, the staff was unable to determine if all of the methodologies, or combination of methodologies, were conservative. Similarly, much of the general guidance on “resolution options” also lacked sufficient detail for the staff to review. Since the staff lacked sufficient detail and supporting justification on many of the “resolution options,” these were generally considered unacceptable without further supporting justification from a licensee or the BWROG. (page 4-2).

- Despite the 1996 determinations of industry, staff and the Committee, numbers of BWRs (but not Vermont Yankee) needed to rely on containment overpressure credit to demonstrate the adequacy of existing designs with revised ECCS strainer loadings. Accordingly, the NRC staff began granting this credit. The Committee concluded in its December 12, 1997 letter, *Credit for Containment Overpressure to Provide Assurance of Sufficient Net Positive Suction Head for Emergency Core Cooling and Containment Heat Removal Pumps*:

As a result of further review of this issue, we now concur with the NRC staff position that *selectively* granting credit for small amounts of overpressure for *a few cases* may be justified. (Emphasis added).

This letter went on to express concern over the completeness of the staff’s consideration for granting this credit and its assessment of risk probabilities.

- During the intervening eight years (between Rev. 2 and Rev. 3 of Regulatory Guide 1.82), the staff has granted overpressure credit to a number of plants and the expectation exists that PWRs will require containment overpressure credit as part of resolution of the pending PWR sump/strainer issues. Regulatory Guide 1.82, Rev. 3, as approved by the Committee, contains the following:

2.1.1.1 ECC and containment heat removal systems should be designed so that adequate available NPSH is provided to the system pumps, assuming the maximum expected temperature of the pumped fluid and no increase in containment pressure from that present prior to the postulated LOCAs. (See Regulatory Position 2.1.1.2.)

2.1.1.2 For certain operating BWRs for which the design *cannot be practicably altered*, conformance with Regulatory Position 2.1.1.1 may not be possible. In these cases, no additional containment pressure should be included in the determination of available NPSH than is necessary to preclude pump cavitation. [Emphasis added.]

In addition, the introductory portion of Regulatory Guide 1.82, Rev. 3, contains the following statement, at 8:

Predicted performance of the emergency core cooling and the containment heat removal pumps *should be* independent of the calculated increases in containment pressure caused by postulated LOCAs in order to ensure reliable operation under a variety of possible accident conditions. . . However, for some operating reactors, credit for containment accident pressure *may be necessary*. This should be minimized to the extent possible. [Emphasis added.]

- Also during the intervening eight years, the staff has considered and granted BWR extended power uprate amendments which also included grants of containment overpressure credit². For NPSH adequacy, it appears the staff's willingness to grant selective overpressure credit for sump/strainer loading resolution, has been changed into a general grant of overpressure credit for power uprate. It appears it has now become standard policy to grant containment overpressure credit to extended power uprate applicants whenever asked.

² Extended power uprate creates more energy transfer during a postulated LOCA that results in higher sump (or torus) temperatures, in turn resulting in reduced available NPSH for ECCS and containment heat removal pumps.

Considering the history stated above, the State of Vermont believes the following:

1. We believe the staff has made a major policy change in reducing defense-in-depth by granting containment overpressure credit whenever an Applicant asked for such credit. Although we may not have seen all the related Committee documentation, we do not believe that ACRS has thoroughly reviewed and recommended this major policy change.
2. Considerable uncertainty continues to exist with regard to determination of BWR pump NPSH adequacy. These uncertainties include non-conservative assumptions in NPSH calculations, reliance on testing which may not conservatively reflect actual conditions, uncertainty and lack of margin in NPSH-required determinations, and non-consideration of chemical effects. Because of the magnitude, importance and significance of these uncertainties we believe that overpressure should be retained as a safety margin rather than used as a credit for NPSH adequacy³.
3. We agree with the appropriate principle of extended power uprate - using certain safety margins, established many years ago, that are now understood to be excessive through experience or more exact calculations, to permit higher power levels. However, Vermont Yankee's overpressure credit request does not conform to this principle. Vermont Yankee's extended power uprate proposal uses all the available safety margin in NPSH, and then inappropriately seeks to change its design basis to use a properly reserved safety margin in order to achieve the increased power level.
4. For power uprate applications, the staff is not following its own guidance in Regulatory Guide 1.82, Rev. 3⁴. The guidance allows containment overpressure credit when necessary and when the design cannot be practicably altered. However, it appears the

³ We are aware of the ACRS interest in NRC staff independent verification of licensee assessments. Because of the importance of this NPSH issue, we asked the NRC staff by letter of June 9, 2004 to independently assess Vermont Yankee's overpressure credit request for LOCA, SBO, ATWS and Appendix R fire events. While the staff has not responded to our letter, it appears from RAI's that the staff is independently verifying the LOCA calculations.

⁴ Vice Chairman Wallis queried the staff on this point during the Thermal Hydraulics Subcommittee consideration of Duane Arnold's extended power uprate, September 2001 - See Attachment D to this letter. We are not aware of additional ACRS attention to this matter.

staff now grants containment overpressure credit whenever asked. For Vermont Yankee, containment overpressure credit is not necessary, because the power uprate is not necessary. Also, the Vermont Yankee's design can be practicably altered such that NPSH requirements are met without the need for overpressure credit⁵.

It appears the NRC staff is indiscriminately granting containment overpressure credit for extended power uprate, contrary to the policy guidance regarding *need* and *practicable alteration* that are in the Regulatory Guide 1.82, Rev. 3 recommended by the Committee. This appears to be a significant deviation from the Committee's 1997 concurrence that containment overpressure credit be granted *selectively, in a few cases*. Vermont therefore considers this major policy change to be ripe for review and requests the following:

- ▶ If the Committee has provided recommendations on the use of containment overpressure credit different from the recommendation in its December 12, 1997 letter quoted above, and different from the guidance in Regulatory Guide 1.82, Rev. 2, we would appreciate it if the documentation of those recommendations would be identified for us.
- ▶ We request that the major policy change of granting overpressure credit, described above, be considered by the Committee in its deliberations regarding Vermont Yankee's extended power uprate. We believe the following questions should be considered in reviewing the issue:
 - Should the defense-in-depth provided by unlinked fission product barriers (the containment function and core cooling function) be surrendered (by linking the core cooling function to containment integrity) when there is no need to do so⁶ and when the design can be practicably altered⁷ to avoid this linkage?

⁵ The backfit rule, 10 C.F.R. §50.109, does not apply because the request for extended power uprate is a voluntary change.

⁶ There is no need to change the overpressure credit design basis because it is not necessary for Vermont Yankee to increase its power level.

⁷ We believe it is practicable for Vermont Yankee to modify its emergency core cooling system and containment cooling system such that overpressure credit is not required. A possible modification would be to install pumps with different NPSH requirements.

- Is there sufficient continued uncertainty⁸ in the sum of:
 - 1) event calculations that develop the heat loading for torus water,
 - 2) calculations determining debris loading and strainer head loss,
 - 3) test results that may not conservatively reflect actual conditions,
 - 4) uncertainty in NPSH-required values, and
 - 5) uncertainty resulting from the adverse trend in as-found leakage in Vermont Yankee containment isolation valve leakage rate tests;

such that the margin provided by containment overpressure should not be surrendered when there is no need to do so and when the design can be practicably altered to avoid this crediting?

- Is risk evaluation methodology sufficiently developed to account for uncertainties in granting overpressure credit, including those identified above, and are the results sufficiently certain, accurate, and reliable to justify using the margin provided by containment overpressure when there is no need to do so and when the design can be practicably altered to avoid this usage?
- Does the post-event, human factors confusion for operators, who would now have to both retain and reduce containment pressure after thirty-two years of training to reduce pressure, merit the containment pressure reliance when there is no need to do so and when the design can be practicably altered to avoid this confusion?
- If this major policy change regarding containment overpressure credit is recommended by the Committee, and if Vermont Yankee's change in design basis is considered, should the precedence created in Section 5.1.4 of Regulatory Guide 1.183⁹, regarding the application of current licensing

⁸ The calculation uncertainty referred to here includes uncertainties in the methodology accepted by the staff and Committee for such calculations, in the application of this methodology by the Applicant, and in the assumptions and initial conditions chosen by the Applicant.

⁹ Regulatory Guide 1.183, *Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors*, July 2000:

5.1.4 Applicability of Prior Licensing Basis - The NRC staff considers the

standards, be extended to the grant of extended power uprate, design basis changes for overpressure credit? This method establishes a precedence for evaluating voluntary, major changes of design bases according to current licensing standards.

- If the major policy change is recommended by the Committee that containment overpressure credit should be granted regardless of need or ability to alter design, should there be limits on the percentage or amount of overpressure credited? Is risk methodology sufficiently developed to allow a risk-informed decision on the percentage or amount of overpressure credit to allow? Does the Vermont Yankee request for design basis change fit within these limits?

- ▶ We request that Vermont be allowed to present on these issues before the Sub- and Full-Committees, along with the Applicant and staff, in the Committees' deliberations for Vermont Yankee extended power uprate.

- ▶ We request that one or both of the Sub- and Full-Committee meetings regarding Vermont Yankee extended power uprate be held in the vicinity of the nuclear plant.

We are aware the staff has granted containment overpressure credit for extended power uprate to other Applicants, and therefore will be reluctant to retreat from this policy. However, Vermont does not believe the implications of this major policy change, as represented by the questions above, have been fully considered. We would greatly appreciate if ACRS

implementation of an AST to be a significant change to the design basis of the facility that is voluntarily initiated by the licensee. In order to issue a license amendment authorizing the use of an AST and the TEDE dose criteria, the NRC staff must make a current finding of compliance with regulations applicable to the amendment. The characteristics of the ASTs and the revised dose calculational methodology may be incompatible with many of the analysis assumptions and methods currently reflected in the facility's design basis analyses. The NRC staff may find that new or unreviewed issues are created by a particular site-specific implementation of the AST, warranting review of staff positions approved subsequent to the initial issuance of the license. This is not considered a backfit as defined by 10 CFR 50.109, "Backfitting." However, prior design bases that are unrelated to the use of the AST, or are unaffected by the AST, may continue as the facility's design basis.

Dr. Mario V. Bonaca, ACRS Chairman
Vermont Request to Consider Containment Overpressure Credit Policy
September 17, 2004

considerations for the Vermont Yankee extended power uprate could document the Committee's recommendations regarding these questions.

We appreciate your consideration of our request. Please call me if you have questions.

Sincerely,

David O'Brien, Commissioner
NRC State Liaison Officer for Vermont