

**From:** Neil Sheehan *NT*  
**To:** INTERNET: CLorie@Reformer.Com  
**Date:** 8/30/04 3:51PM  
**Subject:** re: VY hearing petitions

Carolyn,

Attached is the petition filed by Vermont requesting a hearing on the Vermont Yankee power uprate. Also, I haven't seen a copy of it yet, but I'm told the State of Massachusetts issued a press release announcing its filing of a petition. Nor have I seen a copy of that petition. If I get those, I'll pass them along.

Regards,  
Neil  
NRC Public Affairs  
(610) 337-5331

*C-52*

**UNITED STATES  
NUCLEAR REGULATORY COMMISSION**

**In Re: Entergy Nuclear Vermont Yankee )  
      LLC and Entergy Nuclear        )  
      Operations, Inc.                )**

**Docket No. 50-271  
(Extended Power Uprate)**

**VERMONT DEPARTMENT OF PUBLIC SERVICE  
NOTICE OF INTENTION TO PARTICIPATE  
AND PETITION TO INTERVENE**

**INTRODUCTION**

The State of Vermont has consistently pursued issues related to safety at the NRC while reviewing other issues such as economic interests at the state level. The Vermont Department of Public Service ("DPS") has sent two letters to the NRC<sup>1</sup> requesting answers to the State's questions regarding the change in licensing basis to allow the crediting of containment overpressure for calculating certain pump net positive suction head ("NPSH") following postulated loss of coolant accidents ("LOCA"), station blackouts, and Appendix R fire events. Additionally, we are pleased that the issues associated with power uprate are being explored in the engineering inspection presently being undertaken at Vermont Yankee Nuclear Power Station ("Vermont Yankee") pursuant to Temporary Instruction 2515/158. The State supports this inspection, and believes the findings from this assessment may create the need to file new or amended contentions. However, despite the correspondence and the ongoing assessment, the State has not received answers that satisfy the State's concerns regarding the issue of taking credit for containment overpressure. Accordingly, the State of Vermont, to ensure the

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<sup>1</sup>See letters attached from the Department of Public Service dated December 8, 2003 and June 8, 2004 (DPS Exhibits 13, 19).

continued safety of its citizens, must request a hearing to resolve its concerns and all of the contentions set forth below.

Vermont Yankee is located within the boundaries of the State of Vermont. DPS is the single representative of the State of Vermont for this Hearing. Therefore, pursuant to 10 CFR §2.309(d)(2), DPS is deemed to have standing for purposes of this proceeding and no further showing is required by DPS on that issue.

### I. PARTICIPATION AS A MATTER OF RIGHT

The Atomic Energy Act, 42 U.S.C. §2021(l) specifies that “[w]ith respect to each application for Commission license authorizing an activity as to which the Commission’s authority is continued pursuant to subsection (c) of this section”, which subsection includes a license authorizing, *inter alia*, “the construction and operation of any production or utilization facility”<sup>2</sup> the NRC “shall afford reasonable opportunity for State representatives to offer evidence, interrogate witnesses, and advise the

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<sup>2</sup> There cannot be any serious question that the application now pending to increase the thermal power of Vermont Yankee by 20% is a request to authorize operation of the plant at that level and falls within the scope of 42 U.S.C. §2021(c)(1) and (l). There is no need at this time to address the question of whether this language applies equally to all operating license amendments regardless of whether they seek to alter the power level or term of the operating license. In addition, the provisions of 10 CFR §50.91, which impose certain restrictions on state participation, are inapplicable here. That Section is limited to a Notice of Proposed Action under 10 CFR §2.105 which is deemed by the Commission to present no significant hazards. This is a Notice of Hearing for Consideration of Issuance of Amendment under 10 CFR §2.104.

Commission as to the application". 42 U.S.C. §2021( c)(1) and (l).<sup>3</sup> 10 CFR §2.315( c) acknowledges these rights of a state in those cases where a hearing is being held. However, the statute extends the right to offer evidence and interrogate witnesses to all applications, even if pursuant to 10 CFR §2.309 no hearing will otherwise be held. Thus, in the case of a State and/or its designated representative, NRC must provide these rights of participation regardless of the existence of any "admissible contention" and include the right to present evidence and interrogate witnesses as to matters relevant to the application. DPS recognizes that without pre-filed contentions, witnesses may have difficulty preparing to answer questions posed and the Applicant, and Staff, if it participates, may have difficulty focusing their attention on the issues of concern to the State. For that reason DPS is submitting a statement of the contentions it now believes should be examined at the hearing and will supplement that list of contentions when and if new evidence, such as the report of the Engineering Inspection now being conducted at Vermont Yankee at the request of Vermont Governor James Douglas and the Vermont Public Service Board, becomes available.

DPS believes the most efficient manner by which these statutory rights can be exercised is to allow both depositions and live testimony to the extent the issues are not fully developed in the deposition, but should the NRC conclude all state interrogation must be conducted at a Board supervised hearing, DPS will conduct all of its interrogation of witnesses at that time. Although not

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<sup>3</sup> Thus, DPS should not be required in this case to separately demonstrate that the provisions of Subpart G should apply to any Contentions which are admitted. Nonetheless, out of an abundance of caution, DPS provides that demonstration in the following paragraphs.

specifically mentioned in §2021(l), DPS also believes that cross-examination of witnesses by it will be more efficient if DPS submits cross-examination outlines, five days before the examination, to alert each witness to the subjects which DPS will explore. Similarly, DPS should have the right to seek production of documents if for no other reason than that production of documents will facilitate interrogation of witnesses and narrow the scope of their examination. Otherwise, witnesses will be asked questions about issues which are addressed in documents which either are not present during the interrogation or the analysis of which will require a hiatus in the interrogation.

DPS realizes that it may have information which Applicant, Staff or any other parties which may be permitted hearing status will want to see and although not required to do so by statute, will respond to reasonable requests for production of documents and is willing to have its witnesses cross-examined by Applicant, Staff or any admitted party provided outlines of cross-examination are submitted at least five days in advance for the witness to be prepared to fully answer the questions posed.

The following discussion follows the provisions of 10 CFR §§2.309 and 2.310 for purposes of simplicity and to demonstrate that even if DPS were not entitled to an adjudicatory hearing as a matter of right as to all of its contentions, it would nonetheless be entitled to an adjudicatory hearing on all these contentions under the provisions relevant to other parties.

## II. PETITION TO INTERVENE

Pursuant to 10 C.F.R. §2.309 and the Notice of Consideration of Issuance of Amendment to Facility Operating License for Extended Power Uprate and Opportunity for a Hearing (TAC No. MC0761)(Notice) Petitioner, the DPS hereby submits contentions regarding Vermont Yankee's application for a license amendment to increase the approved thermal power at its boiling water nuclear power plant in Vernon, Vermont by 20% (uprate). As demonstrated below, these contentions should be admitted because they satisfy the NRC's admissibility requirements in 10 C.F.R. § 2.309.<sup>4</sup> Also, the State requests, and is entitled to, as demonstrated below, a full adjudicatory hearing with all the rights of discovery and cross-examination provided by 10 CFR Subpart G because DPS has met the requirements of 10 CFR 2.310 (d).<sup>5</sup>

### A. CONTENTIONS, BASES AND SUPPORTING EVIDENCE

DPS submits the following contentions, bases and supporting evidence regarding the proposed

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<sup>4</sup> Although these contentions meet the requirements of 10 CFR §2.309, DPS does not concede the procedures are lawful and reserves the right to challenge, in an appropriate legal forum, these procedures, as applied to DPS in this case, should that be necessary to permit DPS to present and fully adjudicate the important nuclear safety issues raised in its contentions.

<sup>5</sup> Although DPS meets the requirements of 10 CFR §2.310(d) for a full adjudicatory hearing on all contentions it raises, DPS does not concede the procedures of 10 CFR §2.310 which restrict use of full adjudicatory hearing procedures are lawful and reserves the right to challenge, in an appropriate legal forum, these procedures, as applied to DPS in this case, should that be necessary to permit DPS to fully adjudicate the important nuclear safety issues it raises.

Vermont Yankee uprate:

### **First Contention**

**Applicant Has Claimed Credit for Containment Overpressure in Demonstrating the Adequacy of ECCS Pumps for Plant Events Including a Loss of Coolant Accident in Violation of 10 C.F.R. §50, Appendix A, Criteria 35 and 38<sup>6</sup> and Therefore Applicant Has Failed to Demonstrate That the Proposed Uprate Will Not Create a Significant Hazard as Required by 10 C.F.R. §50.92 and Will Not Provide Adequate Protection for the Public Health and Safety as Required by 10 C.F.R. §50.57(a)(3).**

### **Bases**

1. The portion of NRC Regulatory Guide 1.82, Revision 3 (DPS Exhibit 2) which purports to authorize containment overpressure credit has never been properly evaluated or approved by the Advisory Committee on Reactor Safeguards ("ACRS") in violation of the requirements of 42 U.S.C. §2039.

2. Regulatory Guide 1.82, Revision 3 is substantively indefensible because its authorization for the use of containment overpressure to demonstrate the NPSH required to properly operate ECCS pumps, improperly eliminates NRC safety requirements for defense in depth by multiple fission product barriers by allowing one barrier failure - containment failure - to compromise the effectiveness of two critical safety systems - containment and ECCS pump operation and eventually compromise the two

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<sup>6</sup> Vermont Yankee is committed to the draft general design criteria published July 11, 1967 (32 FR 10213) (DPS Exhibit 1). The corresponding criteria are Draft Criteria 44 and 52.

remaining fission product barriers, fuel cladding and the reactor coolant system..

3. Even if Regulatory Guide 1.82, Revision 3, were applicable to this case, Applicant has failed to demonstrate that it meets the very limited condition required by the Regulatory Guide for use of containment overpressure in calculating NPSH for ECCS pump operation. In particular, Applicant has not shown and cannot show that use of containment overpressure in calculating NPSH for ECCS pump operation is either “necessary” or that plant operations or equipment cannot be “practicably altered” either by limiting thermal output of the reactor or upgrading the ECCS pumps.

### **Supporting Evidence**

1. In issuing Regulatory Guide 1.82, Revision 3, the NRC has accomplished a major policy change regarding containment overpressure credit. NRC policy was previously clear in Safety Guide (Regulatory Guide) 1.1 (DPS Exhibit 3) that credit for containment overpressure was not allowed.

Regulatory Guide 1.82 establishes a new criteria:

**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. Calculation of available containment pressure should underestimate the expected containment pressure when determining available NPSH for this situation. Calculation of suppression pool water temperature should overestimate the expected temperature when determining available NPSH.



This new criteria retains the restriction for crediting containment pressure, but alleviates this restriction under certain conditions. Alleviation is not granted unless the “design cannot be practicably altered.”

2. This major policy change has not received adequate review by NRC. Rather, the policy change is embedded in a detailed technical regulatory guide which is primarily focused on a different safety issue. Regulatory Guide 1.82, Rev. 3, *Water Sources for Long-Term Recirculation Cooling following a Loss-of-Coolant Accident*, was first issued as Regulatory Guide 1.82 (Rev. 0) in June 1974 with the title, *Sumps for Emergency Core Cooling and Containment Spray Systems* (DPS Exhibit 4). It is known throughout the industry as NRC’s policy document addressing continuing unresolved safety issues regarding containment sump design, pump suction strainer design and debris loading assumptions. Background for these unresolved safety issues may be found in:

Documents related to Unresolved Safety Issue (USI) A-43, *Containment Emergency Sump Performance* (DPS Exhibit 5)

NRC Bulletin 96-03, *Potential Plugging of Emergency Core Cooling Suction Strainers by Debris in Boiling-Water Reactors* (DPS Exhibit 6)

Documents related to Generic Safety Issue (GSI) 191, *Assessment of Debris Accumulation on PWR Sump Pump Performance* (DPS Exhibit 7)

NRC Bulletin 2003-01, *Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors* (DPS Exhibit 8)

Therefore, Regulatory Guide 1.82 is known as a technical document for containment sumps. It is not a document in which a major change in policy to allow analytical crediting for containment

pressure would be expected to reside.

3. This major policy change has not received the required review by the ACRS. The Atomic Energy Act requires ACRS to review and advise the NRC on proposed reactor safety standards:

There is established an Advisory Committee on Reactor Safeguards consisting of a maximum of fifteen members appointed by the Commission for terms of four years each. The Committee shall review safety studies and facility license applications referred to it and shall make reports thereon, shall advise the Commission with regard to the hazards of proposed or existing reactor facilities and the adequacy of proposed reactor safety standards.

42 U.S.C. §2039.

4. While the both the full ACRS and the ACRS Thermal-Hydraulic Phenomena Subcommittee reviewed the draft of Regulatory Guide 1.82, Rev. 3, before its issue, their review concentrated only on the technical issues of containment sump design, pump suction strainer design and debris loading assumptions, which have been so prominent throughout the last 30 years. Their review did not consider the containment overpressure policy change. NRC staff presented the policy change to both subcommittee and full committee almost as an afterthought.

Another thing is Reg. Guide 1.1 has been subsumed into this current version. So only for some older plants they have to refer back to this Reg. Guide 1.1. For future plants, they refer to Reg. Guide 1.82 now for the NPSH issue.

Next slide, please.

NRC staff presenter, T.Y Chang, ACRS Thermal-Hydraulic Phenomena Subcommittee transcript of August 20, 2003, at 21-22 (DPS Exhibit 9).

Finally, within this version of the Reg Guide, another Reg Guide is subsumed

into this one. That is Reg Guide 1.1, the net positive suction head for ECCS and containment heat removal system pumps. So Reg Guide 1.1 will no longer be in existence. It will be part of Appendix A of this Reg Guide.

NRC staff presenter, T.Y Chang, ACRS Full Committee, transcript of September 11, 2003, at 354 (DPS Exhibit 10). Since Dr. Chang did not note in the presentation that a critical portion of Reg. Guide 1.1 had been altered, it is not surprising that no ACRS member asked questions of Dr. Chang about containment overpressure credit following his presentation. The subject of the major containment overpressure credit policy change was not brought up again by any NRC presenter, nor did any ACRS member question the change through the lengthy investigation of the proposed Regulatory Guide. The investigation focused only on the technical details of containment sump design, pump suction strainer design and debris loading assumptions. See Subcommittee transcript of August 20, 2003, at 4-198 (DPS Exhibit 9), and Full Committee transcript of September 11, 2003, at 344-415 (DPS Exhibit 10).

5. The ACRS letter of September 30, 2003 (DPS Exhibit 11), that recommends issuing Regulatory Guide 1.82, Rev. 3, is similarly silent regarding the major policy change regarding containment overpressure credit. This supports a conclusion that the ACRS was not fully aware of the major policy change or its implications. This recommendation letter is long, filled with technical details and reservations about containment sump design, pump suction strainer design and debris loading assumptions. One may also conclude that the ACRS recommends issuing Regulatory Guide 1.82, Rev. 3, begrudgingly "in order to facilitate licensee response and resolution of technical issues." Letter at 1. The following is NRC staff M. Mayfield's request for ACRS to recommend issuing Regulatory Guide

1.82, Rev. 3:

NEI is preparing guidance that's more detailed than what you'll find in this regulatory guide. The staff will review that guidance, and we have yet to -- we and NRR will review that guidance document once NEI has it. And the decision will be made at that time, what vehicle to use to endorse that guidance, assuming that that's the direction we go. But in the interim, we felt like it was important to finalize this guide and get it on the street.

Full Committee transcript of September 11, 2003, at 346. By this, it is shown that Regulatory Guide 1.82, Rev. 3, is considered more as interim technical guidance, necessary to be "on the street," rather than a major policy change to allow containment overpressure credit.

6. Granting containment overpressure credit, as requested by the Applicant for Vermont Yankee power uprate, is an inappropriate encroachment on the historical defense-in-depth philosophy of the NRC, and similarly an encroachment on the appropriate application of defense-in-depth in the risk-informed regulatory environment. The history of defense-in-depth consideration was summarized by ACRS:

Defense in depth is a nuclear industry safety strategy that began to develop in the 1950s. A review of the history of the term indicates that there is no official or preferred definition. Where the term is used, if a definition is needed, one is created consistent with the intended use of the term. Such definitions are often made by example.

In a 1967 statement submitted to the Joint Committee on Atomic Energy by Clifford Beck, then Deputy Director of Regulation for the Atomic Energy Commission, three basic lines of defense for nuclear power reactor facilities were described. The first line was the prevention of accident initiators through superior quality of design, construction and operation. The second line was engineered safety systems designed to prevent mishaps from escalating into major accidents. The third line was consequence-limiting safety systems

designed to confine or minimize the escape of fission products to the environment.

A 1969 paper by an internal study group of the Atomic Energy Commission identified the issue of balance among accident prevention, protection, and mitigation, with the conclusion that the greatest emphasis should be put on prevention, the first line of defense.

A 1994 NRC document identifies the elements of the defense in depth safety strategy as accident prevention, safety systems, containment, accident management, and siting and emergency plans. Other interpretations of defense in depth can be found in INSAG-3 and INSAG-10

The historical record indicates an evolution of the term from a narrow application to the multiple barrier concept to an expansive application as an overall safety strategy. The term has increased in scope and gained stature over time. The history also indicates that defense in depth is considered to be a concept, an approach, a principle or a philosophy, as opposed to being a regulatory requirement per se.

Currently the term is commonly used in two different senses. The first is to denote the philosophy of high level lines of defense, such as prevent accident initiators from occurring, terminate accident sequences quickly, and mitigate accidents that are not successfully terminated. The second is to denote the multiple physical barrier approach, most often exemplified by the fuel cladding, primary system, and containment.

One of the essential properties of defense in depth is the concept of successive barriers or levels. This concept applies equally well to multiple physical barriers and to high level lines of defense. A closely related attribute would be requiring a reasonable balance among prevention, protection and mitigation.

ACRS Paper, *On the Role of Defense in Depth in Risk-informed Regulation*, attached to ACRS letter, May 19, 1999, *The Role of Defense in Depth in a Risk-informed Regulatory System* (DPS Exhibit 12). Therefore, historically, the containment is one of the three multiple physical barriers.

However, under the conservative assumptions of historical regulatory evaluation, if containment overpressure credit is granted for ECCS pump NPSH, and then the containment barrier fails, the following is the result. The ECCS pump dependency on the containment means that, were the containment to fail, the ECCS pumps would also be assumed to fail, and this would result in failing the fuel cladding barrier and the primary system barrier if it was not already failed by the initiating event. Creating the dependency between containment functioning and ECCS pump functioning voids the historical multiple physical barrier defense-in-depth strategy.

7. Defense-in-depth by multiple physical fission product barriers is integral to and embedded in NRC regulations. See 10 C.F.R. §50, Appendix A, Criteria 10 through 19 which are labeled, *Protection through Multiple Fission Product Barriers*. This defense-in-depth concept recognizes that, while the licensing basis assumes a single failure, real accidents and events do not proceed according to planned scenarios and often involve multiple failures. Therefore, if the reactor coolant system barrier fails, despite stringent design control provisions, the fuel cladding and reactor containment barriers prevent fission product release. After the reactor coolant barrier is breached, either through LOCA or through the requirement to control pressure with relief valves, if the fuel cladding fails despite ECCS systems which are designed to prevent such failure, then the reactor containment prevents fission product release. Conversely, if the reactor containment fails despite design provisions to prevent such failure, the fuel cladding is provided to stay intact and prevent fission product release. The key to effective defense-in-depth through multiple fission product barriers is not to create

dependencies such that the failure of one barrier will lead to the failure of other barriers.

8. The policy change to allow ECCS pumps to rely on containment pressure creates a dependency such that, in that condition, containment failure would lead to ECCS pump failure, which in turn would defeat cooling to the reactor and lead to fuel cladding and reactor coolant system failure.

9. In the above referenced letter, the ACRS summarized the emerging regulatory consideration of defense-in-depth:

The most recent NRC policy statement that deals with defense in depth is the Probabilistic Risk Assessment (PRA) Policy statement published in 1995, which states, in part:

"The use of PRA technology should be increased in all regulatory matters to the extent supported by the state-of-the-art in PRA methods and data and in a manner that complements the NRC's deterministic approach and supports the NRC's traditional defense-in-depth philosophy."

The policy statement, thus, places PRA in a subsidiary role to defense in depth.

In 1998, the NRC published Regulatory Guide 1.174. This guide establishes an approach to risk-informed decision making, acceptable to the NRC staff, which includes the provision that proposed changes to the current licensing basis must be consistent with the defense in depth philosophy. The RG 1.174 discussion states that, "The defense in depth philosophy . . . has been and continues to be an effective way to account for uncertainties in equipment and human performance." The discussion goes on to say that PRA can be used to help determine the appropriate extent of defense in depth, which, by example, is equated to balance among core damage prevention, containment failure prevention and consequence mitigation. The regulatory guide thus addresses the concern of preventing risk-informed regulation from undermining defense in depth. Defense in depth is primary, with PRA available to measure how well it has been achieved.

ACRS Paper, *On the Role of Defense in Depth in Risk-informed Regulation*, attached to ACRS letter, May 19, 1999, *The Role of Defense in Depth in a Risk-informed Regulatory System* (DPS Exhibit 12). ACRS makes it clear in their summary that “[d]efense in depth is primary,” and “PRA [is] in a subsidiary role to defense in depth.” Therefore, voiding the multiple barrier philosophy by creating a dependency between the containment and the other two barriers violates one of the most fundamental and long-standing nuclear safety principles.

10. ACRS further elaborates in their May 19, 1999, letter regarding defense-in-depth:

Defense in depth can still provide needed safety assurance in areas not treated or poorly treated by modern analyses or when results of the analyses are quite uncertain.

By this criteria, granting overpressure credit that creates a common failure mode among the three multiple fission product barriers violates safety principles on two counts:

The first area of modern analysis that is poorly treated and with results quite uncertain is the area of risk evaluation (e.g., the potential impact on core damage frequency). The Applicant’s risk evaluation calculates there is hardly any increase in risk from taking credit for containment overpressure. There reason for this result is that the risk evaluation used by Applicant is not sufficiently developed to properly evaluate the risk impact associated with granting this overpressure credit. The Applicant’s risk evaluation uses nominal or average values of temperatures, pressures, flows and other parameters, rather than conservative values. Under this nominal value evaluation, torus temperatures do not rise enough to require containment overpressure. Therefore, there is no calculated additional risk



associated with overpressure. However, this result is counter intuitive and incorrect. There is some probability that temperatures, pressures, flows and other parameters will be at conservative values, and that, if containment failed in this situation, it would cause ECCS pump failure and increased core damage frequency, and therefore increased risk. However, risk evaluation techniques only assume nominal values and are not equipped to assign probabilities for a range of operating values. Therefore, the analytical technique does not properly calculate the increased risk from containment overpressure credit.

Second, in recommending issuing Regulatory Guide 1.82, Rev. 3, the ACRS summarized the state of modern analysis for ECCS pump NPSH without considering the containment overpressure issue. (It is shown above that ACRS recommended issuing the Regulatory Guide primarily to get the information "on the street.") ACRS concludes:

The technical basis for analyzing the phenomena described in RG 1.82 is not mature, the available information is inconsistent, and the knowledge base is evolving. Therefore, it is likely that the licensees' responses will be disparate and difficult to evaluate unless more consistent guidance is developed.

The zone of influence (ZOI) models need revision and resolution of inconsistencies.

Neither RG 1.82 nor the knowledge base report (Ref. 2) gives adequate consideration to chemical reactions.

ACRS letter, September 30, 2003, *Draft Final Revision 3 to Regulatory Guide 1.82, "Water Sources for Long-term Recirculation Cooling Following a Loss-of-coolant Accident."* (DPS Exhibit 11) (See also information provided for Contention II.) These ACRS conclusions show that

ACRS has questions about the analytic techniques that are not resolved by the Regulatory Guide and which remain open questions. These conclusions show that the issuance of the Regulatory Guide does not resolve all analytical issues, and that the calculation of the NPSH for ECCS pumps should be considered “poorly treated by modern analyses.”

11. Although it cannot be concluded that NRC, and specifically ACRS, adequately considered the major policy change of granting overpressure credit, the limits for granting this credit in Regulatory Guide 1.82, Rev. 3, are very narrow. In the discussion section of the Regulatory Guide, it is stated:

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.

Regulatory Guide 1.82, Rev. 3, at 8 (Emphasis added). It is further stated:

For certain operating reactors for which the design cannot be *practicably altered*, compliance with Regulatory Position 2.1.1.1 [i.e., no credit for containment accident pressure] may not be possible.

Regulatory Guide 1.82, Rev. 3, at 20 (Emphasis added). As shown below, the Application for power uprate requesting overpressure credit contains no showing that such credit is *necessary* nor that the uprate level or plant design cannot be *practicably altered* to avoid taking overpressure credit.

12. Regarding the *necessary* test, there is no apparent compelling reason that requires the Applicant to request a 20% power uprate of Vermont Yankee. Vermont Yankee is performing adequately and economically at its current power level. There is no power shortage in New England.

There is no way that Vermont Yankee's power 20% uprate could be found to be necessary. The need for containment overpressure credit can be eliminated by reducing the level of power uprate to a level that would not require overpressure credit, even to the current licensed power level. In the DPS December 8, 2003, letter to the NRC Staff (DPS Exhibit 13) , we asked:

At what uprated power level could Vermont Yankee operate and not claim credit for containment accident pressure in its NPSH calculations?

Letter at 3. NRC responded on June 29, 2004 (DPS Exhibit 14):

[T]he NRC staff has not performed calculations to determine the power at which containment pressure is not required when using conservative assumptions and the licensee has not presented such analysis to us.

Response at 5. From this it is clear there has been no consideration of the *necessary* test and no attempt to demonstrate that the 20% uprate is *necessary*. The Staff has not attempted to investigate this possibility by sending a Request for Additional Information (RAI) to Applicant to identify the highest power level at which credit for containment overpressure is not required. Furthermore, it is clear from the following NRC response in the June 29, 2004, letter that it ignores the *necessary* test altogether:

DPS Question 2.a.2

Does the agency believe that it is *necessary* to operate at extended uprated power level, thereby creating the necessity for allowing credit for containment accident pressure? If the answer is in the affirmative, please identify the reason the agency thinks operating at extended uprated power level is *necessary*?

NRC Response to DPS Question 2.a.2

The NRC staff makes no judgment on whether a proposed license amendment, such as a power uprate request, is necessary . . .

Response at 4. Since Applicant has made no attempt to demonstrate that it meets the pre-conditions for use of containment overpressure, it has not demonstrated that it qualifies to use such overpressure under the limited circumstances authorized by Regulatory Guide 1.82, Rev. 3.

13. Regarding the *practicably altered* test, Applicant has not investigated or attempted to apply this test, either. Vermont Yankee design does not need to be *practicably altered* because containment overpressure credit is not required at its current licensed power level and neither is power uprate required. However, given that Applicant wants to implement the 20% power uprate, it has not shown that it is not possible to modify existing ECCS pumps or provide new ECCS pumps that do not require credit for containment overpressure in order to function. Neither has the NRC sent RAI's to investigate this possibility. Vermont witness, William Sherman, testified before the Vermont Public Service Board that the cost of Applicant's proposed power uprate is approximately \$20/MWh or 2.0 cents per kWh. Docket No. 6812, Prefiled Direct Testimony, May 9, 2003, at 11 (DPS Exhibit 15). Since market power costs are at approximately 5.0 cents per kWh, Applicant will earn millions of dollars annually from the 100 MW uprate, clearly sufficient to *practicably alter* the ECCS pumps to function without crediting containment overpressure. Applicant has not shown that its ECCS pumps cannot be *practicably altered* to avoid the extraordinary design basis change of crediting containment overpressure.

### **Second Contention**

**Because of the Current Level of Uncertainty Associated with the Demonstration of the Adequacy of ECCS Pumps, Applicant Has Not Demonstrated That Allowing a Radical Departure from the Defense in Depth Principle Which Prohibits Use of Containment Overpressure to Provide the Necessary NPSH for ECCS Pumps Will Not Constitute a Significant Hazard (10 C.F.R. §50.92) and Will Provide Adequate Protection for the Public Health and Safety as Required by 10 C.F.R. §50.57(a)(3).**

#### **Bases**

1. There is no reliable evidence of the magnitude of the impact of strainer and debris losses on pressure at the ECCS pumps following a LOCA.
2. Without sufficient information to adequately bound the uncertainties associated with the extent to which pressure at the ECCS pumps will be reduced following a LOCA, there is no reliable basis to justify using the equally uncertain containment overpressure to compensate for the unquantifiable pressure losses at the ECCS pump.
3. Vermont Yankee's current design basis and licensing basis recognize that containment pressure increases above atmospheric pressure for various plant events, but do not take credit for this increase in pressure to demonstrate that ECCS pumps will function properly. Thus, this increased containment pressure above atmospheric pressure serves as an additional safety margin or defense-in-depth for the functioning of ECCS pumps. It is inappropriate to abandon this safety margin or defense-in-depth by allowing containment overpressure credit because the calculations and analyses for determining NPSH of the ECCS pumps are uncertain and imprecise.

### Supporting Evidence

1. The ACRS, in reviewing the role of defense-in-depth in a risk informed environment, stated:

Defense in depth can still provide needed safety assurance in areas not treated or poorly treated by modern analyses or when results of the analyses are quite uncertain.

ACRS Letter, May 19, 1999, *The Role of Defense in Depth in a Risk-informed Regulatory System* (DPS Exhibit 12).

2. Vermont Yankee Calculation VYC-0808, Rev. 6 (DPS Exhibit 16), was provided as Exhibit 1 to Attachment 4 of Supplement 8 of Applicant's request for extended power uprate. VYC-0808, Rev. 6 calculates the strainer and debris losses for the NPSH calculation. However, the calculation is not conservative because it does not incorporate all the provisions of Regulatory Guide 1.82, Rev. 3 (DPS Exhibit 2).

3. Even if Regulatory Guide 1.82, Rev. 3 were followed, there would not be high confidence in the calculated results. ACRS Thermal-Hydraulic Phenomena Subcommittee Chairman Graham Wallis, during the ACRS review, stated:

The concern that I have is that you'll put out the Reg Guide, which I think is the right thing to do, get things moving, put out this Reg Guide and say, thou shalt evaluate all of these things.

My concern is there are so many things which there isn't much of a technical basis for. That these folks may come back with some half-baked analysis, which gets accepted. Because nobody knows. And then further research now in progress reveals that it shouldn't have been accepted.

ACRS Full Committee, transcript September 11, 2003, at 387-8 (DPS Exhibit 10).

4. In response to Chairman Wallis, NRC staff presenter, M. Mayfield, admits the flaws and shortcomings of the analytical techniques in Regulatory Guide 1.82, Rev. 3:

Well, that's why -- that is one of the downsides of confirmatory research where I live. The other thing I had said was that we have had, and continue to have, some discussions with NRR about how much more do they need to be comfortable to assess what the licensees are going to bring in the door. The reason for pushing it forward at this time, to include that loosely worded caveat or flag, is frankly let's put everything on the table at this time to what level of information we have. And so we felt like the itch is real, and we needed to flag it in this to the level of detail we can support today, which is to say this is something that should be evaluated. We will continue to work with NRR, looking at how much more information they need to support an evaluation. But today, we felt like we needed to at least flag the issue in the guide . . . The level of detail that we put in this is admittedly sparse.

Id, at 388-9. A little later on, Chairman Wallis again criticized draft Regulatory Guide 1.82, Rev. 3 in the following exchange:

MEMBER WALLIS: This three-region two-phase conical jet model, with numbers on it Figure 17, comes from -- doesn't come from the Sandia work. It doesn't come from the one you referenced. The only place that I could find it was in a later new Reg [sic - NUREG] that the agency prepared.

Right, and my personal view is that it's a complete misapplication of the Sandia work. Maybe, if my colleagues give me permission, I might actually make a presentation to them on that. But I just wanted to warn you -- I don't know if you've looked at its origin and seen if you believe it or not.

DR. LETELLIER (NRC Contractor from Los Alamos National Lab): That model has been discredited by the Barsebaeck event.

MEMBER WALLIS: Right, it has been.

DR. LETELLIER: In fact --

MEMBER WALLIS: And by practice it's been. But it's in your documents that you've accepted it.

DR. LETELLIER: Are you referring to the knowledge base? Please interpret --

MEMBER WALLIS: But it's there, as being authoritative.

DR. CHANG (NRC Staff): The knowledge base report is trying to document order information and pass --

MEMBER WALLIS: But without the critical evaluation, you know, leaves it up to the utilities or NEI to select what's suitable for their purposes.

DR. LETELLIER: Well, that's a fair criticism, that it is presented as authoritative. But it's also intended to be historical.

Id., at 392-3.

5. This uncertainty and imprecision in strainer and debris analytical modeling that was exhibited in ACRS questions, is echoed in the letter recommending the issuing of Regulatory Guide 1.82, Rev. 3.

The ACRS concluded:

The technical basis for analyzing the phenomena described in RG 1.82 is not mature, the available information is inconsistent, and the knowledge base is evolving. Therefore, it is likely that the licensees' responses will be disparate and difficult to evaluate unless more consistent guidance is developed.

The zone of influence (ZOI) models need revision and resolution of inconsistencies.

Neither RG 1.82 nor the knowledge base report (Ref. 2) gives adequate consideration to chemical reactions.

ACRS letter, September 30, 2003, *Draft Final Revision 3 to Regulatory Guide 1.82, "Water Sources for Long-term Recirculation Cooling Following a Loss-of-coolant Accident."* (DPS



Exhibit 11) These conclusions by the ACRS demonstrate that, even with the issuance of the new Regulatory Guide, important uncertainties in analytical methods still exist. These are examples of open and unresolved questions about the analytical methods for calculating the strainer head loss and debris loading effect. This demonstrates that, because of lack of confidence in analytical results, the defense-in-depth and safety margin inherent in not taking overpressure credit must be retained to provide reasonable assurance of adequate protection of the public health and safety. 6. Another reason that containment overpressure credit should not be granted is that there is insufficient conservatism and margin in the values used for required NPSH or NPSHr in Applicant's demonstration of ECCS pump adequacy. The values used for NPSHr are determined in calculation VYC-0808, Rev. 6, which identifies areas of imprecision and uncertainty. Both the residual heat removal and core spray pumps were only NPSH-tested over a limited flow range. No head drop was specified on the original curves. VYC-0808, Rev. 6, Attachment 5, p. 6 of 19. According to the pump vendor, the tests of the residual heat removal pumps were not complete enough to determine the exact NPSH-characteristics of the pumps. Id. No vibration readings were taken in the NPSH tests for the residual heat removal pumps. Id., Attachment 5, p. 7 of 19. Only one of the four residual heat removal pumps was tested for NPSHr, and this value was assumed correct for the other three pumps. Id., at 9. The core spray pumps original witness tests for NPSHr do not bracket the expected flow range during accidents. Id., at 10. NPSHr for the core spray pumps was not determined from Vermont Yankee's pumps, but rather for pumps for another customer not even the same size as Vermont Yankee's. The NPSHr for

Vermont Yankee core spray pumps was estimated by the vendor from this other pump rather than measured from Vermont Yankee's core spray pumps. Id. For both residual heat removal and core spray pumps, curve fit regimes were used to acquire NPSHr values for specific flow rates used in the demonstrations of adequacy. Id., at 12-13. Their curve fit programs create an uncertainty in the precision of results. The vendor summarized the state of NPSH testing:

The original pump NPSH requirements were not well defined. The result was only two (2) NPSH-Test points for each capacity were measured. From two (2) NPSH-test points it is not possible to establish the "knee." At each NPSH-test point (during witness tests) the pumps were operating only a few minutes and the capacity-range was limited.

Id., Attachment 5, p. 10 of 19. In the vendor prepared document (Attachment 5 to VYC-0808, Rev. 6), there is no indication of accounting for instrumentation inaccuracies in test instruments. Nor is margin provided to account for the extrapolation of data and assumptions used for actual test data that is lacking.

7. The Hydraulic Institute recommends that margin be applied above measured NPSHr. The NRC staff asked about this margin in RAI SPSB-C-25 (DPS Exhibit 17), and Applicant responded as follows:

The required NPSH (NPSHR) information provided for the Vermont Yankee Nuclear Power Station (VYNPS) core spray (CS) and residual heat removal (RHR) pumps by the manufacturer specifically address time-phased operational requirements with low available NPSH (NPSHA). No specific margin is included or required in the NPSHA calculation. However, there is some margin between the overpressure required and the credited overpressure requested and more margin to the overpressure available.

Entergy Request for Extended Power Uprate, Supplement 8, Attachment 2, page 183. Applicant states that no margin is provided for measured NPSHr values and also states no margin is required in available NPSH. However, the uncertainties from instrument inaccuracies, extrapolations and assumptions instead of hard test data, direct that margin should be provided. While Applicant notes in response that the remaining containment pressure above the credited overpressure remains as margin, it is more appropriate to reserve the entire containment overpressure to allow for analytical uncertainties rather than take credit for some or all of it to seek to resolve the separate safety issue of NPSH following a LOCA.

8. Uncertainty also exists in the value that the Applicant uses for containment leakage. Frequently the as-found condition of containment isolation valves from their leakage tests exceeds allowables such that containment leakage is underestimated.

9. Analytical uncertainties also exist in the containment pressure and torus temperature calculations, and these uncertainties are another reason that containment overpressure should be retained as a safety margin and defense-in-depth. In Section 4.2.6 of Safety Analysis Report for Constant Pressure Power Uprate ("PUSAR") (DPS Exhibit 18), Applicant has stated it requires containment overpressure credit for loss of coolant accidents (LOCAs), station blackouts (SBOs), Appendix R fire events and anticipated transients without scram (ATWS). PUSAR is deficient since it does not identify the amount of overpressure developed or credited for the SBO, Appendix R fire events and ATWS, although the NRC staff has received this information through data requests. The

calculations to develop containment pressure and torus temperature responses for these events are complex. For this reason, the DPS letter of June 8, 2004 (DPS Exhibit 19), requests that the NRC staff perform independent verifications of Applicant's calculations for LOCAs, SBOs, Appendix R, and ATWS events. NRC has not responded to the DPS June 8, 2004 letter. However, based on RAI's, it appears NRC is only independently verifying the LOCA calculations. If this is the case, this will leave uncertainty regarding the accuracy of the SBO, Appendix R and ATWS calculations.

10. Even if NRC's independent verification of LOCA calculations confirm the results of Applicant's calculations, uncertainty will still exist in the calculations. The scrutiny on LOCA calculations has resulted in two modifications from the results provided in PUSAR in a period of less than a month. On July 1, 2004, Applicant corrected VYC-0808, Rev. 6 with change notice 5 (DPS Exhibit 20) to incorporate the revised containment leak rate for power uprate. Entergy Request for Extended Power Uprate, Supplement 8, Attachment 4, Exhibit 1. On July 16, 2004, Applicant again corrected VYC-0808, Rev. 6 with change notice 6 (DPS Exhibit 21) to use a conservative containment spray thermal mixing efficiency. Entergy Request for Extended Power Uprate, Supplement 9, Attachment 2. It is likely that additional calculation changes will be discovered with further review and as time goes on. These results indicate that uncertainty exists within the analytical methods such that it is appropriate to retain the entire containment overpressure as a safety margin and defense-in-depth.

11. The above information shows that significant uncertainties exist in 1) the method of

calculating strainer losses and debris loading effects, 2) the proper value of the required NPSH, 3) the value used for containment leakage, and 4 ) the results of calculations that have unverified input parameters and calculation methods. These latter calculations have a recent history of revision by the Applicant when viewed carefully. All of these uncertainties lead to the conclusion that the ACRS statement in its paper on Defense in Depth must be accepted. Defense in depth must not be abandoned for areas not treated or poorly treated by modern analyses or when results of the analyses are quite uncertain. The specific defense in depth required for these uncertainties is the uncredited pressure in the containment, which serves as a hedge for these uncertainties. The whole pressure in containment must be retained since the calculation methods are so uncertain. Giving up a portion of the containment pressure for overpressure credit for proper operation of ECCS pumps is an unacceptable erosion of the defense in depth provided by the pressure in containment. Without retention of the whole amount of pressure in containment for defense in depth, the uncertainties in the NPSH calculations dictate that it cannot be determined that reasonable assurance exists that public health and safety will be protected.

### **Third Contention**

**Because Applicant Is Voluntarily Seeking A Change In Design Or Licensing Basis, It Should Comply With Current, More Restrictive Practices Which Relate to the Proposed Design or Licensing Basis Change in Order to Demonstrate That it Will Provide Adequate Protection to the Health and Safety of the Public As Required By 42 U.S.C. §2232(a).**

### **Bases**

1. Taking credit for containment overpressure in order to meet NPSH requirements for ECCS pumps involves a change to the design or licensing basis for the plant.

2. When such changes are made voluntarily, as is the case here, the Applicant should then meet current more restrictive practices with regard to issues related to the proposed design or licensing basis change because the justification for “grandfathering” the plant as to such design or licensing basis changes no longer exists.

3. There are two issues which are directly related to the proposal to take credit for containment overpressure in order to meet NPSH requirements for ECCS pumps for which Applicant has not used the current more restrictive practices in its analysis:

a. Applicant has not evaluated the containment and its appurtenances under the current rules for single failure.

b. Applicant has not evaluated the proposed uprate in light of current assumptions for simultaneous safe shutdown earthquake (SSE) but relies on analytical methods and SSE values that have evolved dramatically.

### **Supporting Evidence**

1. The Applicant’s request for credit for containment overpressure is a request for a change in its design or licensing basis (these two terms are used synonymously in this motion).

2. The Applicant wishes to implement this design basis change, which results from a change in NRC policy and practice, albeit improperly implemented, by using analyses related to the use of the

reactor containment that are less restrictive than those currently in use. The Applicant is not implementing more restrictive analyses, resulting from similar design basis changes to NRC policies and practices, that are related to the use of the reactor containment. This practice by the Applicant of seeking to take advantage of one design basis change authorized by the NRC while ignoring the related, and more restrictive design basis changes, also authorized by the NRC, is known throughout the industry as "cherry-picking."

3. NRC has established a precedent for an acceptable approach to the problem of regulatory cherry-picking in Regulatory Guide 1.183, *Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors*, July 2000 (DPS Exhibit 22) :

#### **5.1.4 Applicability of Prior Licensing Basis**

The NRC staff considers the 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.

With this approach, NRC staff may apply more restrictive, current practices to issues related to changes in design bases that are voluntarily initiated by the licensee.

4. In order to prevent regulatory cherry-picking in conjunction with the Applicant's power uprate application, two considerations associated with the request for a change in design basis related to containment overpressure credit for ECCS pumps are warranted.

5. Since the Applicant voluntarily wishes to use the reactor containment for a new design basis function of maintaining a minimum level of pressure for up to 50 hours after an event, the Applicant needs to evaluate the containment and its appurtenances under the current rules for single failure. The Applicant's current design basis only assumes a single failure of active equipment or components. Current criteria requires assumption of a single active failure in the short term, or either a single active or passive failure in the long term. Current criteria considers check valve movement and spurious valve movement as single active failures and also considers the effects of a single inappropriate operator action. Applicant's analysis did not consider these as single active failures. Applicant has not evaluated the containment and its appurtenances to these current single failure criteria, and thus there is not reasonable assurance that the proposed crediting of containment overpressure will protect public health and safety.

6. The other area in which current practices must be applied is the seismic analysis of the reactor containment. The voluntary change in design basis for containment overpressure credit is requested in part for LOCA's. The Applicant's current design basis for LOCA's includes the assumption of simultaneous safe shutdown earthquake (SSE). However, the Applicant's design basis value for an SSE is only 0.14 g, and the analytical methods used by the Applicant have evolved



dramatically. Newer nuclear plants in the New England region, Seabrook and Millstone 3, have significantly higher SSE accelerations than the Applicant.

7. The NRC summarized the evolution of seismic analysis methods as follows:

Over the years, there has been an evolution of seismic design requirements and technology. Early nuclear power plants were designed without specific seismic design requirements. In the early 1970s, the requirement for resistance to seismic events was included in the regulations. The state of knowledge has advanced rapidly and the methods of seismic design vary with the vintage of the nuclear power plant. Also, the complex process of seismic design and analysis involved many engineering disciplines: seismic, geotechnical, structural, mechanical, electrical, and nuclear.

NUREG-0093. Item A-40 (DPS Exhibit 23).

8. The Vermont State Geologist also questions the adequacy of the Applicant's containment seismic analysis. He identifies aspects of current seismic analysis that appear more restrictive than the Applicant's analysis. See Vermont State Geologist letter of August 26, 2004, *Probability of Earthquake Induced Ground Accelerations at Vermont Yankee* (DPS Exhibit 24).

9. Containment isolation valves have frequently exceeded allowables in leakage tests. The Applicant has not demonstrated, from the as-found condition of containment isolation valves, that these valves will satisfactorily retain containment pressure for a period up to 50 hours following an earthquake using current seismic analysis standards.

10. If the containment does not adequately withstand an earthquake, the containment or its attached isolation valves could fail in a manner not to retain pressure. In this event, the containment overpressure would not be present for ECCS pump adequacy, and there could be a high likelihood that

the ECCS pumps would fail, in turn causing fuel failure and fission product release.

11. Under current operation, we accept the adequacy of Vermont Yankee's current seismic analysis. However, for the new use of containment and voluntary design basis change, the containment must be analyzed to current seismic analysis method to demonstrate adequacy. Lacking the evaluation of the containment and its appurtenances to current seismic analysis methods, there will not be reasonable assurance that the proposed crediting of containment overpressure will protect public health and safety.

#### **Fourth Contention**

**The Change in Design Basis to Use the Reactor Containment as an Engineered Safety Feature to Guarantee at Least a Minimum Pressure for ECCS Pump Performance Violates the Lessons- Learned Regarding Human Factors for Operators in the Three Mile Island Event and Creates Contrary and Confusing Operating Requirements That Will Create a Significant Hazard (10 C.F.R. §50.92) and Will Not Provide Adequate Protection for the Public Health and Safety as Required by 10 C.F.R. §50.57(a)(3).**

#### **Bases**

1. The primary and desired response by plant operators in an event which increases containment pressure is to reduce containment pressure. With the proposed design basis change to credit set levels of containment overpressure, the operators will be placed in the confused position of both needing to reduce containment pressure and to maintain containment pressure.
2. The Applicant's proposal related to emergency operator procedure would create the same

unacceptable human factors paradigm for operators that was found by the Task Force which investigated the causes of the Three Mile Island, Unit 2, accident.

### Supporting Evidence

1. The review of the Three Mile Island, Unit 2, accident revealed that human factors for plant operators and emergency operating procedures were a primary contributor.

The principal conclusion of the Task Force is that, although the accident at Three Mile Island stemmed from many sources, the most important lessons learned fall in a general area we have chosen to call operational safety. This general area includes topics of human factors engineering, qualification and training of operations personnel; integration of the human element in the design, operation, and regulation of system safety; and quality assurance of operations. Specifically, the primary deficiency in the reactor safety technology identified by the accident was the inadequate attention that had been paid by all levels and all segments of the technology to the human element and its fundamental role in both the prevention of accidents and the response to accidents.

NUREG-0585, *TMI-2 Lessons Learned Task Force Final Report*, October 1979, at p. 1-2 (DPS Exhibit 25).

The NRC [at the time of the TMI-2 accident] gives short shrift in the design safety review process to determining how well operators will be able to diagnose abnormal events, based on what they see on their instruments, and respond to them.

NUREG/CR-1250, Vol. 1, *Three Mile Island, A Report to the Commissioners and the Public*, NRC Special Inquiry Group, Mitchell Rogovin, Director, circa. 1980, at 122 (DPS Exhibit 26).

The use of properly prepared procedures in plant operations is another important ingredient in the matrix of operational safety . . . Emergency operating procedures should consider system interactions and be written in such a manner that they are unambiguous and useful in crisis control . . . The Task Force has found the NRC review process for emergency procedures to be inadequate . . . Past practice was not sufficient because it did not specifically

investigate the compatibility of emergency procedures with the design bases of the systems involved, nor was the discipline of human factors involved.

NUREG-0585, at p. 2-6.

Emergency operating procedures for all nuclear power plants should be reviewed by the NRC. The review should be conducted by interdisciplinary review groups comprising I&E inspectors and NRR technical reviewers knowledgeable in system design, accident analysis, operator training, theories of education and crisis management, human factors, and the underlying technical bases for licensing.

Id., at p. A-9.

2. The use of reactor containment as an engineered safety feature to guarantee at least a minimum pressure for ECCS pump performance creates confusion for operators. Operators are trained, and have been trained for the past 32 years at Vermont Yankee, to take action to reduce containment pressure if it increases (for any reason) a small amount over atmospheric pressure. If the containment overpressure credit were granted, these operators would be required not only to concentrate on reducing containment pressure, but would also be required to retain a minimum amount of pressure.

3. The minimum pressure to retain is confusing since it is not a constant amount, but rather varies for different time steps; at times when operators would be diverted with many other contravening tasks to mitigate the various event. For example, the pressure credited for a LOCA includes these pressure steps over a 50 hour period: 2.4 psig, 3.4 psig, 4.4 psig, 5.1 psig, 6.1 psig, 5.6 psig, 5.1 psig, 4.6 psig, 4.1 psig, 3.6 psig, 3.1 psig, 2.6 psig, 2.1 psig, 1.7 psig, and 1.3 psig. VYC-0808, Rev. 6

(DPS Exhibit 16). Instead, if it is an ATWS, the pressure credited is 2.4 psig over a period of almost 2 hours. VYC-0808, Rev. 6, Change 4 (DPS Exhibit 27). If it is an SBO, the pressure credited varies from 0.5 psig to 2.1 psig over a period of almost three and one-half hours which begins six hours after the station loses power. VYC-2314, Rev. 0 (DPS Exhibit 28). Finally, if it is an Appendix R fire, pressure credited varies from 0.5 psig to 0.9 psig over a three and one-half hour period. VYC-2314, Rev. 0. This pressure crediting scheme is complicated for operators to grasp in the middle of emergencies.

4. It is highly undesirable to allow the containment pressure to be higher than necessary, because higher pressure would result in greater fission product leakage in a fission product release accident. It is not clear that operators will be able to control pressure within the limits required by the new proposed design basis. For example, the Applicant proposes to credit containment pressure following a LOCA at 6.1 psig from time 9000 seconds (2.5 hours) to time 400000 seconds (11.1 hours), a period of almost nine hours. If the operator uses maximum containment sprays, where should the pressure be stopped to keep 6.1 psig for nine hours? What will the operator do if he undershoots the credited pressure, or if the pressure drops over the nine hours below the 6.1 credit? These requirements create unacceptable levels of confusion for the operator and create the kind of situation described by the reviews of the Three Mile Island accident, quoted earlier.

5. Review of VYC-0808, Revision 6, Change 6, page 12 of 14 (Table 4.2 LOCA) (DPS Exhibit 21) identifies that for much of the 50 hour period that the Applicant proposes to credit

overpressure, the difference between overpressure available and overpressure credited is between 1 psig and 1.5 psig for much of the time. This is too small a band for an operator to be able to control in the midst of a crisis with such dire consequences - the potential failure of ECCS cooling pumps.

6. The Applicant responded to an RAI on emergency operating procedures. The RAI illustrates that the Applicant, if allowed, would create the same type of unacceptable situation regarding emergency operating procedures described by the Three Mile Island accident Task Force. The entire RAI and its response are repeated below:

**RAI SPSB-C-22**

Describe how the VYNPS emergency operating procedures will be revised to ensure that the containment accident pressure will be prevented from falling below the pressure required for adequate available NPSH.

**Response to RAI SPSB-C-22**

**The VYNPS emergency operating procedures (EOPs) do not require revision to ensure that the containment accident pressure will be prevented from falling below the pressure required for adequate available NPSH. Current EOPs incorporate guidance to ensure that containment accident pressure will be prevented from falling below the pressure required for adequate available NPSH.**

Per VYNPS emergency operating procedure (EOP) EOP-1, "RPV Control," after an automatic action level has been reached, operators are directed to verify applicable automatic actions have occurred. Verifying automatic actions provides backup confirmation that all isolation valves have closed on a primary containment isolation signal.

VYNPS EOPs establish NPSH limits for residual heat removal (RHR) and core spray (CS) pumps. (Separate limits are provided for RHR and CS). The NPSH limit is a function of pump flow, torus water temperature, and suppression chamber pressure. It is used to preclude ECCS pump damage due to cavitation and to ensure adequate

coolant flow. As overpressure increases, the static pressure and margin to saturation at the pump inlet also increase. The available NPSH therefore increases with overpressure.

In accordance with EOP-1, when using RHR for an injection system, operators are directed to inject through the heat exchanger as soon as possible and to control and maintain pump flow below the RHR NPSH Limit. For the core spray system, operators are directed to control and maintain pump flow below the CS NPSH Limit.

EOP-3, "Primary Containment Control," Note 5 states: **"Reducing primary containment pressure will reduce the available NPSH for pumps taking suction from the torus."** Per the EOP Study Guide, if there is no future need for sprays and containment overpressure is desired to provide adequate NPSH for pumps drawing suction from the suppression pool, sprays may be terminated at a higher pressure.

In accordance with EOP-3, drywell sprays are initiated before containment temperature reaches 280 IF or when torus pressure exceeds 10 psi. **Containment sprays should isolate automatically when drywell pressure decreases to 2.5 psig.** Both of these steps in EOP-3 provide reference to Caution #5 emphasizing the relationship between primary containment pressure and available NPSH.

Also, per EOP-3, once the high drywell pressure isolation occurs, containment venting is directed only after a reactor pressure vessel emergency depressurization (RPV-ED) is required and prior to exceeding the primary containment pressure limit (PCPL-A curve in EOP-3). **In the event that containment venting is required, operators will vent the containment to control pressure below the PCPL-A curve.** The pressure at which containment is maintained during venting is based on considerations of NPSH for the RHR and core spray pumps, expected release rates, and total releases. Therefore, sufficient containment overpressure is preserved.

Applicant request for Extended Power Uprate, Supplement 8, Attachment 2, at 178-9 (Emphasis added) (DPS Exhibit 29) .

7. The following are areas in which the Applicant's plans for emergency operator procedures create the same type of unacceptable situation described by the Three Mile Island Task Force:

- It is unacceptable that the Applicant does not plan to change EOPs to incorporate the new proposed design basis of credited overpressure. This means that while the Applicant proposes to license its design based on this pressure, it will not have its operators attempt to maintain that pressure in accidents. Neither will the Applicant train operators to maintain the credited overpressure. The Task Force found “emergency operating procedures should . . . be written in such a manner that they are unambiguous . . . Past practice was not sufficient because it did not specifically investigate the compatibility of emergency procedures with the design bases of the systems involved.”
- The Applicant’s note, “Reducing primary containment pressure will reduce the available NPSH for pumps taking suction from the torus,” is unacceptable because it does not tell the operator he must maintain a set level of overpressure according to the licensing basis.
- The fact that containment sprays automatically terminate at 2.5 psig creates an additional step the operator must take during a crisis. This is inconsistent with the proposed licensing basis, which is to maintain overpressure at a range of pressures. On the one hand, to try to control to these licensing basis pressures will create great operator distraction. However, the Applicant’s plan not to have the operator control to the licensing basis overpressure is a violation of that licensing basis. This fact illustrates



the confusion created by the Applicant's proposal, and shows that overpressure credit should not be granted.

- The EOP's identify the possibility of containment venting. The possibilities of over venting or not being able to re-close the vent have not been investigated properly, and when investigated, will illustrate that overpressure credit should not be granted.
- The fact that EOP's have not been modified and cannot be reviewed by the NRC staff is not acceptable. NRC review of EOP's was a cited weakness and contributing cause to the Three Mile Island accident. The NRC staff has accepted the TMI Task Force recommendation and has devoted much interdisciplinary review to EOP's. However, the incorporation of this proposed change in design basis related to containment overpressure should receive the same level of interdisciplinary review as the EOP's on the whole. It is unacceptable that the Applicant is creating a situation in which the NRC staff will not give the changes to the EOP's the necessary interdisciplinary review.

#### **Fifth Contention**

**To the Extent Applicant Is Claiming That Use of Containment Overpressure as a Credit to Meet NPSH Is Necessary and Failure to Use it Is Impracticable Because of Economic or Need for Power Considerations, its Request Should Be Rejected as Contrary to the Atomic Energy Act (42 U.S.C. §2232).**

**Bases**

1. Regulatory Guide 1.82, Revision 3, authorizes the use of containment overpressure to meet NPSH requires when it is "necessary" or when it would be "impracticable" to alter the plant to meet NPSH requirements. The normal meaning of these terms implicates economic considerations.

2. Applicant has not demonstrated that there is no available alternative to use of containment overpressure to meet NPSH requirement and in fact either lowering the level of the proposed uprate or upgrading the ECCS pumps would allow Vermont Yankee to meet NPSH requirements.

3. It is well-established under the Atomic Energy Act by decisions of federal courts and the Commission, that cost considerations are irrelevant to determining whether safety requirements have been met.

4. The Applicant cannot excuse failure to meet NPSH requirements without the use of containment overpressure by asserting that meeting such requirements, without the use of containment overpressure, is too expensive or will reduce power output below the proposed 20% uprate.

#### **Supporting Evidence**

1. The evidence related to the technical issues raised by this contention is contained in the Supporting Evidence related to the First through the Fourth Contentions.

2. The legal evidence in support of this Contention includes the following:

- In setting or enforcing the standard of "adequate protection" that this section [42 U.S.C. §2232] requires, the Commission may not consider the economic costs of safety measures. The Commission must determine, regardless of costs, the precautionary measures necessary to provide adequate protection to the public; the Commission then must impose those measures, again regardless of costs, on all holders of or applicants for operating licenses.

*Union of Concerned Scientists v. U.S. Nuclear Regulatory Com'n* 824 F.2d 108, 114, (C.A.D.C.,1987)

- *Power Reactor Development Co. v. International Union of Electrical, Radio, and Machine Workers*, 367 U.S. 396, 81 S.Ct. 1529, 6 L.Ed.2d 924 (1961).
- *Maine Yankee Atomic Power Co.*, 6 A.E.C. 1003 (1973).

**B. HEARING ON THESE CONTENTIONS SHOULD BE CONDUCTED  
PURSUANT TO THE PROCEDURES IN 10 CFR PART 2, SUBPART G**

In adopting the current Rules of Practice the NRC noted the following:

The AEC of the 1950s asserted that formal hearings were required by Section 189.a. At that time, the AEC saw benefits in a highly formal process, resembling a judicial trial, for deciding applications to construct and operate nuclear power plants. It was thought that the panoply of features attending a trial—parties, sworn testimony, and cross-examination—would lead to a more satisfactory resolution of the complex issues affecting the public health and safety and would build public confidence in the AEC's decisions and thus in the safety of nuclear power plants licensed by the AEC.

69 F.R. 2182, 2183 (January 14, 2004). Although the NRC has now determined that these principles are no longer universally relevant to its hearings, DPS respectfully submits that these principles are very relevant to the contentions it raises in this particular hearing. Vermont has demonstrated a keen and continuing interest in its one nuclear power plant. Elected officials, including the Governor and the entire Congressional delegation, have already expressed their concern that adequate time be provided

to prepare for this hearing to fully explore the many complex issues presented by Applicant's proposal to essentially add 100MW of nuclear power to Vermont's generating capacity. DPS letter to NRC, December 8, 2003; DPS letter to NRC, June 8, 2004 (DPS Exhibits 13, 19), NRC Order denying request for delay of deadline to file for hearing, August 18, 2004. DPS has been actively involved in oversight of Vermont Yankee ever since the plant received its operating license and has, through the efforts of its staff nuclear engineer, William K. Sherman, maintained a physical presence at Vermont Yankee at crucial times and during periodic reviews. Most recently, the NRC, at the request of Governor Douglas and the Vermont Public Service Board, is conducting an independent engineering inspection directly related to the complex safety issues raised by this Application for a 20% power uprate. Mr. Sherman fully participated in that review on behalf of the DPS and the State as an observer. Many Vermonters are very interested in and concerned about the proposal to increase the level of nuclear power output from the State's only commercial nuclear power plant.

In light of these considerations, we believe it is essential that the NRC have a full hearing, with live witnesses and cross-examination of those witnesses, and full discovery with document production requests and depositions, to assure the public that whatever decision is reached, there has been a full and public airing of the important safety issues which this proposal raises. The fact that the issues involved are extremely complex underscores the need for such a public hearing where witnesses, compelled to address a hearing board composed of at least some members who are not nuclear engineers, will be required to put into understandable terms their concerns about the proposed uprate

and the answers to those concerns. The above articulation of the Contentions which DPS believes should be addressed and the bases and supporting evidence for those conditions provide ample evidence that the issues involved in this Application are neither trivial nor simple. They are concerned with the safety policies of the NRC, the work of the ACRS and research conducted by nuclear engineers at national laboratories and research centers across the country.

10 CFR §2.310(d) provides that a hearing “will be conducted under subpart G” if, *inter alia*, the presiding officer “finds that resolution of the contention or contested matter necessitates resolution of issues of material fact relating to the occurrence of a past activity”. *Id.* As will be evident when the Applicant files its response to this Petition to Intervene, there is substantial controversy, both regarding the facts and the interpretation to be placed on those facts as these relate to past activities. Among the issues which we expect will require resolution by the Board of material fact disagreements related to past activities are 1) how did Applicant calculate post-accident conditions in making its determination of the level of post-accident containment pressure and was this calculation appropriate?, 2) did testing conducted of the performance of ECCS pumps following a LOCA leave a large area of uncertainty regarding NPSH including the impact of strainers and debris on NPSH?, 3) did the ACRS actually conduct the statutorily required safety review of the portion of Regulatory Guide 1.82, Revision 3, which altered the long-standing NRC prohibition against using containment overpressure as a credit to meet NPSH for ECCS pumps following a LOCA?, 4) does defense in depth as traditionally developed by the NRC and used in licensing decisions prohibit allowing failure of one physical barrier, in this case

the reactor containment, to result in the failure of the ECCS pump function which in turn will fail a second physical barrier, the fuel cladding, and if so is the level of uncertainty associated with the calculation of post-LOCA NPSH and containment performance sufficiently high to make reliance on probabilistic risk analyses (PRA) instead of defense in depth, unacceptable? and 5) has Applicant provided sufficient evidence to prove that meeting NPSH requirements without taking credit for containment overpressure by altering the plant or the proposed level of uprate is "impracticable" or that use of containment overpressure is necessary? Should the Staff decide to participate they will add further controversy to these issues.

These are not issues which can be rationally decided on the bare bones of the written word. When such complex and controversial issues are involved, oral presentations, with the benefit of probing questions from the parties and the Board are the only way to get to the facts.

We distinguish between the assertion of a broad right of cross-examination, such as that argued to this court, and a claim of a need for cross-examination of live witnesses on a subject of critical importance which could not be adequately ventilated under the general procedures. This is the kind of distinction that this court made in its en banc opinion in *American Airlines v. CAB*, *supra*, 123 U.S.App.D.C. at 318-319, 359 F.2d at 632-633. We see no principled manner in which firm time limits can be scheduled for cross-examination consistent with its unique potential as an "engine of truth"-the capacity given a diligent and resourceful counsel to expose subdued premises, to pursue evasive witnesses, to "explore" the whole witness, often traveling unexpected avenues.

*International Harvester Co. v. Ruckelshaus* 478 F.2d 615, 631 (C.A.D.C.1973). Where issues of the complexity involved in this proceeding are presented it is unrealistic to expect that the parties can

fully develop their issues without being able to ask and receive answers to their questions or that the Board can resolve disagreements among the parties about the facts and the interpretations to be placed on those facts without the benefit of live testimony to “expose subdued premises . . . and to ‘explore’ the whole witness, often traveling unexpected avenues”. *Id.*

Similarly, the complexity of the issues and the far reaching nature of the documents which may shed light on these issues, including the actual tests run and analyses performed to determine the level of risk associated with the post accident impacts on ECCS pump operation and the underlying documentation which is alleged to support Applicant’s conclusions regarding the containment pressure following a postulated-LOCA, warrant allowing an opportunity for full document production requests which can obtain information beyond the hearing file and beyond the information voluntarily produced by the Applicant pursuant to 10 CFR §2.336. The use of depositions will have the salutary effect of reducing the hearing time and will allow a fuller opportunity for the witness to make his/her position clear and for the examiner to probe all the bases for those positions. DPS has a number of concerns which might be satisfied by full discovery and which might actually reduce the number of issues to be raised at the hearing. DPS has neither an interest in or motive for using the discovery process for any purpose other than getting at the correct statement of the facts. The record as it now stands makes it impossible to determine whether the Applicant has stated the facts correctly and without full discovery and cross-examination rights, DPS respectfully submits the Board will not be able to determine the correct statement of the facts. Deficiencies in the record and uncertainties over critical issues ultimately

disadvantages the party with the burden of proof. In this case that is the Applicant. DPS believes the public will be ill-served by rejecting the Application on the basis of an incomplete record just as it would be ill-served by the granting the Application when important safety issues remain unresolved.

Listed below are a few examples of the document production requests DPS would make and the areas of examination which DPS would explore in deposition or at the hearings.

Please identify all initial conditions, inputs, and assumptions for analysis for the following:

- Determination of torus temperature for LOCA, SBO, ATWS, and Appendix R fire events

- Determination of available NPSH for LOCA, SBO, ATWS, and Appendix R fire events

- Determination of head losses for piping, clean strainer, and debris loading for LOCA, SBO, ATWS and Appendix R fire events

Please provide the Vermont Yankee Calculations used for the determinations identified above.

Please provide copies of all references from the calculations provided above.

Please provide a copy of all emergency operating procedures.

Please provide copies of operating procedures applicable for LOCA, SBO, ATWS and Appendix R fire events, and related actions and references.

Please provide copies of all training material for operators regarding the assuring the adequate performance of the residual heat removal and core spray pumps during LOCA, SBO, ATWS, and Appendix R fire events.

Please identify and provide documentation for all tests run to determine NPSH and to verify the adequacy of NPSH of the residual heat removal and core spray pumps.



### **C. RESERVATION OF RIGHT TO AMEND**

In furtherance of its interests in the Vermont Yankee extended power uprate, the State, by requests from Governor Douglas and the Vermont Public Service Board, requested the NRC to conduct an independent and in-depth review of a number of important features at Vermont Yankee. The NRC agreed to conduct a significant portion of the review sought by the State. In agreeing to conduct an independent inspection, Chairman Diaz described the process to be used:

Over the past several months, the NRC has been developing a new engineering inspection program which we intend to pilot at selected plants. The NRC staff considered a number of factors, including the Board's request for an independent engineering assessment, and concluded it is appropriate to conduct this engineering inspection at Vermont Yankee. This new engineering assessment inspection incorporates the best practices of the existing and past engineering inspections. The NRC will use this inspection to verify that design bases have been correctly implemented for a sampling of components across multiple systems and to identify latent design issues. The inspection process uses operating experience, risk assessment, and engineering analysis to select risk significant components and operator actions, and will ensure that adequate safety margins exist. Although the specific sampling of components is still being developed, it will include components from multiple systems that are potentially affected by a power uprate such as the emergency core cooling systems, the containment system, power conversion systems, and auxiliary systems.

Letter, Nils J. Diaz to Michael H. Dworkin (5/4/04). Among the issues to be investigated are "changes that could impact the integrity of barriers (e.g., higher flow rates which could increase vibration at specific support points), safety evaluations, plant modifications, post maintenance and surveillance testing, heat exchanger performance, and integrated plant operation." Established NRC Power Uprate Review Process with letter from Diaz to Dworkin (5/4/04).

DPS believes completion of this inspection, now scheduled for mid-September 2004, will

provide critical information relevant to issues which are likely to require thorough evaluation in the NRC hearing process, including some issues already identified as to which the review may provide relevant information and bases for modified contentions or elimination of a contention. Attempting at this time, without the benefit of the results of the review, to identify all the appropriate issues, provide the bases for each issue, identify supporting information for each of those bases and demonstrate how resolution of those issues requires a full adjudicatory hearing, is not feasible. Thus, motions to amend the filed contentions are almost certain to be filed. If action is taken on the now filed contentions before proposed amended contentions, bases and/or supporting evidence are submitted, it is likely the Board will waste its own time and the time of the parties and potential parties. On the other hand, by delaying the date for action on the requests for intervention until 30 days after the full report of the independent inspection and its supporting documents have been made publicly available, will enable the parties to better identify any issues which require resolution, the bases for these issues, the information which supports these issues and the reason why an adjudicatory hearing is required.

Although 10 CFR §§2.309( c) and (f)(i)(ii) and (iii) provide narrow opportunities for submitting new contentions or amending previous contentions, each imposes additional hurdles which are not applicable to initial contentions. Moreover the use of such procedures following the issuance of the independent engineering inspection, will ultimately delay the hearing process and enmesh the Board or Commission and the parties in an unnecessary wrangle over the application of a procedural rule rather than maintaining focus on the substantive issues involved in the uprate proceeding. It makes far

more sense for the Board to allow amendments to the contentions, bases and supporting evidence and the request for adjudicatory hearing to be filed within 30 days of the public availability of independent engineering inspection report and supporting documentation without the constraints imposed by 10 CFR §§2.309( c) and (f)(i)(ii) and (iii). Otherwise the Board will have devoted considerable time first to determining the intervention status of the parties based on filings made on August 30<sup>th</sup> and then will have to reconsider those decisions in light of the new submittals based on the independent engineering inspection report as well as determining whether the procedural requirements of 10 CFR §§2.309( c) and (f)(i)(ii) have been met. Inasmuch as the independent engineering inspection report is scheduled for release in mid-September and by application of the procedures of 10 CFR §2.309(h) the middle of October is the earliest the Board could begin to consider the Petitions, responses and replies, there is virtually no time lost by allowing amendments of contentions, bases and supporting evidence and requests for adjudicatory hearings to be made within 30 days after the independent engineering inspection report and its documentation are made public.

**CONCLUSION**

For all the reasons stated, the State of Vermont, acting through its Department of Public Service requests that an adjudicatory evidentiary hearing under 10 CFR Part 2, Subpart G be held to fully examine the contentions it has raised in this pleading and any subsequent amendments it may submit to these contentions.

Respectfully submitted,

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August 30, 2004

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**Created By:** NAS@nrc.gov

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