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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of

ENTERGY NUCLEAR VERMONT YANKEE,
LLC and ENTERGY NUCLEAR
OPERATIONS, INC.
(Vermont Yankee Nuclear Power Station)

Docket No. 50-271

ASLBP-No. 04-832-02-OLA

NEW ENGLAND COALITION'S PROPOSED FINDINGS OF FACT
AND
CONCLUSIONS OF LAW FOLLOWING EVIDENTIARY HEARING

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I. INTRODUCTION

The following Proposed Findings of Fact and Conclusions address the central issue in this proceeding: a request for an exemption from requirements for full transient testing ("FTT") contained in an Extended Power Uprate license amendment application filed by Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operations, Inc, ("Entergy") on September 10, 2003; as it was examined in Evidentiary Hearings held on September 13 and 14, 2006.

The requested amendment to the Vermont Yankee Nuclear Power Station ("Vermont Yankee") operating license is to authorize an increase in the maximum reactor power level from 1593 megawatts thermal (Mwt) to 1912 Mwt, or to approximately 120% of original licensed thermal power ("OLTP"), and to modify associated technical

specifications of the license. Such increases of OLTP (over 7% and up to 20%) are termed, Extended Power Uprate(s) (“EPU”).

II. PROCEDURAL BACKGROUND

A. The following summary procedural background is provided here in order to offer a context in which to assess the findings of fact and conclusions of law deriving from the written and oral testimony in the evidentiary hearings.

B. After an initial review of Entergy’s September 10, 2003, EPU License Amendment Request, the Commission published a notice of opportunity for hearing. 69 Fed. Reg. 39,976 (July 1, 2004)

C. The State of Vermont Department of Public Service and New England Coalition then timely filed petitions for leave to intervene and contentions on August 30, 2004.

D. On November 22, 2004, the Board granted the petitioners’ hearing requests and admitted two of New England Coalition’s six proposed contentions. LBP-04-28, 60 NRC 548 (2004).

E. One of those contentions, designated NEC Contention 3,¹ challenges Entergy’s request for an exception from the regulatory requirement for performing large transient testing (LTT).

F. In its November 22, 2004 Order, the Licensing Board restated “NEC Contention 3” as follows: “the license amendment should not be approved unless Large

¹ “New England Coalition’s Request for Hearing, Demonstration of Standing, Discussion of Scope of Proceeding and Contentions,” August 30, 2004, at 11 The basis for admission of this contention was identified in the petition as “the Declaration of Arnold Gunderson under Exception to Large Transient Testing [Exhibit D. . .]” *Id*; see also “Declaration of Arnold Gunderson in Support of Petitioners’ Contentions,” August 30, 2004, at 3-5.

Transient Testing is a condition of the Extended Power Uprate.” *Entergy Nuclear Vermont Yankee, L.L.C., and Entergy Nuclear Operations, Inc.* (Vermont Yankee Nuclear Power Station), LBP-04-28, 60 NRC 548, 580 (2004).

G. In initially admitting NEC Contention 3, the Licensing Board relied on the August 30, 2004 declaration of Arnold Gunderson (“Gunderson Declaration”). LBP-04-28, 60 NRC at 571-72. Mr. Gundersen argued that Entergy’s plan to not perform large transient testing at EPU conditions “cannot be justified as good engineering practice nor is it in accord with staff positions interpreting NRC regulation.” Gundersen Declaration at 3.

H. Specifically, Mr. Gundersen asserted that: (1) the Applicant’s citation of operational experience in the nuclear industry does not justify taking an exception to performing large transient testing for Vermont Yankee at EPU conditions; (2) Vermont Yankee’s own experience with generator load rejections at 100% of the original licensed power level does not demonstrate that there will be adequate plant performance during transients at EPU conditions; (3) periodic testing of SSCs during steady-state plant operation does not confirm performance characteristics of the SSCs required for appropriate transient response; and (4) “Entergy ignores the NRC staff’s decision in the case of the Duane Arnold EPU application.” Gundersen Declaration at 3-5.

I. On December 2, 2005, Entergy filed a Motion For Summary Disposition of New England Coalition Contention 3, claiming that evidence in support of its exemption to full transient testing, including the application of certain analytical techniques, was so overwhelming as to leave no credible dispute.

J. On December 22, 2005, New England Coalition filed its Answer to Entergy's Motion for Summary Disposition. New England Coalition included a declaration of Dr. Joram Hopenfeld ("Hopenfeld Declaration"), which responded to all of Entergy's claims including that certain analytical techniques justified exemption to requirements for large transient testing ("LTT").

K. Dr. Hopenfeld questioned whether the transient analysis code (ODYN) relied upon by Entergy in its application was properly benchmarked or utilized to predict plant transient performance at EPU conditions.²

L. On January 31, 2006 the Board denied Entergy's Motion For Summary Disposition.

M. In its Order, the Board noted Entergy's reliance (for summary disposition) on its assertions that Vermont Yankee had satisfied four factors to be considered for exemption to the requirements for LTT, including the appropriate use of analytical tools, in particular, the ODYN code.

Entergy presents facts and technical evidence, which it asserts are undisputed and which can be divided into four basic statements:

- (1) The analytical tools used by Entergy will accurately predict plant performance in large transient events under EPU conditions;
- (2) Operational experience in the United States and abroad justifies the granting of the exception;
- (3) The Vermont Yankee operational experience justifies the requested exception;
- (4) Component testing at Vermont Yankee provides assurance that the plant's safety systems will operate as intended during transient conditions. (Board Order at 3, citing Entergy Motion at 3)

N. The Board further noted that the NRC Staff Answer to Entergy's Motion (December 22, 2005) took a position almost identical to that of Entergy.

² During the April 20, 2006 teleconference, Administrative Judge Baratta specifically requested that the parties address this issue. Tr. at 899-903.

NRC Staff Answer at 1, 5. “[T]he Staff submits that each of the issues raised by NEC in Contention 3 and its supporting basis statements have been resolved, and there is no genuine dispute of material fact with respect to this contention.” Id. at 1 (emphasis added). “[T]he Staff concluded, inter alia, that the Applicant’s justifications for not conducting large transient testing were adequate.” Id. at 5 (emphasis added). “[T]he Staff agrees with the Applicant . . . that each of the issues raised in NEC Contention 3 have been resolved.” Id. (emphasis added). “[T]he Draft SE concluded that the Applicant had provided adequate justification for not conducting post-uprate large transient testing.” Id. at 7 (emphasis added). “[T]he Staff has concluded that the Applicant’s Statement of Material Facts is correct, except in certain limited respects.” Id. at 8 (emphasis added). (Board Order at 5)

O. On March 14, 2006, the Board ordered that New England Coalition provide a Brief on the material scope of Contention 3 (as well as legal scope of Contention 4 regarding the Alternate Cooling System) to be produced (notwithstanding that hearing was generally conceded to be several months away) within one week’s time as follows:

[ORDER (Supplemental Schedule)] During the prehearing conference of [Friday] March 10, 2006 in this matter, the Board ordered the parties to brief certain issues and established various deadlines for these (and other) activities. The following is the schedule set during the conference.

A. Briefing on the legal scope of New England Coalition (NEC) Contention 4.³

1. March 17, 2006: NEC Contention 4 alleges that certain deficiencies in the license application render the application “not in conformance with the plant specific original licensing basis and/or 10 C.F.R. Part 50, paragraph I(a), and/or 10 C.F.R. Part 100, Appendix A.” On March 17, 2006, NEC shall submit a statement or brief, not to exceed ten pages, that identifies which of these three legal standards are allegedly not satisfied with regard to each of the deficiencies asserted by NEC. This statement or brief should also specify with more particularity, which provisions of the legal standards are allegedly not satisfied, e.g., which part of Appendix A of Part 100 or which part of the plant specific licensing basis are not met. On that same date, in addition to any other method, this brief shall be served electronically on all parties.

B. Briefing schedule on the proper scope of NEC Contention 3.

1. March 20, 2006: NEC Contention 3 alleges that “The license amendment should not be approved unless Large Transient Testing is a condition of the Extended Power Uprate.” On March 20, 2006, NEC shall submit a statement or brief, not to exceed ten pages, that specifies all of the large transient tests that it believes are necessary, and, if NEC asserts that large transient tests in addition to the main steam isolation valve closure test

³ If NEC, Entergy, and the NRC Staff are in agreement, a joint stipulation may be submitted, in lieu of briefing this issue.

and the generator load rejection test are required, why those two tests do not bound NEC's safety concerns. [Emphasis added] On that same date, in addition to any other method, this brief shall be served electronically on all parties.

P. On March 21, 2006, New England Coalition filed a brief stating that it was "...convinced that any additional type of Large Transient Testing beyond the main steam valve closure test and the generator load rejection test is not within the scope of [NEC] Contention 3 as admitted."⁴

Q. New England Coalition also argued that the station blackout test [inferring that station blackout may also be the bounding transient initiator] should also be required, despite the fact that it is not within the scope of its contention. NEC Statement at 1-2.

R. On April 17, 2006, the Board ruled that the scope of NEC Contention 3 is limited to two large transient tests: the main steam isolation valve ("MSIV") closure test and the turbine generator load rejection test. Memorandum and Order, "Clarifying the Scope of NEC Contention 3," April 17, 2006, slip op. at 2.

S. Finally, Administrative Judge Baratta requested testimony regarding qualification of the "ODYN" code and mechanical stress calculations with respect to transients experienced during EPU operations. Tr. at 899-904.

III. Legal and Regulatory Requirements

The Commission's requirements with respect to the need to perform large transient testing as part of the testing program for the Vermont Yankee EPU is described Staff's Final Safety Evaluation for the Vermont Yankee EPU amendment.

⁴ [NEC]'s Statement on the Scope of [NEC] Contention 3 (Mar. 21, 2006) at 2 [NEC Statement]. Although the pleading was dated March 20, 2006, it was served electronically on March 21, 2006.

One of the applicable legal standards for review of Entergy's "Justification for Exception to Large Transient Testing" for the Vermont Yankee EPU is Criterion XI, "Test Control," of Appendix B to 10 C.F.R. Part 50, which states:

A test program shall be established to assure that all testing required to demonstrate that structures, systems, and components ("SSCs") will perform satisfactorily in service is identified and performed in accordance with written test procedures which incorporate the requirements and acceptance limits contained in applicable design documents. The test program shall include, as appropriate, proof tests prior to installation, preoperational tests, and operational tests during nuclear power plant or fuel reprocessing plant operation, of structures, systems, and components. Test procedures shall include provisions for assuring that all prerequisites for the given test have been met, that adequate test instrumentation is available and used, and that the test is performed under suitable environmental conditions. Test results shall be documented and evaluated to assure that test requirements have been satisfied.

Therefore, the applicable legal basis against which the exception to large transient testing should be evaluated is the regulatory requirement that the test program demonstrate that SSCs will perform satisfactorily in service.

New England Coalition avers, and Entergy and NRC Staff have failed to convincingly show to the contrary, that the Entergy-proposed surrogate for full transient testing does not demonstrate the SCC's will perform satisfactorily in service (during a severe transient).

The NRC's Review Standard RS-001, "Review Standard for Extended Power Uprates," Revision 0 (December 2003) (NRC Staff Exhibit A) references Standard Review Plan ("SRP") Section 14.2.1, "Generic Guidelines for Extended Power Uprate Testing Programs" (NRC Staff Exhibit B), for plant-specific reviews of EPU testing plans.

The NRC Staff claims that its review of Entergy's justification for an exception from large transient testing utilizes the criteria set forth in subsection III.C.2 of SRP Section 14.2.1. Those criteria include:

- previous operating experience;
- introduction of new thermal-hydraulic phenomena or identified system interactions;
- facility conformance to limitations associated with analytical analysis methods; plant staff familiarization with facility operation and trial use of operating and emergency operating procedures;
- margin reduction in safety analysis results for anticipated operational occurrences;
- guidance contained in vendor topical reports; and
- risk implications.

(SRP Section 14.2.1 at 7-10)

The Staff's decision regarding large transient testing must be part of its finding, pursuant to subsection IV of SRP Section 14.2.1, of reasonable assurance that the test program satisfies the requirements of Criterion XI, of Appendix B to 10 C.F.R. Part 50.

General Electric Licensing Topical Report ELTR-1, issued in 1999, and proposed for incorporation into NRC review standards, provided generic guidelines for GE BWR EPU's. ELTR-1 required an MSIV Closure test for EPU's to be performed for uprates of more than 10% above any previously recorded MSIV closure data. It also required a generator load rejection test for uprates of more than 15% above any previous generator load rejection transient data. GE subsequently sought and received NRC approval of a

newer EPU approach, “Constant Pressure power Uprate” that does not increase the maximum reactor operating pressure. GE Licensing Topical Report NEDC-3300P-A, Revision 4, dated July 2003, “Constant Pressure Power Uprate.”⁵ *Id.* at 10. . GE attempted to provide a generic justification (and therefore secure NRC agreement) for not performing large transient testing as part of the CPPU approach. The NRC Staff approved the CPPU approach, but stated that exceptions [exemptions] from large transient testing would be considered on a plant-specific basis.

Technical Specification (“TS”) surveillance testing conducted pursuant to 10 C.F.R. § 50.36(c)(3) is intended to assure that TS limiting conditions for operation (“LCOs”) are met. A TS LCO must be established for each item meeting four criteria, including:

Criterion 2: A process variable, design feature, or operating restriction that is an initial condition of a design basis accident or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.

Criterion 3: A structure, system, or component that is part of the primary success path and which functions or actuates to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.
10 C.F.R. § 50.36(c)(2)(ii).

The plant-specific review of the Vermont Yankee justification for exception to large transient testing must be performed through analysis of the criteria listed in subsection III.C.2 of SRP Section 14.2.1, in order to determine if the test program provides reasonable assurance that SSCs will perform satisfactorily in service.

⁵ “Safety Evaluation by the Office of Nuclear Reactor Regulation, GE Nuclear Energy Licensing Topical Report, NEDC-33004P, Revision 1,” (March 31, 2003), §§ 3.4 and 10.5. (NRC Staff Exhibit 1)

Testing requirements of the quality assurance program are required for each reactor pursuant to 10 C.F.R. § 50.34(b)(6)(ii) and implemented pursuant to 10 C.F.R. § 50.54(a).

10 C.F.R. Part 50, Appendix B, Criterion XI, requires that the quality assurance program must include a test program to assure that testing necessary to provide reasonable assurance that SSCs will perform satisfactorily in service is identified and performed.

Periodic or routine testing is most often performed at the component or system level. However, initial test programs include integrated transient tests. *See*, NRC Regulatory Guide (“RG”) 1.68, “Initial Test Programs for Water-Cooled Nuclear Power Plants,” Revision 2, dated August 1978. . Appendix A of RG 1.68 describes a set of tests acceptable to demonstrate that the plant will operate in accordance with design specifications (SSC integrity and performance) during normal steady-state conditions as well as , to the extent practical, during and following anticipated operational occurrences (transients), including, “MSIV closure” and “generator load rejection” events.

NRC regulatory guidance for EPUs is contained in RS-001, “Review Standard for Extended Power Uprates.”

RS-001 indicates that NRC Staff guidance for assessing the extent of testing necessary for EPU applications may be found in NUREG-0800,⁶ SRP Section 14.2.1, “Generic Guidelines for Extended Power Uprate Testing Programs,” Draft Revision 0, dated December 2002.

⁶ Office of Nuclear Reactor Regulation, NRC, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants,” NUREG-0800 (NRC Staff Exhibit B).

Subsection III.B of SRP Section 14.2.1 provides procedures for a review of EPU post-modification testing requirements. Attachment 2 to SRP Section 14.2.1 provides a generic listing of transient tests drawn from RG 1.68 that are typically included in initial plant test programs that may be affected by modifications associated with an EPU. The two large transient tests named in NEC Contention 3, Attachment 2 and are listed in Attachment 2 as “Dynamic Response of Plant for Full Load Rejection,” and “Dynamic Response of Plant to Automatic Closure of All Main Steam Isolation Valves.”

NRC Staff has approved General Electric Licensing Topical Report ELTR-1, “Generic Guidelines for General Electric Boiling Water Reactor Extended Power Uprate”; following NRC approval, ELTR-1 was issued in February 1999. Topical report ELTR-1 provides generic guidelines for BWR EPU. Section 5.11.9 and Appendix L.2.4 of ELTR-1 state that: (1) a MSIV closure test, equivalent to that conducted in the initial startup testing, will be performed if the power uprate is more than 10% above any previously recorded MSIV closure data; and (2) for uprates of more than 15%, a generator load rejection test, equivalent to that conducted in the initial startup testing, will be performed if the power uprate is more than 15% above any previously recorded generator load rejection transient data.

NRC Staff has rejected, for generic application conditions in a revised GE ELTR, GE Licensing Topical Report NEDC-3300P-A, Revision 4, dated July 2003, “Constant Pressure Power Uprate [“CPPU”] that would dispose of the full transient testing requirement.

The NRC Staff did conduct a Safety Evaluation on GE’s proposed topical report generic application, wherein [CPPU SE Section 10.5.9] the Staff’s stated exceptions to

performing large transient tests have only been considered on a plant-specific basis and that generic guidance to address the question large transients tests in conjunction with power uprates was under study. The NRC Staff stated that it was therefore not prepared to accept GE's generic proposed elimination of large transient tests for CPPU type uprates. The Staff CPPU SE also found that information obtained from the MSIV closure and generator load rejection tests could be useful to confirm plant performance, adjust plant control systems, enhance training material and gain information with respect to plant analyses.

The Staff indicated in the CPPU SE that it would continue to consider, on a plant-specific basis, the need to conduct these tests.

As stated in RG 1.68, the primary objectives of a suitable test program are “ (1) to provide additional assurance that that the facility has been adequately designed and to the extent practical, to validate the analytical models and to verify correctness or conservatism and assumptions used for plant responses to anticipated transients and postulated accidents, and (2) to provide additional assurance, that construction and installation of equipment in the facility has been accomplished in accordance with design.”

IV. New England Coalition's Expert Witness

The New England Coalition's Large Transient Testimony presents the opinions of a very highly qualified witness and one of unimpeachable authority and expertise, Dr. Joram Hopensfeld.

Dr. Hopensfeld's credentials are presented in New England Coalition's pleadings as follows: New England Coalition's Answer to Entergy's Motion for Summary

Disposition, Statement of Position, and Response to the Statements of Position of Entergy
And NRC Staff.

In short, Dr. Hopenfeld is a PhD. Nuclear Engineer of many years experience with the Atomic Energy Commission, the U.S. Nuclear Regulatory Commission, and private industry; also with substantial publication in peer-reviewed journals.

Dr. Hopenfeld, his credentials show, had a significant role in the development and evaluation of the codes and engineering protocols under assessment in this licensing process.

Thus, if proper weight were to be given to Dr. Hopenfeld's opinions and observations, he would be regarded as a primary source, in contrast to Entergy and NRC Staff witnesses, who cannot, as has Dr. Hopenfeld without dispute, claim to having participated in laying the technical foundations for the referenced codes and engineering protocols.

**V. PROPOSED FINDINGS OF FACT REGARDING VERMONT YANKEE'S
QUALIFICATIONS FOR EXCEPTION TO FULL TRANSIENT TESTING**

A. Full transient testing has been held by NRC Staff to have real value in determining adequate assurance of public health and safety. All considerations of exception to the requirement for full transient testing must be weighed against this value.

Q17. Which are the tests that are classified as LTTs?

A17. (JLC) NEDC-33004P-A defines two LTTs applicable to EPU operations: the Main Steam Isolation Valve ("MSIV") Closure and the Generator Load Rejection tests. These tests, when conducted during plant operation, are similar to counterpart tests performed during initial plant startup testing. The NRC Staff has accepted these two LTTs as verifying that plant performance after EPU will be as predicted. See Exhibit 4, SRP 14.2.1, "Generic Guidelines for Extended Power Uprate Testing Programs" (Draft, 2002) ("SRP 14.2.1"), Section III.C.2.f.

Q18. Does NRC guidance call for the performance of LTT at plants undergoing an EPU?

A18. (JLC) NRC's Review Standard RS-001, "Review Standard for Extended Power Upgrades," Revision 0 (December 2003) refers to SRP 14.2.1 for the testing related to extended power upgrades. The SRP specifies that LTT is to be performed in a similar manner to the testing that was performed during initial startup testing of the plant. SRP 14.2.1, Section III. A. 1 (Entergy's Direct at 8)

As stated in RG 1.68, the primary objectives of a suitable test program are "(1) to provide additional assurance that the facility has been adequately designed and to the extent practical, to validate the analytical models and to verify correctness or conservatism and assumptions used for plant responses to anticipated transients and postulated accidents, and (2) to provide additional assurance, that construction and installation of equipment in the facility has been accomplished in accordance with design." [Emphasis added]

B. NRC's practice of granting universal exceptions to the full transient testing requirement voids the rule and makes an oxymoron of the term, exception. Further, the practice undermines the NRC's regulatory goal of increasing public confidence because the public simply cannot take NRC at its word.

Q15. Have any other plants uprated their thermal power using the CPPU approach?

A15. (JLC) Yes. Thirteen BWRs similar to VY have implemented EPUs without increasing reactor operating pressure:

Hatch Units 1 and 2 (1998) (105% to 113% of Original Licensed Thermal Power ("OLTP")) (The Hatch units previously had 5% "stretch" upgrades, from 100% to 105% OLTP)

Monticello (1998) (106% OLTP)

Muehleberg (i.e., KIM) (1993) (105% to 116% OLTP)

Leibstadt (i.e., KKL) (2000) (104% to 119.7% OLTP)

Duane Arnold (2001) (104.1% to 119.4% OLTP) (The Duane Arnold unit previously had a 4.1% "stretch" upgrade, from 100% to 104.1% OLTP)

Dresden Units 2 and 3 (2001) (100% to 117% OLTP)

Quad Cities Units 1 and 2 (2001) (100% to 117.8% OLTP)

Clinton (2002) (100% to 120% OLTP)

Brunswick Units 1 and 2 (2002) (105% to 120% OLTP)

(The Brunswick units previously had 5% “stretch” uprates, from 100% to 105% OLTP).

None of the domestic BWR plants similar to VY that have implemented EPUs without increasing reactor operating pressure has been required to perform LTT at EPU power levels.

(Entergy Direct Testimony at 5 & 6) [Emphasis added]

TR. at 1452-53

CHAIR KARLIN: And on a case by case basis how many EPUs have been requested?

CHAIR KARLIN: Well, if you go back and look at the total EPU inventory of applications they break down into applications that were filed prior to the Staff's -

CHAIR KARLIN: Well, subsequent to the issuance of this draft standard review plan how many?

WITNESS PETTIS: This draft standard review plan covered, primarily, about four plants,

because this came out in draft form in 2002.. And since then we have applied, Waterford was. one, Brown's Ferry is the second one.

CHAIR KARLIN: What is this reference to plants that I have seen?

WITNESS PETTIS: Earlier, in yesterday's testimony there was a reference made to the NRC review standard, which is RS-001. And that plays an important role only because it defines a point in time in which the Staff's review of the EPUs followed a more prescribed programmatic process for evaluation.

CHAIR KARLIN: Okay. Well, are there four, or are there 11?

WITNESS PETTIS: There is a total of about Eleven were done prior to the risk development

and four or so plants were done after that development.

CHAIR KARLIN: And how many of those have you required, on a case by case basis, large transient testing of the MSIV and the generator load rejection?

WITNESS PETTIS: Well, in a more --

CHAIR KARLIN: Is the answer none?

C. Subsection III.C of Standard Review Plan, Section 14.2.1, “Use of Evaluation to Justify Elimination,” provides for EPU test program proposals that do not include all of the power ascension testing (including large transient testing) for such proposals and lists the following factors to be considered when assessing the adequacy of the licensee’s justification:

1. Previous Operating Experience

a. In accordance with Subsection III.C of SRP Section 14.2.1, industry-operating experience is one consideration licensees may use to support an exception to certain EPU

power ascension. However, experience with constant pressure (extended) power uprates -- in excess of 7% is limited to 13 plants and little more than six calendar years for the oldest CPPU EPU plant. Thus comparisons and correlations for EPU experience must be drawn from a very small pool of data and is therefore of limited value in predicting performance of SSCs at Vermont Yankee under EPU and transient conditions.

A44. (JLC) Of the thirteen BWR plants that have implemented EPUs without increased reactor operating pressure, four (Hatch 1 and 2, Brunswick 2, and Dresden 3) have experienced one or more unplanned large transients from uprated power levels. Specifically: Southern Nuclear Operating Company's ("SNOC") application for EPU of Hatch Units 1 and 2 was granted without a requirement to perform large transient testing. VY and Hatch are both BW4 plants with Mark I containments. Hatch Unit 2 experienced a post-EPU unplanned transient that resulted in a generator load rejection from approximately 111% OLTP (98% of uprated power) in May 1999. As noted in SNOC's LER 1999-005-00 (attached as Exhibit 9)...Hatch 2 also experienced a post-EPU reactor trip on high reactor pressure as a result of MSIV closure (from 113% OLTP (100% of uprated power)) in 2001. As noted in SNOC's LER 2001-003-00 (attached as Exhibit 10), all systems functioned as expected and designed, given the conditions experienced during the transient.

In addition, Hatch Unit 1 has experienced two post-EPU turbine trips from 112.6% and 113% of OLTP (99.7% and 100% of uprated power) as reported in SNOC LERs 2000-004-00 and 2001-002-00, respectively (copies attached as Exhibits 11 and 12). Again, the behavior of the primary safety systems was as expected....Progress Energy's Brunswick Units 1 and 2 - which are very similar in design to VY - were licensed to uprate their power output to 120% of OLTP. Brunswick Unit 2 experienced a post-EPU unplanned transient that resulted in a generator turbine trip due to loss of generator excitation from 115.2% OLTP (96% of uprated thermal power) in the fall of 2003. As noted in Progress Energy's LER 2003-004-00 (attached as Exhibit 13), no anomalies were experienced in the plant's response to this transient...Exelon Generating Company LLC's applications for EPU for Quad Cities Units 1 and 2, and Dresden Units 2 and 3 were granted without requiring the performance of LTT. The Quad Cities and Dresden units are plants similar to VY, featuring Mark I containments. Dresden 3 has experienced several turbine trips and a generator load rejection from high uprated power conditions. In January 2004, Dresden 3 experienced two turbine trips from 112.3% and 113.5% of OLTP (96% and 97% of uprated power) as reported in Exelon LERs 2004-001-00 and 2004-002-00, respectively (attached as Exhibits 14 and 15)...Dresden 3 also experienced a loss of offsite power which resulted in a turbine trip on Generator Load Rejection from 117% of OLTP (100% of uprated power). See Exelon LER 2004-003-00 (attached as Exhibit 16).

The fact that the Hatch, Brunswick, and Dresden plants, all of which are similar in design to VY, experienced no anomalous response to large transients from

EPU operating levels supports the conclusion that VY should also respond as predicted to large transients during EPU operation.

A45. ...In every instance in which unplanned large transients from EPU power levels have been experienced at these plants and an analysis of the scenario involved in the transients existed, the plant's response was bounded by the analyses performed using ODYN and no new phenomena were exhibited in the response.(Entergy Direct A-44-A45) {Emphasis added}

b. In Vermont Yankee's operating experience since 1990, the plant has experienced several large transients at full power (OLTP). Two large transients have occurred since EPU modifications were done to the plant (2004 and 2005). While Entergy points to the absence of major equipment performance failures or other anomalies as indicative of the absence of need for full transient testing, we must view the frequency of large transients under uprated conditions at Vermont Yankee (and plants similar in design to Vermont Yankee, see Entergy's account of industry experience above) as troubling indicators that an increased frequency of large transients may be expected. If that is the case, then NRC Staff should be requiring whatever added assurance of SSC performance may be had from full transient testing rather than to be trying to draw tenuous correlations from a small and diverse sample.

A49. ...VY has previously experienced the following unplanned large transients:

- On 3/13/1991, with the reactor at full power, a reactor SCRAM occurred as a result of Turbine/Generator Trip on Generator Load Rejection due to a 345 kV Switchyard Tie Line Differential Fault. This transient was reported to the NRC in LER 1991 -005-00, dated 4/12/91 (attached as Exhibit 17).
- On 4/23/1991, with the reactor at full power, a reactor SCRAM occurred as a result of a turbine/generator trip on generator load rejection due to the receipt of a 345 kV breaker failure signal. The transient included a loss of offsite power. This was reported to the NRC in LER 1991-009-00, dated 05/23/91 (attached as Exhibit 18).
- On 6/15/1991, during normal operation with reactor at full power, a reactor SCRAM occurred due to a Turbine Control Valve Fast Closure on Generator Load Rejection resulting from a loss of the 345 kV North Switchyard bus. This transient was reported to the NRC in LER 1991-014-00, dated 7/15/91 (attached as Exhibit 19).

- On 6/18/2004, during normal operation with the reactor at full power, a two phase electrical fault-to-ground caused the main generator protective relaying to isolate the main generator from the grid and resulted in a Generator Load Rejection reactor SCRAM. This transient was reported to the NRC in LER 2004-003-00, dated 8/16/2004 (attached as Exhibit 20).
- On 7/25/2005, during normal operation with the reactor at full power, a generator load rejection SCRAM occurred due to an electrical transient in the 345 kV Switchyard. This transient was reported to the NRC in LER 2005-001 - 00 (attached as Exhibit21). (Entergy-Direct at 21)

2. Introduction of New Thermal-Hydraulic Phenomena or Identified system

Interactions

a. The EPU represents a major modification to the Vermont Yankee plant. The modification has reduced the margin of safety by increasing the void fraction and increased the uncertainties of how many fuel rods will experience transition boiling. Entergy has not met its burden of showing that ODYN can be applied to the VY plant at EPU conditions to demonstrate that the thermal design limits were not exceeded. (i.e. less than 0.1% of the fuel rods will experience transition boiling) The increase in flow has increased the exposure of vessel internals; the steam dryer for example, to steady state flow induced vibrations. Entergy has not demonstrated that degraded components will not form loose parts from vibration during transients.

3. Facility Conformance to Limitations Associated with Analytical Analysis

Methods

a. NRC Staff and Entergy have held that benchmarking of the ODYN code for transients at the Hatch and Liebstadt nuclear power plants is key to confidence in application of the ODYN code, both generically and at Vermont Yankee.

However, NRC Staff has failed to confirm this benchmarking through review or analysis and is therefore in error in crediting reliance on the ODYN code with this benchmarking.

Although the Staff has not reviewed the benchmarking performed for the transients at Hatch and Liebstat (KKL) discussed in Exelon's report, a preliminary assessment of Exelon's July 2005 evaluation of the Dresden 3 turbine trip indicates that, overall, the ODYN predictions appear to be generally consistent with the timing and trends of the plants' instrumentation readings. (NRC Direct at 23) [Emphasis added]

b. The ODYN code has had little NRC-approved updating in the last 20 years and must be evaluated on a case-by-case basis for reliable application. NRC Staff has cited approved updates only in 1981 and 1985.

The Staff evaluated differences between the PB-2 transient test results and the ODYN predictions. Based on the confirmatory analyses/ODYN code-to-code comparisons and the comparisons of ODYN predictions against the integral test data, the Staff quantified the uncertainties in ODYN's predictions that must be accounted for in the simulations of the plants' transients. The Staff found the use of ODYN acceptable for performing design bases transients, in a safety evaluation issued in 1981. See footnote 5 above. In November 1985, the Staff approved an updated version of ODYN that incorporated improvements in the specific models, stemming from some of the differences observed in the PB-2 integral tests comparisons.⁷ (NRC Staff Direct at 21) [Emphasis added]

c. Industry assessment of ODYN against EPU plant transient responses has not been independently analyzed or confirmed by NRC Staff.

Several domestic BWRs that have implemented extended power uprates have experienced transient events; in addition, a foreign plant, Liebstat ("KKL") that had undergone an EPU performed large transient tests. In all transient events and tests at the EPU power levels, the plants responded as expected, without indicating any significant changes in the fidelity of the analytical models and codes at the EPU conditions. A review of these events was provided to the NRC by Exelon Generation Company, LLC ("Exelon"), in a letter supporting the EPU applications of the Dresden and Quad Cities plants, submitted in May 2001.⁸ (NRC Direct at A-23) [Emphasis added]

⁷ See Letter from Cecil O. Thomas (NRC) to J. S. Charnley (General Electric Co.), dated November 5, 1985 ("Acceptance for Referencing of Licensing Topical Report NEDE-24011-P-A, Rev. 6, Amendment 11, 'General Electric Standard Application for Reactor Fuel' (GESTARII))."

⁸ Letter from R. M. Krich, Exelon Generation Co., LLC, to NRC, "Additional Testing Information Supporting the License Amendment Request to Permit Uprated Power Operation at Dresden Nuclear Power Station and Quad Cities Nuclear Power Station," RS-01-104 (May 18, 2001). This letter was cited in the Staff's approval of the Dresden power uprate applications. See "Safety Evaluation by the Office of [NRR] Related to Amendment No. 191 to Facility Operating License No. DPR-19, and

d. It is not evident that NRC Staff has independently performed any benchmarking of the ODYN code insofar as measuring or predicting the performance of SSCs under full transient conditions.

NRC Exhibit 1, SER, 2,8.7.1 Page 190 clearly outlines what benchmarking means:

In general measurement data. The validation and benchmarking process provides the means to establish the associated biases and uncertainties. The uncertainties associated with predicted parameters and the correlations modeling the physical phenomena are accounted for in the analysis. NRC – approved licensing methodology, topical reports and codes specify the applicable range; the analytical methods and codes are assessed and benchmarked against measurement data, comparisons to actual nuclear plant and research reactors.

e. ODYN was originally qualified by GE and the NRC to predict only the Critical Power Ratio, [Entergy Exhibit 26] CPR, Item 04- NEC 3- NEDO 24154-A, Vol. 2.

Subsequent to the initial comprehensive assessment of the ODYN performance, GE incorporated improved analytical methods and revised specific models that provided input to ODYN. The revised ODYN code set comparison to PB-2 yielded closer predictions than the original comparison. *Id.* at 21.

f. Examination of Figures 3-25,27,30,31,60 in the above document [Entergy Exhibit 26] show that the ODYN code consistently over predicts pressures, and power.

g. The ODYN code completely fails to predict pressure oscillations during the transient.

h. Comparison between predicted and observed water level changes was not presented.

i. With regard to the perceived notion that ODYN provides conservative predictions, the NRC stated in (Entergy Exhibit 26) Item 04- NEC 3, pg II-52 above that

Amendment No. 185 to Facility Operating License No. DPR-25, Exelon Generation Company, LLC, Dresden Nuclear Power Station Units 2 and 3, Dockets No. 50-237 and 50-249” (Mar. 2, 2006), at 90-98.

Based, on the Peach Bottom tests we do not give any credit for the conservatism in the models used in the ODYN code. The code will be regarded as best estimates for delta CPR calculations and any discrepancy between the test results and the code will be treated as an uncertainty or an error. Further tests will be needed to reduce these uncertainties.

j. Entergy provides no explanation of how the correlations in Table 1 (Exhibit 23) relate to the operating conditions of EPU by VY. This statement is practically the sole justification that Entergy provided for the applicability of the ODYN code to predict plant performance at EPU conditions. As discussed by dr. Joram Hopenfeld, in the transcript 1540 – 1550 generally, Entergy statement has no technical basis to draw conclusions from the data that they provided.

k. NRC Staff and Entergy cite Liebstat as an example of a plant that engaged in full transient testing. But they are silent on the reasons that plant's owner-managers may have chosen to engage in full-transient testing and why the Liebstat plant and its apparent yield of information should not be used as an exemplar.

Exelon further indicated that Liebstat ("KKL"), a European BWR, also underwent transient testing as part of its uprate implementation plan. The plant was uprated in phases, with testing at the uprated conditions conducted: (1) in 1998, at 10.5% above OLTP, (2) in 1999, at 13% above OLTP, and in 2000 at 16.7% above OLTP. A turbine trip test was performed at 10.5% above OLTP. During the KKL testing, the following key parameters and system and actuation setpoint characteristics were monitored: reactor power, reactor vessel and turbine steam flow, reactor vessel and turbine pressure, effectiveness of the reactor recirculation runback, effectiveness of the selected rod plant response values.
NRC Staff Direct at A-22)

4. Plant Staff Familiarization with Facility Operation and Trial Use of Operating and Emergency Operating Procedures

Entergy has provided little information on this evaluation criteria and apparently deems it irrelevant, though prudence would suggest that risk levels associated with the quality and training of crews in handling emergency procedures would inform the choice about foregoing the assurance to be gained from FTT that SSCs, including automated systems automated systems, would function as designed.

With respect to "operator actions," there are no operator actions required in the LTT, thus performance of the tests would shed no light on "operator actions." (Entergy Rebut-A-19, Pg.9)

5. Margin Reduction in Safety Analysis Results for Anticipated Operational Occurrences

As described under 2.8.7.1, and under number 7 in this section, the margin to fuel cladding damage is reduced under EPU conditions and constitutes a margin reduction in safety.

6. Guidance Contained in Vendor Topical Reports

The only topical vendor report regarding the GE Extended Power Uprate that is accepted by NRC in its entirety is one which sets a requirement for full transient testing similar to that performed at original licensing start-up.

General Electric Licensing Topical Report ELTR-1, issued in 1999, and proposed for incorporation into NRC review standards, provided generic guidelines for GE BWR EPUs. ELTR-1 required an MSIV Closure test for EPUs to be performed for uprates of more than 10% above any previously recorded MSIV closure data. It also required a generator load rejection test for uprates of more than 15% above any previous generator load rejection transient data. and to include: MSIV Closure and Generator Load Shed. NRC Staff has rejected, for generic application conditions in a revised GE ELTR, GE Licensing Topical Report NEDC-3300P-A, Revision 4, dated July 2003, "Constant Pressure Power Uprate ["CPPU"] that would dispose of the full transient testing requirement.

7. Risk Implications.

a. Risk is increased through EPU. Based on the considerations below we must conclude that Entergy's claim that Table 1 [Entergy Exhibit 23] encompasses Vermont Yankee operating conditions at EPU has no technical justification.

The increase in the void fraction at EPU conditions is described under 2.8.7.1 of the SER:

To implement the proposed EPU and maintain the current 18-month cycle a higher number of maximum powered bundles are loaded into the core and the power of the average bundles is also increased, making the core radial power distribution flatter. Due to increased two-phase pressure drop and higher coolant voiding, the flow in the maximum powered bundles decreases. This effect leads to a higher bundle power to flow ratio and higher exit void fraction. Since the maximum powered bundles set the thermal limits, EPU operation reduces the margins to thermal limits. [Emphasis added]

b. Impact of LTT on plant systems and components is alluded to but not quantified in Entergy's testimony

Q58. Would performance of LTT have an adverse impact on the plant?

A58. (CJN, JLC) The performance of a SCRAM from high power, such as those that take place during LTT, results in an undesirable transient cycle on the primary system. The occurrence of primary system transient cycles should be minimized, since they introduce unnecessary stresses on the primary system components. The undesirable effects of performing the tests outweigh the benefits of any limited additional information that may be gained from them.

In addition, performance of each LTT causes a plant shutdown.

Any plant shutdown results in a generation outage for a period of time (typically 2-3 days) for the plant. Since there are no measurable safety benefits to be derived from the performance of the tests, the loss of generation revenue and other costs associated with the performance of the tests cannot be economically justified. (Entergy Direct at Q&A 58)

VI. CONCLUSIONS

In consideration of the foregoing, together with a review of both written and oral testimony presented at evidentiary hearing, and for the reasons stated below, the Board makes the following findings of facts and conclusions of law.

Entergy and NRC Staff do not provide adequate assurance that structures, systems and components are demonstrated to perform satisfactorily under full transient conditions as required in Appendix B to 10 C.F.R. Part 50:

A test program shall be established to assure that all testing required to demonstrate that structures, systems, and components ("SSCs") will perform satisfactorily in service is identified and performed in accordance with written

test procedures which incorporate the requirements and acceptance limits contained in applicable design documents. The test program shall include, as appropriate, proof tests prior to installation, preoperational tests, and operational tests during nuclear power plant or fuel reprocessing plant operation, of structures, systems, and components. Test procedures shall include provisions for assuring that all prerequisites for the given test have been met, that adequate test instrumentation is available and used, and that the test is performed under suitable environmental conditions. Test results shall be documented and evaluated to assure that test requirements have been satisfied.

In summary, the criteria for exemption to full transient testing are not met: NRC Staff and Entergy have failed to validate or independently confirm that the ODYN code is properly benchmarked against the various conditions it is expected to predict.

In some cases, NRC Staff appears to have done no more than a cursory review of industry comparisons between experimental or field data and analytical code predictions.

NRC Staff and Entergy have failed to validate their statistical sampling of EPU power station experiences or to show that the correlations are valid and meaningful.

Where it appears that frequency of full transient events already experienced at Vermont Yankee is such that a transient in the near term may be inevitable and

- where Entergy's position is that relief and by-pass valves (unless they are delayed or disabled) and other design features will inevitably yield a soft test with little risk of harming equipment, and
- where Entergy has offered no reason why full transient tests cannot be scheduled in conjunction with the onset of the next refueling outage so as to avoid undue cost,
- where, as stated in RG 1.68,
the primary objectives of a suitable test program are (1) to provide additional

assurance that that the facility has been adequately designed and to the extent practical, to validate the analytical models and to verify correctness or conservatism and assumptions used for plant responses to anticipated transients and postulated accidents, and (2) to provide additional assurance, that construction and installation of equipment in the facility has been accomplished in accordance with design.

the Board finds that NEC Contention 3, requiring large transient testing, (*i.e.*, MSIV closure and turbine generator load rejection), should be granted,

However, recognizing that Vermont Yankee has been operating at extended power uprate capacity since authorized by the NRC Staff in March, 2006, the Board now orders Entergy to submit within fifteen (15) days a proposal for a schedule to commence full transient testing, to include both MSIV closure and turbine generator load rejection, and to commence before the next scheduled refueling.

In the interim , out of an abundance of concern for the risk inherent in inadvertent plant trips and transients, the board orders that Vermont Yankee shall be returned to Original Licensed Thermal Power within ten days and OLTP not to be exceeded prior to the commencement of full transient testing.

Upon completion of the tests, Vermont Yankee shall be returned to OLTP for a period of thirty days or until such later time as approval for EPU is granted by the staff. Results and collected data from the full transient testing shall be provided to NRC Staff and the intervenors no later than ten days from completion of the tests.

Entergy shall conduct transient testing so as to accomplish the following purposes

- To meet 10CFR Part 50 Appendix B, Section XI
- To Validate ODYN predictions at VY at EPU conditions
- To verify that the maximum pressure does not exceed 1230psig

- To determine whether the MSIV closure and Generator Load Rejection transients can excite severe component vibrations.
To verify general component functionality

**Proposed Findings, Conclusions, and Order Respectfully
Submitted on Behalf of New England Coalition,**

A handwritten signature in black ink, appearing to read "Raymond Shadis". The signature is written in a cursive style with a large initial "R" and a long horizontal stroke at the end.

**Raymond Shadis
Pro Se Representative**

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of

ENTERGY NUCLEAR VERMONT YANKEE
LLC and ENERGENCY NUCLEAR
OPERATIONS, INC.
(Vermont Yankee Nuclear Power Station)

Docket No. 50-271OLA

ASLBP No. 04-832-02-OLA

CERTIFICATE OF SERVICE

I hereby certify that copies of NEW ENGLAND COALITION'S PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW in the above-captioned proceeding have been served on the following by deposit in the United States mail, first class; or by e-mail as indicated by a double asterisk (**), this 7th day of November, 2006.

<p>Alex S. Karlin, Chair** Administrative Judge Atomic Safety and Licensing Board Panel Mail Stop T-3F23 U.S. Nuclear Regulatory Commission Washington, DC 20555-0001 E-mail: ask2@nrc.gov</p>	<p>Dr. Anthony J. Baratta** Administrative Judge Atomic Safety and Licensing Board Panel Mail Stop T-3F23 U.S. Nuclear Regulatory Commission Washington, DC 20555-0001 E-mail: ajb5@nrc.gov</p>
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<p>Office of Commission Appellate Adjudication* Mail Stop: O-16C1 U.S. Nuclear Regulatory Commission Washington, DC 20555-0001</p>	<p>John M. Fulton, Esq. Assistant General Counsel Entergy Nuclear Operations, Inc. 440 Hamilton Avenue White Plains, NY 10601</p>

<p>Marcia Carpentier, Esq.** Law Clerk Atomic Safety and Licensing Board Panel Mail Stop: T-3F23 U.S. Nuclear Regulatory Commission Washington, DC 20555-0001 (E-mail: MXC7@nrc.gov)</p>	<p>Sherwin E. Turk, Esq.** Richard Ennis, NRR, US NRC Office of the General Counsel Mail Stop O-15 D21 U.S. Nuclear Regulatory Commission Washington, DC 20555-0001 set@nrc.gov, jcz@nrc.gov</p>



Raymond Shadis
Pro Se Representative
New England Coalition

UNITED STATES
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the matter of

ENTERGY NUCLEAR VERMONT YANKEE, LLC
and ENERGENCY NUCLEAR OPERATIONS, INC.
(Vermont Yankee Nuclear Power Station)

November 7, 2006

Docket No. 50-271

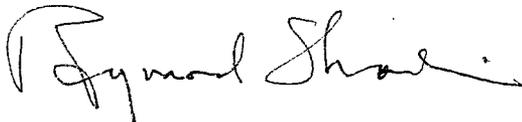
ASLBP No. 04-832-02-OLA

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

Dear Rulemaking and Adjudications Staff,

Please find for filing in the above captioned matter one original and two copies of
**NEW ENGLAND COALITION'S PROPOSED FINDINGS OF FACT, AND
CONCLUSIONS OF LAW FOLLOWING EVIDENTIARY HEARING.**

Thank you for your kind assistance in making this filing,



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