RAS 13735

June 5, 2007

DOCKETED
USNRC

June 5, 2007 (4:29pm)

OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

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

ENTERGY'S MOTION FOR SUMMARY DISPOSITION OF NEW ENGLAND COALITION'S CONTENTION 4 (FLOW ACCELERATED CORROSION)

I. INTRODUCTION

Applicants Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operations, Inc. (collectively "Entergy") submit this motion, pursuant to 10 C.F.R. §2.1205(a)[1] and the Atomic Safety and Licensing Board's ("Board") Initial Scheduling Order (November 17, 2006) ("Initial Scheduling Order") to seek dismissal by summary disposition of the New England Coalition's ("NEC") Contention 4 in this proceeding ("NEC Contention 4"). Entergy asks for summary disposition of the contention on the grounds that no genuine issue as to any material fact exists and Entergy is entitled to a decision as a matter of law. 10 C.F.R. § 2.710(d)(2). This motion is supported by a Statement of Material Facts as to which Entergy asserts there is no genuine dispute and the Joint Declaration of Jeffrey S. Horowitz and James C. Fitzpatrick ("Joint Decl."), filed simultaneously herewith.

[1] 10 C.F.R. §2.1205(a) states: "(a) Unless the presiding officer or the Commission directs otherwise, motions for summary disposition may be submitted to the presiding officer by any party no later than forty-five (45) days before the commencement of hearing. The motions must be in writing and must include a written explanation of the basis of the motion, and affidavits to support statements of fact. Motions for summary disposition must be served on the parties and the Secretary at the same time that they are submitted to the presiding officer."

Template = SECY-041

SECY-02

II. STATEMENT OF FACTS

NEC Contention 4 asserts that Entergy's license renewal application for the Vermont Yankee Nuclear Power Station ("VY") ("Application")[2] should be denied because it "does not include an adequate plan to monitor and manage aging of plant piping due to flow-accelerated corrosion ["FAC"] during the period of extended operation." NEC's "Petition for Leave to Intervene, Request for Hearing, and Contentions" dated May 26, 2006 ("Petition") at 18.

The Board found that the following statements in the Declaration of Dr. Joram Hopenfeld[3] submitted in support of NEC's Petition were sufficient to meet the contention admissibility standards of 10 C.F.R. § 2.309(f)(1):

> The theoretical basis of FAC is not completely understood; however, it is well established that turbulence intensity, steam quality, material compositions, oxygen content and coolant pH are the main variables that affect FAC. The CHECWORKS computer code is not a mechanistic code; it is an empirical code that must be updated continuously with plant-specific data. Inspection results are routinely used as inputs to the code. The code can be used to predict pipe wall thinning as long as plant parameters (velocity, coolant chemistry, etc.) do not change drastically and the data have been collected for a long period of time. It is important to realize that wall thinning rate from FAC is not necessarily consistent with time, and therefore a considerable number of cycles are needed to establish the FAC rate on a given component at a particular plant. Since Vermont Yankee has recently increased the coolant flow rate by 20%, which also significantly accelerates local wall thinning, it would take at least 10-15 years before CHECWORKS can be benchmarked with the Vermont Yankee inspection data.

Memorandum and Order (Ruling on Standing, Contentions, Hearing Procedures, State Statutory Claim, and Contention Adoption), LBP-06-20, 64 NRC 131, 194 (2006) ("LBP-06-20"), quoting Hopenfeld Decl., ¶24.

The scope of NEC Contention 4, as proffered by NEC and as admitted by the Board, is very narrow and is limited to Dr. Hopenfeld's assertion that the FAC program at VY is defective

---

[2] Vermont Yankee Nuclear Power Station, License Renewal Application (January 25, 2006), available in the NRC ADAMS system with Accession No. ML060300085.

[3] Petition Exh. 7, Declaration of Dr. Joram Hopenfeld (May 12, 2006) ("Hopenfeld Decl.").

because it relies on the use of CHECWORKS and that code needs to be "benchmarked" against ten to fifteen years of VY inspection data. As will be seen, the alleged limitations in the CHECWORKS program are non-existent. Furthermore, the FAC program that will be implemented by Entergy during the license renewal period, which is the same as the program being carried out today and which has not been otherwise challenged by NEC, will meet all regulatory requirements and industry guidance. Consequently, there are no material facts in dispute that warrant holding a hearing on this contention.

III. ENTERGY IS ENTITLED TO SUMMARY DISPOSITION

A. LEGAL STANDARDS FOR SUMMARY DISPOSITION

Motions for summary disposition are available in 10 C.F.R. Part 2, Subpart L proceedings. They may be filed up to 45 days before the commencement of a hearing, unless the presiding officer orders otherwise. 10 C.F.R. §2.1205(a).[4] In ruling on motions for summary disposition, the Board is to apply the standards in subpart G of 10 C.F.R. Part 2. *Id.*, §2.1205(c). The standards for summary disposition under Subpart G are defined in 10 C.F.R. §2.710, which states that the "presiding officer shall render the decision sought if . . . there is no genuine issue as to any material fact and . . . the moving party is entitled to a decision as a matter of law." *Id.*, §2.710(d)(2). The Commission's requirements for summary disposition are satisfied with respect to NEC Contention 4 because there is no genuine issue of disputed fact that would require a hearing and Entergy is entitled to a favorable decision as a matter of law.

Under the NRC Rules of Practice, a moving party is entitled to summary disposition of a contention as a matter of law if the filings in the proceeding, together with the statements of the parties and the affidavits, demonstrate that there is no genuine issue as to any material fact. The

---

[4] In its Initial Scheduling Order, the Board set June 15, 2007 as the deadline for filing motions for summary disposition herein. Initial Scheduling Order at 7.

Rules "long have allowed summary disposition in cases where there is no genuine issue as to any material fact and where the moving party is entitled to a decision as a matter of law." *Carolina Power & Light Co.* (Shearon Harris Nuclear Power Plant), CLI-01-11, 53 N.R.C. 370, 384 (2001) (internal quotations omitted); *Advanced Medical Sys., Inc.* (One Factory Row, Geneva, Ohio), CLI-93-22, 38 N.R.C. 98, 102-03 (1993). The Commission has held that summary disposition is appropriate "[a]bsent any probative evidence supporting [a party's] claims . . . ." *Advanced Medical Sys., Inc.* (One Factory Row, Geneva, Ohio), CLI-94-06, 39 N.R.C. 285, 309-310 (1994), *aff'd*, *Advanced Medical Sys., Inc. v. NRC*, 61 F.3d 903 (6th Cir. 1995) (Table). Commission case law is clear that for there to be a genuine issue, "the factual record, considered in its entirety, must be enough in doubt so that there is a reason to hold a hearing to resolve the issue." *Cleveland Electric Illuminating Co.* (Perry Nuclear Power Plant, Units 1 and 2), LBP-83-46, 18 N.R.C. 218, 223 (1983). Summary disposition "is a useful tool for resolving contentions that . . . are shown by undisputed facts to have nothing to commend them." *Private Fuel Storage, L.L.C.* (Independent Fuel Storage Installation), LBP-01-39, 54 N.R.C. 497, 509 (2001). "'Demonstrably insubstantial issues' . . . should be decided pursuant to summary disposition procedures . . . ." *Louisiana Power and Light Co.* (Waterford Steam Electric Station, Unit 3), LBP-81-48, 14 N.R.C. 877, 883 (1981) (*citing Houston Lighting and Power Co.* (Allens Creek Nuclear Generating Station, Unit 1), ALAB-590, 11 N.R.C. 542 (1980)).

Those principles apply here. Lacking any genuine factual dispute, NEC Contention 4 has "nothing to commend" it for further litigation in this proceeding and should be dismissed.

B. THERE IS NO FACTUAL DISPUTE REQUIRING LITIGATION

In its License Renewal Application, Entergy described the proposed VY program for addressing FAC as follows:

> The Flow-Accelerated Corrosion (FAC) Program at VYNPS is comparable to the program described in NUREG-1801, Section XI.M17, Flow-Accelerated Corrosion.
>
> This program applies to safety-related and nonsafety-related carbon steel components carrying two-phase or single-phase high-energy fluid > 2% of plant operating time.
>
> The program, based on EPRI Report NSAC-202L-R2 recommendations for an effective flow accelerated corrosion program, predicts, detects, and monitors FAC in plant piping and other pressure retaining components. This program includes (a) an evaluation to determine critical locations, (b) initial operational inspections to determine the extent of thinning at these locations, and (c) follow-up inspections to confirm predictions, or repair or replace components as necessary.

Application at B-47. The VY program is comparable to, and consistent with, the program described in the NRC guidance document "Generic Aging Lessons Learned (GALL) Report -- Tabulation of Results," NUREG-1801, Vol. 2, Rev. 1 (Sep. 2005) ("NUREG-1801"), Section XI.M17, Flow Accelerated Corrosion. Id.

As described in NUREG-1801, an acceptable FAC program "relies on implementation of the Electric Power Research Institute (EPRI) guidelines in the Nuclear Safety Analysis Center report NSAC-202L-R2 for effective flow-accelerated corrosion (FAC) program. The program includes performing (a) an analysis to determine critical locations, (b) limited baseline inspections to determine the extent of thinning at these locations, and (c) follow-up inspections to confirm the predictions, or repairing and replacing components as necessary." Id.

The scope of and implementation guidelines for the FAC program at VY during the license renewal period are described in EPRI guidance document NSAC-202L. Application at B-47; Joint Decl., ¶ 25. To ensure that all the aging effects caused by FAC are properly managed, the program includes the use of a predictive code, CHECWORKS, that uses the implementation guidance of NSAC-202L. NUREG-1801 at XIM-61; Joint Decl., ¶ 25.

A formal FAC program based on the EPRI guidelines, including the most recent revision of NASC-202L, has been in effect at VY since 1990. Id., ¶ 26. The VY FAC Program includes appropriate procedures or administrative controls to assure that the structural integrity of all steel lines containing high-energy fluids (two-phase as well as single phase) is maintained. Id., ¶ 25.

The criteria for component selection for FAC inspection during outages at VY are consistent with those cited in NSAC-202L, with the selection being based on (1) pipe wall thickness measurements from past outages, (2) predictive evaluations performed using the CHECWORKS code, (3) industry events related to FAC, (4) results from other plant inspection programs, and (5) engineering judgment. Id., ¶ 27. Other factors considered in planning inspections at VY include the consequences of failure of a particular component with respect to personnel safety and plant availability, and the margin of nominal wall thickness to code minimum wall thickness. Id.

The VY FAC Program provides detailed instructions on how to conduct the inspections, the evaluation of the inspection data, acceptance criteria for inspected components, disposition of components failing to meet acceptance criteria, expansion of the sample to other components similar to those failing to meet acceptance criteria, and updating of CHECWORKS models to incorporate inspection data. Id., ¶ 26. The FAC Program currently in effect at VY will continue to be implemented during the license renewal period. Id., ¶ 25.

The FAC Program at VY is complemented by the use of FAC resistant materials in the design of the plant, the use of a water chemistry that inhibits FAC, and the progressive replacement of FAC-susceptible piping and components with FAC-resistant ones. Id., ¶ 28.

The piping system locations at VY that are most susceptible to FAC are generally known, since they are typically the areas of high flow velocity and the regions of high turbulence. Id., ¶

30. These locations have already been identified through many years of inspections performed under the FAC Program. These locations provide a baseline for the performance of inspections, which is refined by the use of the CHECWORKS code and other tools. Id.

A two-day audit of the VY FAC Program conducted in April 2007 by a recognized industry expert found that the program appropriately implements the approach recommended by NSAC-202L. Id., ¶ 32. The program was found to have substantial strengths and no apparent weaknesses. The observed program strengths include, in addition to conformance with NSAC-202L, the extensive use of FAC-resistant materials in the original construction, relatively simple plant design, proactive replacement of vulnerable components with others of resistant material, and an experienced program lead. Id. The audit concluded that the VY FAC Program has been effective at managing aging effects, and that the program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation. Id.

As noted above, the only aspect of the VY FAC Program that NEC challenges is the use of the CHECWORKS code as a tool to identify the piping and components that should be inspected for potential FAC effects. CHECWORKS is one of the tools used at VY to identify FAC-susceptible areas. Id., ¶ 29. A user of CHECWORKS, such as Entergy, constructs a mathematical model of the susceptible piping systems, similar in concept to a piping stress model or flow model. Plant design, water chemistry and operating data, together with a predictive algorithm, are used to predict the rate of wall thinning, and remaining service life on a component-by-component basis. The resulting predictions are then used by plant personnel to help select inspection locations. Id., ¶ 34.

The CHECWORKS predictions are refined by comparing them against plant inspection data. This approach provides a more accurate prediction of the wear rates then trending alone and allows the analyst to gauge the success of the program in predicting piping wear by comparing the analytical predictions with the actual observed wear. Id. At VY, the model includes the changes that have been made in piping an component materials, the higher flow velocities due to EPU operations, and the adjustments in water chemistry that have been instituted since the EPU's implementation. Id., ¶ 30.

NEC does not dispute the suitability or usefulness of CHECWORKS. This is not surprising, since CHECWORKS has been endorsed by the NRC and the Institute of Nuclear Power Operations ("INPO") and is used in all U.S. nuclear units, all Canadian units, and a number of other foreign plants. Id., ¶¶ 8, 33. There has never been a fatality at any plant using CHEC or its successors, including CHECWORKS, since the first release of CHEC in 1987. Id., ¶ 35. Also, there has not been a major FAC-caused pipe rupture in a nuclear unit in the United States for more than 7 years. Id.

NEC claims that CHECWORKS may not be used at VY during the initial years of license renewal operation because CHECWORKS is an empirical model that must be continuously updated with plant-specific data so that once "benchmarked" to a specific plant, it makes accurate predictions as long as plant parameters, such as velocity and coolant chemistry, do not change drastically. NEC argues that since those parameters have changed as a result of the EPU, it would take 10-15 years of inspection data collection and entry to the model following the power uprate to benchmark CHECWORKS for use at VY. See Petition at 18-19; Hopenfeld Decl.,¶¶ 22-24. However, according to the creator of CHECWORKS and leading authority on FAC, no such prolonged period of data collection is required to use CHECWORKS effectively.

Joint Decl., ¶ 38. The predictive algorithms built into CHECWORKS are based on all available laboratory data and FAC data from many plants. CHECWORKS was designed, and has been shown, to handle large changes in chemistry, flow rate and or other operating conditions typically found in power uprates. Id. Its predictions provide "best estimates" of the FAC wear rates at particular plants, including VY. The plant-specific information that is obtained during plant inspections is used to adjust the estimates to more realistic levels that reflect the plant's configuration, water chemistry and operating conditions. Prolonged "benchmarking" as suggested by Dr. Hopenfeld will not result in identifying new locations to inspect, but will in most cases determine that inspections at certain locations are not necessary. Id.

Also, by the time the VY license renewal is in effect (in the year 2012), inspection data for three refueling outages under EPU conditions will have been obtained. These additional data sets, when added to the CHECWORKS database, will result in more refined wear rate predictions. Those additional inspection data sets are sufficient to calibrate the CHECWORKS predictions to provide a good fit to the VY post-EPU conditions. Id., ¶ 39.

NEC also asserts that it may be necessary to modify the FAC program as a plant ages and that Entergy's license renewal application does not explain how it proposes to use CHECWORKS as an aging management tool during the period of extended operation. NEC's Reply to Entergy and NRC Staff Answers to Petition for Leave to Intervene, Request for Hearing, and Contentions (June 29, 2006) at 26. However, CHECWORKS has the demonstrated ability to handle without problems the impact of changes of operating conditions in units, such as VY, that undergo chemistry changes or power uprates. Joint Decl., ¶ 40. Also, EPRI periodically reexamines the success of the program in predicting plant experience and refines the CHECWORKS model as necessary. The predictive model has been improved over the years as more plant experience and inspection data has become available, keeping the program an effective aging management tool. Id. There is no reason why CHECWORKS would not remain a suitable aging management tool in years to come, and NEC identifies none.

Thus, the program that VY has proposed for managing the loss of piping and component material due to FAC during the period of extended operation after license renewal, which consists of the use of CHECWORKS as a predictive tool together with results from other plant inspection programs, relevant industry operating experience, engineering judgment, consideration of the consequences of failure of a particular component with respect to personnel safety and plant availability, and other factors, will adequately predict the locations where piping inspections must be conducted so the potential adverse effects of FAC may be avoided. Id., ¶ 41. The program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation. Id.

C. ENTERGY IS ENTITLED TO A FAVORABLE DECISION AS A MATTER OF LAW

There is no genuine issue on a material fact regarding NEC Contention 4 that could result in the denial of Entergy's Application. Accordingly, Entergy is entitled to summary disposition of the contention as a matter of law.

IV. CONCLUSION

As demonstrated above, the objection to the aging management program for FAC raised by NEC and its consultant in Contention 4 is not valid. Accordingly, there is no genuine dispute of material fact remaining to litigate and Entergy is entitled to a decision as a matter of law on NEC Contention 4.

CERTIFICATION

In accordance with 10 C.F.R. §2.323(b), counsel for Entergy has discussed this motion with counsel for the other parties in this proceeding in an attempt to resolve this issue but has not been successful in resolving it.

Respectfully Submitted,

David R. Lewis
Matias F. Travieso-Diaz
PILLSBURY WINTHROP SHAW PITTMAN LLP
2300 N Street, N.W.
Washington, DC 20037-1128
Tel. (202) 663-8000

Counsel for Entergy

Dated: June 5, 2007

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

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

STATEMENT OF MATERIAL FACTS REGARDING NEC CONTENTION 4 ON WHICH NO GENUINE DISPUTE EXISTS

Applicants Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operations, Inc. (collectively "Entergy") submit, in support of their motion for summary disposition of NEC Contention 4, that there is no genuine issue to be heard with respect to the following material facts.

A. THE FAC PROGRAM AT VY

1. Section B.1.13 of the License Renewal Application for VY ("Application") indicates that the VY program for addressing flow accelerated corrosion ("FAC") of steel piping and components is comparable to the program described in the NRC guidance document "Generic Aging Lessons Learned (GALL) Report -- Tabulation of Results," NUREG-1801, Vol. 2, Rev. 1 (Sep. 2005) ("NUREG-1801"), Section XI.M17, Flow Accelerated Corrosion. Application at B-47.
2. The scope of and implementation guidelines for the FAC program at VY during the license renewal period are described in the Electric Power Research Institute ("EPRI") guidance document NSAC-202L. Joint Declaration of Jeffrey S. Horowitz and James C. Fitzpatrick ("Joint Decl."), ¶ 25.
3. A program implemented in accordance with the EPRI guidelines predicts, detects, and monitors FAC in plant piping and other components, such as elbows and expanders. Such a program includes the following recommendations: (a)

conducting an analysis to determine critical locations, (b) performing limited baseline inspections to determine the extent of thinning at these locations, and (c) performing follow-up inspections to confirm the predictions, or repairing or replacing components as necessary. To ensure that all the aging effects caused by FAC are properly managed, the program includes the use of a predictive code, such as CHECWORKS, that uses the implementation guidance of NSAC-202L- to satisfy the criteria specified in 10 CFR Part 50, Appendix B, criteria for development of procedures and control of special processes. NUREG-1801 at XIM-61; Joint Decl., ¶ 25.

4. A FAC program based on the EPRI guidelines, including the most recent revision of NASC-202L, has been in effect at VY since 1990. Id., ¶ 26. The VY FAC program includes appropriate procedures or administrative controls to assure that the structural integrity of all carbon steel lines containing high-energy fluids (two-phase as well as single phase) is maintained. Id., ¶ 25.
5. The criteria for component selection for FAC inspection during outages at VY are consistent with those cited in NSAC-202L, with the selection being based on (1) pipe wall thickness measurements from past outages, (2) predictive evaluations performed using the CHECWORKS code, (3) industry events related to FAC, (4) results from other plant inspection programs, and (5) engineering judgment. Other factors considered in planning inspections at VY include the consequences of failure of a particular component with respect to personnel safety and plant availability, and the margin of nominal wall thickness to code minimum wall thickness. Id., ¶ 27.
6. The VY FAC Program provides detailed instructions on how to conduct the inspections, the evaluation of the inspection data, acceptance criteria for inspected components, disposition of components failing to meet acceptance criteria, expansion of the sample to other components similar to those failing to meet acceptance criteria, and updating of CHECWORKS models to incorporate inspection data. Id., ¶ 26.
7. The FAC Program currently in effect at VY will continue to be implemented during the license renewal period. Id., ¶ 25.

8. The FAC program at VY is complemented by the use of FAC-resistant materials in the design of the plant, the use of a water chemistry that inhibits FAC, and the progressive replacement of FAC susceptible piping and components with FAC-resistant ones. Id., ¶ 28.
9. The piping system locations at VY that are most susceptible to FAC are generally known, since they are typically the areas of high flow velocity and the regions of high turbulence. These locations have already been identified through many years of inspections performed under the FAC Program. These locations provide a baseline for the performance of inspections, which is refined by the use of the CHECWORKS code and other tools. Id., ¶ 30.
10. A two-day audit of the Vermont Yankee FAC Program conducted in April 2007 by a recognized industry expert found that the program appropriately implements the approach recommended by NSAC-202L. Id., ¶ 32. The program was found to have substantial strengths and no apparent weaknesses. The observed program strengths include, in addition to conformance with NSAC-202L, the extensive use of FAC-resistant materials in the original construction, relatively simple plant design, proactive replacement of vulnerable components with others of resistant material, and an experienced program lead. Id.
11. The auditor concluded that the VY FAC Program has been effective at managing aging effects, and that the program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation. Id. This conclusion was consistent with other favorable audits of the program by the NRC, Entergy and EPRI. Id.

B. USE OF CHECWORKS

12. The CHECWORKS code is one of the tools used at VY to identify FAC-susceptible areas. It is used in conjunction with trend data from actual inspections, operating experience and engineering judgment, among other information, in deciding where to conduct piping inspections. Id., ¶ 29.

13. The changes that have been made in piping and component materials, the higher flow velocities due to EPU operations, and the adjustments in water chemistry have all been incorporated into the CHECWORKS model that is used at VY. Id., ¶ 30.

14. In the three refueling outages that are scheduled to occur between implementation of the EPU at VY in 2006 and the end of the current license in 2012, the number of piping inspections will be increased by 50 percent. Therefore, by the time the license renewal is in effect (in the year 2012), three refueling outages (4.5 years) of inspection data under EPU conditions will have been obtained and added to the CHECWORKS database and wear rate predictions. Id., ¶ 31.

15. A user of the CHECWORKS code constructs a mathematical model of the susceptible piping systems, similar in concept to a piping stress model or flow model. Plant design, water chemistry and operating data, together with a predictive algorithm, are used to predict the rate of wall thinning, and remaining service life on a component-by-component basis. The resulting predictions are then used by plant personnel to help select inspection locations. The CHECWORKS predictions are refined by comparing inspection data with the CHECWORKS predictions. This approach provides a more accurate prediction of the wear rates then trending alone and allows the analyst to gauge the success of the program in predicting piping wear by comparing the analytical predictions with the actual observed wear. Id., ¶ 34.

16. As a result of the use of the CHEC and its successor programs including CHECWORKS and the associated development of technology and programmatic guidance on FAC control, there has never been a fatality at any plant using CHEC or its successors since the first release of CHEC in 1987. Id., ¶ 35.

17. There has not been a major FAC-caused pipe rupture in a nuclear unit in the United States for more than 7 years. This is compared to approximately one major rupture a year at plants in countries where CHECWORKS is not used. Id.

18. NEC alleges that CHECWORKS may not be used at VY during the initial years of license renewal operation because CHECWORKS must be continuously updated with plant-specific data so that, once "benchmarked" to a specific plant, it

makes accurate predictions as long as plant parameters, such as velocity and coolant chemistry, do not change drastically. Since those parameters have changed at VY as a result of the EPU, NEC alleges that it would take 10-15 years of inspection data collection and entry to the model following the power uprate to benchmark CHECWORKS for use at VY. Petition at 18-19; Hopenfeld Decl.,¶¶ 22-24.

19. No such prolonged period of data collection is required to use CHECWORKS effectively. The predictive algorithms built into CHECWORKS are based on all available laboratory data and FAC data from many plants. CHECWORKS was designed, and has been shown, to handle large changes in chemistry, flow rate and or other operating conditions typically found in power uprates. Its predictions provide "best estimates" of the FAC wear rates at particular plants, including VY. The plant-specific information that is obtained during plant inspections is used to adjust the estimates to more realistic levels that reflect the plant's configuration, water chemistry and operating conditions. Prolonged "benchmarking" as suggested by Dr. Hopenfeld will not result in identifying new locations to inspect, but will in most cases determine that inspections at certain locations are not necessary. Joint Decl., ¶ 38.

20. In addition, by the time the VY license renewal is in effect (in the year 2012), inspection data for three refueling outages under EPU conditions will have been obtained. These additional data sets, when added to the CHECWORKS database, will result in more refined wear rate predictions. Those additional inspection data sets are sufficient to calibrate the CHECWORKS predictions to provide a good fit to the VY post-EPU conditions. Id., ¶ 39.

21. NEC also asserts that it may be necessary to modify the FAC program as a plant ages and that Entergy's license renewal application does not explain how it proposes to use CHECWORKS as an aging management tool during the period of extended operation. NEC's Reply at 26. However, CHECWORKS has the demonstrated ability to handle without problems the impact of changes of operating conditions in units, such as VY, that undergo chemistry changes or power uprates. Joint Decl., ¶ 40.

22. EPRI periodically re-examines the success of the program in predicting piping and component wear rates and refines the model as necessary. The predictive model has been improved over the years as more plant experience and inspection data has become available, keeping the program an effective aging management tool. Id.

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.	))	Docket No. 50-271-LR ASLBP No. 06-849-03-LR
	)	
(Vermont Yankee Nuclear Power Station)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of "Entergy's Motion for Summary Disposition of New England Coalition's Contention 4 (Flow Accelerated Corrosion)" dated June 5, 2007 and "Joint Declaration of Jeffrey S. Horowitz and James C. Fitzpatrick in Support of Entergy's Motion for Summary Disposition of New England Coalition's Contention 4" were served on the persons listed below by deposit in the U.S. Mail, first class, postage prepaid, or with respect to Judge Elleman by overnight mail, and where indicated by an asterisk by electronic mail, this 5th[th] day of June, 2007.

*Administrative Judge
Alex S. Karlin, Esq., Chairman
Atomic Safety and Licensing Board
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
ask2@nrc.gov

*Administrative Judge
Dr. Richard E. Wardwell
Atomic Safety and Licensing Board
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
rew@nrc.gov

*Administrative Judge
Dr. Thomas S. Elleman
Atomic Safety and Licensing Board
5207 Creedmoor Road, #101,
Raleigh, NC 27612.
tse@nrc.gov; elleman@eos.ncsu.edu

*Secretary
Att'n: Rulemakings and Adjudications Staff
Mail Stop O-16 C1
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
secy@nrc.gov, hearingdocket@nrc.gov

Office of Commission Appellate Adjudication
Mail Stop O-16 C1
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Atomic Safety and Licensing Board
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

*Mitzi A. Young, Esq.
*Mary C. Baty, Esq.
Office of the General Counsel
Mail Stop O-15 D21
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001may@nrc.gov;
mcb1@nrc.gov

*Sarah Hofmann, Esq.
Director of Public Advocacy
Department of Public Service
112 State Street – Drawer 20
Montpelier, VT 05620-2601
Sarah.hofmann@state.vt.us

*Anthony Z. Roisman, Esq.
National Legal Scholars Law Firm
84 East Thetford Road
Lyme, NH 03768
aroisman@nationallegalscholars.com

*Ronald A. Shems, Esq.
*Karen Tyler, Esq.
Shems, Dunkiel, Kassel & Saunders, PLLC
9 College Street
Burlington, VT 05401
rshems@sdkslaw.com
ktyler@sdkslaw.com

*Jennifer J. Patterson, Esq.
Senor Assistant Attorney General
Environmental Protection Bureau
33 Capitol Street
Concord, NH 03301
Jennifer.Patterson@doj.nh.gov

Matias F. Travieso-Diaz

May 31st, 2007

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

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

JOINT DECLARATION OF JEFFREY S. HOROWITZ AND JAMES C. FITZPATRICK IN SUPPORT OF ENTERGY'S MOTION FOR SUMMARY DISPOSITION OF NEC CONTENTION 4

Jeffrey S. Horowitz ("JSH") and James C. Fitzpatrick ("JCF") state as follows under penalties of perjury:

I. PERSONAL BACKGROUND (JSH)

1. (JSH) My name is Jeffrey S. Horowitz. I am an independent consultant. I am providing this declaration in support of Applicant's Motion for Summary Disposition of New England Coalition's ("NEC") Contention 4 ("NEC Contention 4") in the above captioned proceeding.
2. (JSH) My professional and educational experience is summarized in the *curriculum vitae* attached as Exhibit 1 to this Joint Declaration. Briefly summarized, I have more than 35 years of experience in the field of nuclear energy and related disciplines. For the last 22 years I have been an independent consultant specializing in flow-accelerated corrosion ("FAC") and nuclear safety analysis. My main client during this time has been the Electric Power Research Institute ("EPRI"). I have also consulted for utilities that operate nuclear power plants, including Exelon Nuclear, Pacific Gas & Electric, and Southern California Edison. In Canada, I have consulted for the CANDU Owners Group and Ontario Power Generation. I hold four degrees in mechanical engineering including a doctor of science ("ScD") degree from the Massachusetts Institute of Technology.

3. (JSH) I have personal knowledge of the matters discussed herein that relate to the industry experience with FAC and the development of programs to predict the components that may be susceptible to FAC. I also have personal knowledge of my findings and observations with respect to the FAC management program at the Vermont Yankee Nuclear Power Station ("VY").
4. (JSH) Flow-accelerated corrosion is a degradation mechanism that attacks carbon steel piping and vessels exposed to moving water or wet steam. This attack occurs under specific water chemistry conditions. If FAC is not detected, the piping or vessel walls will become progressively thinner until they can no longer withstand internal pressure and other applied loads. Sufficient concentrations of certain alloying elements make steels immune to FAC.
5. (JSH) My involvement with the assessment of FAC dates back to December 1986, when an elbow in the condensate system at the Surry Unit 2 nuclear plant failed catastrophically, causing steam and hot water to be released into the turbine building and resulting in the deaths of four workers and severe injuries to others. Post-accident investigations revealed that FAC was the cause of the degradation to the elbow. At that time, the U.S. nuclear fleet did not have programs in place to deal with single-phase (i.e., water only) piping degradation caused by FAC. Some programs were in place to deal with two-phase (i.e., water and steam) piping degradation, but in general, these programs were very limited in their scope.
6. (JSH) In response to the Surry accident, EPRI became committed to developing a computer code that would assist utilities in determining the most likely places for FAC damage to occur, and thus the key locations to inspect for pipe wall thinning. The late Bindi Chexal, the EPRI Program Manager, gave me the job of designing and implementing such a code. I developed the computer program CHEC (Chexal-Horowitz Erosion Corrosion) and demonstrated and released it to U.S. utilities in 1987. CHEC was replaced by CHECMATE (Chexal-Horowitz Methodology for Analyzing Two-Phase Environments) in 1989. CHECMATE expanded on the capabilities of CHEC and featured the first accurate prediction of two-phase FAC. CHECMATE was later replaced by CHECWORKS (Chexal-

Horowitz Engineering Corrosion Workstation) in 1993. Each new version built on the success of the previous program and incorporated user feedback, improvements in software technology, and available laboratory and plant data into the algorithms used in the programs. I remained the technical lead person in the development of these new and revised codes.

7. (JSH) I have performed, by myself or with another engineer, audits of the FAC programs at 51 nuclear units in the United States and Canada. My reports describing the state of the programs and recommendations for improvement have always been accepted by the plant owners. The most recent FAC program audit I conducted was at VY in April 2007.

8. (JSH) After the first several audits I performed, the need became apparent for a guidance document that would help utilities improve and standardize their FAC programs. NSAC-202L, entitled "Recommendations for an Effective Flow-Accelerated Corrosion Program" was the document created to meet this need. I played a key role in drafting the original version of NSAC-202L and resolving numerous utility and U.S. Nuclear Regulatory Commission ("NRC") comments on it. Since that time, I have played a significant role in each of the three subsequent revisions to NSAC-202L, which has become the most important standard-setting document for the conduct of FAC control programs in the United States. NSAC-202L also has been accepted as a valuable guidance tool by the Institute of Nuclear Power Operations (INPO) and the NRC.

9. (JSH) After developing CHECWORKS, I co-authored three books on FAC and related issues. One book is a compendium of FAC science and experience; it is the most complete reference available on the subject of FAC. The other two books deal with thermal-hydraulic issues. I have also authored or co-authored 27 EPRI reports related to FAC and nuclear safety issues. I was the principal investigator and sole author of 10 of them. Among the most important reports with which I have been involved are a study of weld attack in nuclear piping and preliminary guidance for the protection of piping against damage from erosive forms of attack.

10. (JSH) I have made technical presentations at each of the semi-annual CHUG (CHECWORKS Users Group) meetings. CHUG meetings typically attract between 50 and 100 utility engineers and station managers. I have made presentations (usually 2 or more) at every one of the 36 CHUG meetings. These presentations cover the results of research I have performed or topics of general interest. In addition to making presentations, I have served as session chair and moderated various discussion groups.
11. (JSH) I have presented a number of technical papers on FAC, including papers at the "Water Chemistry of Nuclear Reactors - Chimie 2002" held in Avignon, France (a meeting attended by over 300 international scientists and engineers), at an ASME Pressure Vessel and Piping Conference, at a Nuclear Regulatory Commission Water Reactor Safety Meeting, and at other technical meetings.
12. (JSH) I have also conducted more than two dozen two or three-day training sessions covering FAC and the use of the EPRI computer programs (CHEC, CHECMATE and CHECWORKS). These training sessions have been held in the United States and in foreign countries including Belgium, Canada, the Czech Republic, Korea and Taiwan. The training sessions have been attended by utility engineers, utility management, engineers from the INPO, and the staff of the NRC.
13. (JSH) I have developed for EPRI two computer-based training modules. One of these modules covers FAC and the other covers erosive attack on piping in power plants. These modules have been distributed to EPRI member utilities. I also continue to be actively involved in training people to use the latest versions of CHECWORKS.

II. PERSONAL BACKGROUND (JCF)

14. (JCF) My name is James C. Fitzpatrick. I am employed by Entergy Nuclear Operations, Inc. ("Entergy") as a Senior Lead Engineer in Design Engineering at VY. I am providing this declaration in support of Applicant's Motion for Summary Disposition of New England Coalition's Contention 4 in the above captioned proceeding.

15. (JCF) My professional and educational experience is summarized in the *curriculum vitae* attached as Exhibit 2 to this Joint Declaration. I have over twenty-nine years experience in design, construction, and modification of nuclear power plant structures, piping systems, pressure vessels, and in the seismic evaluation of mechanical and electrical equipment. Twenty-one of those years are in operating plant engineering support in both the mechanical and structural areas. I have been responsible for the development and implementation of plant design changes, inspection programs, equipment specifications, installation support, outage support, and operability evaluations of degraded components.
16. (JCF) My involvement with FAC dates back to 1987. While employed at Yankee Atomic, I assisted in the preparation of VY's response to NRC Bulletin 87-01, "Thinning of Pipe Walls in Nuclear Power Plants," issued as a result of the Surry accident. Later, I performed the first modeling of plant piping systems at VY using the EPRI CHEC code and the selection of single phase piping component inspection locations for the 1989 refueling outage.
17. (JCF) I was responsible for the development of a long term "Piping Erosion-Corrosion Inspection Program" ("FAC Program") for VY. Development of this FAC Program involved determining the scope of piping potentially affected by FAC, modeling of plant systems using the CHECMATE code, developing the criteria and procedures for performing the inspections, and evaluating inspection data.
18. (JCF) I have been responsible for implementing the FAC Program at Vermont Yankee for every refueling outage since 1990. As Cognizant Engineer for the VY FAC Program, I was and remain responsible for updating the CHECWORKS models of plant piping systems, developing refueling outage inspection scopes, providing on-site engineering support, screening and evaluating piping and components, determining if the piping inspection sample during a refueling outage needs expansion, coordinating repairs and replacements, and maintaining the FAC Program Manual and supporting documentation.
19. Part of my responsibilities as Cognizant Engineer for the VY FAC Program is to review industry experience with FAC and to assess its impact on VY. As such, I

have developed contacts with other plant FAC Program Engineers by attending many of the EPRI-sponsored CHUG meetings since 1987. I also participated in the NRC Erosion-Corrosion Workshop in February 1993. I have participated either as a team member or a technical specialist in audits and assessments of FAC programs at six other nuclear plants.

20. I have personal knowledge of the matters discussed herein that relate to the implementation of the FAC Program at VY.

III. BACKGROUND OF FAC CONTENTION

21. (JCF) As admitted by the Atomic Safety and Licensing Board ("Board") in this proceeding, NEC Contention 4 asserts: "Entergy's License Renewal Application does not include an adequate plan to monitor and manage aging of plant piping due to flow-accelerated corrosion during the period of extended operation." Memorandum and Order (Ruling on Standing, Contentions, Hearing Procedures, State Statutory Claim, and Contention Adoption), LBP-06-20, 64 NRC 131, 192 (2006).

22. (JCF) NEC Contention 4 notes that VY's piping is subject to aging management review, pursuant to 10 C.F.R. § 54.21(a), and FAC is an aging phenomenon that must be adequately managed. NEC's "Petition for Leave to Intervene, Request for Hearing, and Contentions" dated May 26, 2006 ("Petition") at 18. NEC goes on to assert that accurate specification of the frequency of piping inspections "is the key to a valid FAC management program." *Id.* NEC points out that Entergy proposes to use "a computer model called CHECWORKS to determine the scope and frequency of inspections of components that are susceptible to FAC." *Id.* NEC objects to the use of CHECWORKS because "the Vermont Yankee plant recently increased its operating power level by 20%, changing plant parameters including coolant flow rate," which in NEC's view renders CHECWORKS unusable to determine inspection frequency at VY because "CHECWORKS is an empirical model that must be continuously updated with plant-specific data" so that "[o]nce 'benchmarked' to a specific plant, it makes accurate predictions as long as plant parameters, such as velocity and coolant chemistry, do not change

drastically." NEC concludes that "[i]t would take 10-15 years of inspection data collection and entry to the model to benchmark CHECWORKS for use at Vermont Yankee." *Id.* at 19.

23. (JCF) In its June 29, 2006 "Reply to Entergy and NRC Staff Answers to Petition for Leave to Intervene, Request for Hearing, and Contentions" ("NEC Reply"), NEC further states that "[t]he possibility of undetected wall thinning increases substantially with age. Therefore, it may be necessary to modify the FAC program as a plant ages. Entergy's license renewal application does not explain how it proposes to use CHECWORKS as an aging management tool during the period of extended operation, or how it will overcome the problem of establishing valid trends at higher EPU [extended power uprate] velocities . . . ." NEC Reply at 26.

IV. VY'S AGING MANAGEMENT PROGRAM FOR PIPING

24. (JCF) Section B.1.13 of the License Renewal Application for VY ("Application") indicates that the VY program for addressing FAC is comparable to the program described in the NRC guidance document "Generic Aging Lessons Learned (GALL) Report -- Tabulation of Results," NUREG-1801, Vol. 2, Rev. 1 (Sep. 2005) ("NUREG-1801"), Section XI.M17, Flow Accelerated Corrosion. Application at B-47. The Application raises no exceptions to the guidance in NUREG-1801 with respect to FAC.

25. (JCF) The FAC Program during the license renewal period is described in the EPRI guidelines in NSAC-202L. The FAC Program currently in effect will continue to be implemented during the period of extended operation after license renewal. The VY FAC Program "includes procedures or administrative controls to assure that the structural integrity of all carbon steel lines containing high-energy fluids (two-phase as well as single-phase) is maintained. A program implemented in accordance with the EPRI guidelines predicts, detects, and monitors FAC in plant piping and other components, such as elbows and expanders. Such a program includes the following recommendations: (a) conducting an analysis to determine critical locations, (b) performing limited

baseline inspections to determine the extent of thinning at these locations, and (c) performing follow-up inspections to confirm the predictions, or repairing or replacing components as necessary. NSAC-202L-R2 (April 1999) provides general guidelines for the FAC program. To ensure that all the aging effects caused by FAC are properly managed, the program includes the use of a predictive code, such as CHECWORKS, that uses the implementation guidance of NSAC-202L-R2 to satisfy the criteria specified in 10 CFR Part 50, Appendix B, criteria for development of procedures and control of special processes." NUREG-1801 at XIM-61.

26. (JCF) A formal FAC inspection program based on EPRI's guidelines has been in effect at VY since 1990. The VY FAC Program predates NSAC-202L. However, the program documents have been revised as required to conform to the recommendations contained in the revisions to NSAC-202L. The program calls for piping and component inspections to be conducted at each refueling outage, with the items to be inspected being selected based on CHECWORKS results, industry/station/utility experience, required re-inspections, the non-modeled program piping and engineering judgment. The program provides detailed instructions on how to conduct the inspections, the evaluation of the inspection data, acceptance criteria for inspected components, disposition of components failing to meet acceptance criteria, expansion of the sample to other components similar to those failing to meet acceptance criteria, and updating of CHECWORKS models to incorporate inspection data.

27. (JCF) The VY criteria for component selection for FAC inspection during outages are consistent with those cited in NSAC-202L, with the selection being based on (1) pipe wall thickness measurements from past outages, (2) predictive evaluations performed using the CHECWORKS code, (3) industry experience related to FAC, (4) results from other plant inspection programs, and (5) engineering judgment. Other factors considered in planning future inspections at VY include: the consequences of failure of a particular component with respect to personnel safety and plant availability, and the margin of nominal wall thickness to code minimum wall thickness.

28. (JCF) The FAC Program at VY is complemented by the use of FAC-resistant materials in the design of the plant, the use of a water chemistry that inhibits FAC, and the planned replacement of FAC susceptible piping and components with FAC-resistant ones. These features of the VY facility can be summarized as follows:

- X A significant amount of FAC-resistant piping was included in the original design of VY. In particular, the extraction steam system at Vermont Yankee was originally constructed using FAC-resistant materials. The extraction steam system in both PWR and BWR plants throughout the industry has had a history of susceptibility to damage and wall loss due to FAC.

- X VY has replaced a number of components and piping systems since 1976 with others made out of FAC-resistant materials. For example, VY replaced all 10 of its feedwater heater shells with shells made out of FAC-resistant material, and has likewise replaced the low pressure turbine casings with FAC-resistant material.

- X The majority of the two-phase flow piping at VY been changed out to FAC-resistant material.

- X A large amount of FAC-susceptible small bore piping has also been replaced with FAC-resistant material. The replaced piping includes the steam drain lines to the condenser for the high pressure cooling injection system, the reactor core isolation cooling system, and the augmented off-gas system. Also, all the high pressure feedwater heater shell vent lines have been replaced.

- X VY injects oxygen into the condensate/feedwater train just downstream of the condensate pumps. This results in about 40ppb dissolved O2 in the entire train. This level of dissolved oxygen serves to reduce the rate of FAC.

29. (JCF) CHECWORKS is one of the tools used to identify FAC-susceptible areas. It is used in conjunction with trend data from actual inspections, operating experience and engineering judgment. Thus, the CHECWORKS predictions are considered, among other information, in deciding where to conduct piping inspections.

30. (JCF) The piping system locations at VY that are most susceptible to FAC are generally known, since they are typically the areas of high flow velocity and the regions of high turbulence. These locations have already been identified through

many years of inspections performed under the FAC Program. Though not relying exclusively on prior operating experience, these locations provide a baseline for the performance of inspections, which is refined by the use of CHECWORKS and other tools discussed above. Likewise, the changes that have been made in piping and component materials, the higher flow velocities due to EPU operations, and the adjustments in water chemistry have all been incorporated into the CHECWORKS model that is used at VY.

31. (JCF) In the three refueling outages that are scheduled to occur between implementation of the EPU in 2006 and the end of the current license in 2012, the number of piping inspections will be increased by approximately 50 percent. Therefore, by the time the license renewal is in effect (in the year 2012), three refueling outages (4.5 years) of inspection data under EPU conditions will have been obtained and added to the CHECWORKS database and wear rate predictions.

32. (JSH) In April 2007, I performed a two-day audit of the Vermont Yankee FAC Program. I found that the program appropriately implements the approach recommended by NSAC-202L. Further, the program has substantial strengths and no apparent weaknesses. These findings are consistent with previous audits of the program by the NRC, Entergy and EPRI. The observed program strengths include, in addition to conformance with NSAC-202L, the extensive use of FAC-resistant materials in the original construction, relatively simple plant design, proactive replacement of vulnerable components with others of FAC-resistant material, and an experienced program lead. A copy of the letter summarizing my findings is attached as Exhibit 3. Based on my review, I agree with the statement in the VY License Renewal Application that "[t]he Flow-Accelerated Corrosion Program has been effective at managing aging effects. The program has been improved through implementation of lessons learned from operating experience. The Flow-Accelerated Corrosion Program provides reasonable assurance that effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation." Application at B-48.

V. ALLEGED NEED TO BENCHMARK CHECWORKS AFTER EPU

33. (JSH) As indicated earlier, I was responsible for the development of the series of programs – CHEC, CHECMATE and CHECWORKS – used for determining the locations in the piping installed at a nuclear or fossil power plant where FAC may occur. CHECWORKS is now used in all U.S. nuclear units, all Canadian units, and nuclear units in Belgium, the Czech Republic, England, Japan, Korea, Mexico, Romania, Slovenia, Spain, and Taiwan – totaling more than 150 units.

34. (JSH) The user of CHECWORKS constructs a mathematical model of the susceptible piping systems, similar in concept to a piping stress model or flow model. Plant design, water chemistry and operating data, together with a predictive algorithm, are used to predict the rate of wall thinning, and remaining service life on a component-by-component basis. The resulting predictions are then used by plant FAC personnel to help select inspection locations. The CHECWORKS predictions are subsequently refined by comparing the inspection data with the CHECWORKS predictions. This approach provides a more accurate prediction of the wear rates then trending alone and allows the analyst to gauge the success of the program in predicting piping wear by comparing the analytical predictions with the actual observed wear.

35. (JSH) As a result of the use of CHEC and its successor programs and the associated development of technology and programmatic guidance on FAC control, there has never been a fatality at any plant using CHEC or its successors since the first release of CHEC twenty years ago. (There were five fatalities at a Japanese nuclear plant not using CHECWORKS in 2004.) In fact, there has not been a major FAC-caused pipe rupture in a nuclear unit in the United States for more than 7 years. This is compared to approximately one major rupture a year at plants in countries where CHECWORKS is not used.

36. (JSH) The successful record in the use of CHECWORKS demonstrates that it is a suitable tool for predicting where potential pipe failures due to FAC might occur. As the program's developer, I believe its continued use at VY will greatly assist in preventing problems with FAC during the license renewal period.

37. (JSH) NEC claims that CHECWORKS may not be used at VY during the initial years of license renewal operation because CHECWORKS is an empirical model that must be continuously updated with plant-specific data so that once "benchmarked" to a specific plant, it makes accurate predictions as long as plant parameters, such as velocity and coolant chemistry, do not change drastically. NEC argues that since those parameters have changed as a result of the EPU, it would take 10-15 years of inspection data collection and entry to the model following the power uprate to benchmark CHECWORKS for use at VY.

38. (JSH) There are two reasons why no such prolonged period of data collection is required to use CHECWORKS effectively at VY. First, the predictive algorithms built into CHECWORKS are based on all available laboratory data and FAC data from many plants. CHECWORKS was designed, and has been shown, to handle large changes in chemistry, flow rate and or other operating conditions typically found in power uprates. Its predictions provide "best estimates" of the FAC wear rates at particular plants, including VY. The plant-specific information that is obtained during plant inspections is used to adjust the estimates to more realistic levels that reflect the plant's configuration, water chemistry and operating conditions. Prolonged "benchmarking" as suggested by Dr. Hopenfeld will not result in identifying new locations to inspect, but will in most cases determine that inspections at certain locations are not necessary.

39. (JSH) Second, as indicated above, by the time the VY license renewal is in effect (in the year 2012), inspection data for three refueling outages under EPU conditions will have been obtained. These additional data sets, when added to the CHECWORKS database, will result in more refined wear rate predictions. Based on my experience with the use of CHECWORKS, those additional inspection data sets are sufficient to calibrate the CHECWORKS predictions to provide a good fit to the VY post-EPU conditions.

40. (JSH) NEC also asserts that it may be necessary to modify the FAC program as a plant ages and that Entergy's license renewal application does not explain how it proposes to use CHECWORKS as an aging management tool during the period of extended operation, or how it will overcome the problem of establishing valid

trends at higher EPU velocities. These concerns are unwarranted. CHECWORKS has the demonstrated ability to handle without problems the impact of changes of operating conditions in units, such as VY, that undergo chemistry changes or power uprates. Further, EPRI periodically re-examines the success of the program in predicting piping and component wear rates and refines the model as necessary. Thus, the predictive model has been improved over the years as more plant experience and inspection data has become available, keeping the program an effective aging management tool.

VI. SUMMARY AND CONCLUSIONS

41. (JSH, JCF) Our testimony in this Joint Declaration justifies the following conclusions:

- The program that VY has proposed for managing the loss of piping and component material due to FAC during the period of extended operation after license renewal, which consists of the use of CHECWORKS as a predictive tool together with results from other plant inspection programs, relevant industry operating experience, engineering judgment, consideration of the consequences of failure of a particular component with respect to personnel safety and plant availability, and other factors, will adequately predict the locations where piping inspections must be conducted so the potential adverse effects of FAC may be avoided.

- The program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

- CHECWORKS can be used effectively during the VY license renewal period as an aging management tool, without the need to further "benchmark" it for EPU plant operating conditions beyond the refinements resulting from the inspections during the three refueling outages prior to license renewal.

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

Jeffrey S. Horowitz
Executed on May 30, 2007

James C. Fitzpatrick
Executed on May 31, 2007

RESUME

Jeffrey S. Horowitz, ScD
3331 Avenida Sierra
Escondido, California 92029
(760)-747-8714 – home
(760)-747-1397 – office
JSHorowitz@aol.com

PROFESSIONAL EXPERIENCE

1985 – Present Independent consultant working in the nuclear and mechanical engineering fields. Consultant to EPRI (Electric Power Research Institute) on single and two-phase flow-accelerated corrosion (also known as erosion-corrosion), cavitation, thermal-hydraulic analyses, void fraction correlation and service water corrosion.

Principal creator of CHEC, CHECMATE and CHECWORKS, the computer programs which predict single-phase and two-phase flow-accelerated corrosion. CHECWORKS is currently used to improve maintenance efficiency and enhance safety in more than 150 nuclear units worldwide.

Consultant to Ontario Power Generation, Inc., the CANDU (Canadian Deuterium Uranium reactors) Owners Group, Exelon Corporation, Pacific Gas & Electric and Southern California Edison on issues of nuclear safety.

Co-author of three books and 17 published EPRI reports. Sole author of 10 published EPRI reports.

1980 - 1984 Program Manager, U.S. Department of Energy, 9800 South Cass Avenue, Argonne, Illinois, 60439, 630-252-2000, Frank Herbaty, supervisor:

Managed substantial portions of the Industrial Co-generation, Magneto-hydrodynamics (MHD) and Ocean Thermal Energy Conversion (OTEC) Programs at the Chicago Operations Office. The annual value of the work I managed was about $10 million.

Promoted from GS-13 to GS-14.

1977 – 1980 Mechanical Engineer, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439, 630-252-2000. Dr. Norman Sather, supervisor:

Government Technical Manager on several, multi-million dollar OTEC power systems studies and heat exchanger construction programs.

Conducted design studies, computer modeling and laboratory testing on a metal-hydride heat pump system.

Promoted from Assistant Mechanical Engineer to Mechanical Engineer.

1973 - 1977 Principal Engineer, Combustion Engineering, 1000 Prospect Hill Road, Windsor, CT 06095, 860-688-1911, Dr. Hector Guerrero, supervisor:

Lead engineer on a series of nuclear safety experiments including tests on an alternate emergency core cooling system, steam generator depressurization, re-flood heat transfer and an innovative primary system flow meter.

1972 - 1973 Nuclear Engineer, Quadrex Corporation, 477 Division Street, Campbell, California, (company now defunct), Randolph Broman, supervisor:

Conducted various nuclear safety analyses.

Wrote and modified computer programs (e.g., RELAP and CONTEMPT) related to nuclear safety. The areas of focus included boiling water reactor loss of coolant accident analysis, pipe rupture loads and effects, building pressurization and hydraulic loads resulting from valve closure.

REFERENCES

Professional and personal references available on request.

EDUCATION

ScD	Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, MA 02139, 1972
Mech Eng	Mechanical Engineering, Massachusetts Institute of Technology, 1968
MS	Mechanical Engineering, Massachusetts Institute of Technology, 1968
BSME	Mechanical Engineering, Magna Cum Laude, New Jersey Institute of Technology, Newark, NJ 07102, 1966
	Bayonne High School, Bayonne, New Jersey 07002

HONORS

American Nuclear Society, Fellow
American Society of Mechanical Engineers, Fellow
Sigma Xi (Honorary Scientific Research Society)
National Science Foundation Graduate Fellowship
Tau Beta Pi (Engineering Honor Society)
Pi Tau Sigma (National Mechanical Engineering Honor Society)
Honors on Admission, New Jersey Institute of Technology

PATENTS AND PUBLICATIONS

U.S. Patent – Patent Number 4,372,376, Heat Pump Apparatus, February 8, 1983.

Books

Co-author of the EPRI book, ***Pressure Drop Technology for Design and Analysis,*** published 1999.

Co-author of the EPRI book, ***Flow-Accelerated Corrosion in Power Plants***, published 1996 and revised in 1998.

Co-author of the EPRI book, ***Void Fraction Technology for Design and Analysis,*** published 1997.

Published Reports – sole author of the following EPRI Reports

Investigation into Flow-Accelerated Corrosion at Low Temperatures, EPRI Report, to be published.

Computer-Based Training Module on Erosion in Piping Systems. EPRI Report 101357, to be published.

Computer Based Training Module on Flow-Accelerated Corrosion (FAC) for non-FAC Personnel, EPRI Report 1013249, May 2006.

Determining Piping Wear Caused by Flow-Accelerated Corrosion from Single-Outage Inspection Data, EPRI Report 1013012, March 2006.

An Evaluation of Flow-Accelerated Corrosion in the Bottom Head Drain Lines of Boiling Water Reactors, EPRI Report 1013013, March 2006.

Chemistry Effects on Flow-Accelerated Corrosion – PWR: Hydrazine and Oxygen Investigations, EPRI Report 1011835, November 2005.

Chemistry Effects on Flow-Accelerated Corrosion – BWR: Dissolved Oxygen Investigation, EPRI Report 10118330, November 2005.

Recommendations for Controlling Cavitation, Flashing, Liquid Droplet Impingement, and Solid Particle Erosion in Nuclear Power Plant Piping Systems, EPRI Report 1011231, November 2004.

Flow-Accelerated Corrosion Investigations of Trace Chromium, EPRI Report 1008047, November 2003.

Selective Attack of Welds by Flow-Accelerated Corrosion, EPRI Report 1007057, July 2002.

Published Reports – co-author of the following EPRI Reports

Recommendations for an Effective Flow-Accelerated Corrosion Program (NSAC-202L-R3), EPRI Report 1011838, May 2006.

Recommendations for an Effective Flow-Accelerated Corrosion Program, NSAC-202L, Revision 2, April 1999.

CHECUP™, a CHECWORKS™ Application for FAC Evaluation of Fossil Power Plants – Users Guide, EPRI TR-103198-P5, November 1998.

CHECWORKS™ Computer Program Users Guide, EPRI TR-103198-P1, December 1997.

Guidelines for Controlling Flow-Accelerated Corrosion in Fossil Plants, EPRI TR-108859, November 1997.

Recommendations for an Effective Flow-Accelerated Corrosion Program, NSAC-202L, Revision 1, January 1997.

Understanding Void Fraction in Steady State and Dynamic Environments, EPRI TR-106326, August 1996.

Recommendations for an Effective Flow-Accelerated Corrosion Program, NSAC-202L, November 1993.

An Analysis of BWR Fuel Heatup During a Loss of Coolant While Refueling, NSAC-169, November 1991.

CHEC-NDE™ a Tool for Managing Non-Destructive Evaluation Data from Pipe Inspections, EPRI NP-7017-CCML, NSAC-149L, April 1991.

CHECMATE™ Computer Program Users Guide, NSAC-145L, Original May 1989, and Rev. 1, April 1991.

The Chexal-Lelouche Void Fraction Correlation for Generalized Applications, NSAC-139, April 1991.

CHEC® Computer Program Users Manual, NSAC-112L, Original July 1987 and Rev. 1, July 1989.

An Assessment of Eight Void Fraction Models for Vertical Flows, NSAC-107, December 1986.

A Full-Range Drift-Flux Correlation for Vertical Flows (Revision 1), EPRI NP-3989-SR, September 1986.

Response of a B&W Plant to Steam Generator Tube Ruptures, NSAC-101, September 1986.

EPRI R&D Contributions to the Technical Basis for Revision of ECCS Rules, EPRI NP-4146-SR, July 1985.

Technical Papers – More than 40 published technical papers on nuclear safety analysis, thermal-hydraulics, and flow-accelerated corrosion.

RESUME
JAMES C. FITZPATRICK

SUMMARY QUALIFICATIONS:

Twenty-nine years experience in design, construction, and modifications of nuclear power plant structures, piping systems, pressure vessels, and anchorage of mechanical and electrical equipment. Twenty-one years of operating plant engineering support in both the mechanical and structural areas. Responsible for development and implementation of plant design changes, inspection programs, equipment specifications, installation support, outage support, and operability evaluations of degraded components.

EDUCATION AND LICENSES:

Northeastern University, Boston Ma. - M.S. Civil Engineering (1984).
Northeastern University, Boston Ma. - B.S. Civil Engineering (1977).
Registered Professional Engineer - Massachusetts, Vermont.

PROFESSIONAL EXPERIENCE:

Entergy Nuclear Northeast - Vermont Yankee (2002 –present) Sr. Lead Engineer, Design Engineering.

Responsible Engineer for implementation and maintenance of the Piping FAC Inspection Program. Performed piping component inspection selections, evaluations of inspection results, trending of refueling outage inspection data, updating the CHECWORKs predictive models, and engineering changes for repair or replacement of piping components. Provided support for License Renewal Project for aging management issues related to FAC and metal fatigue. Responsible Engineer for mechanical/structural analyses and modifications associated with extended power uprate. Projects include Alternate Source Term Seismic Boundary, Cooling Tower Modifications, and a Revised Stress Analysis of Reactor Feedwater Nozzles. Provided engineering support for ASME Section XI and Reactor Vessel Inspection Programs.

Vermont Yankee Nuclear Power Corp. (1997 - 2002) Senior Engineer, Design Engineering.
Yankee Atomic Electric Company (1991 - 1997) Senior Mechanical Engineer, Vermont Yankee Project.

Cognizant engineer with overall responsibility for development and implementation of a number of Engineering Design Changes including replacement of check valves on the Reactor Feedwater System, seismic supports for control room panels and electrical equipment, new station air compressors with associated piping, and GE Mark 1 Torus piping support modifications. Responsible for structural engineering support for ASME Section XI IWE inspections. Developed acceptance criteria for localized thinning of a GE Mark I containment.

Cognizant engineer for Piping Flow Accelerated Corrosion (FAC) Inspection Program. Responsible for program implementation, establishing and maintaining criteria for selection of systems and components susceptible to FAC. Tasks include CHECWORKS modeling of plant piping systems, development of refueling outage inspection scope, providing on-site engineering support, screening and evaluation of piping components, inspection sample expansion, coordination of repairs and replacements, and maintenance of Program Manual and documentation.

Seismic Capability Engineer for SQUG program. Performed equipment walkdowns, screening evaluations, anchorage calculations, and preparation of licensing submittal for resolution of USI-A46 and the seismic portion of the IPEEE. Developed and implemented design changes to resolve SQUG GIP criteria Outliers and to resolve Design Basis concerns. Provided mechanical/structural engineering support for procurement of new and replacement equipment. Responsible for development of design specifications and review of seismic qualification test reports. Also provided engineering support and evaluations for ASME Section XI and Service Water inspection programs. Performed evaluations of degraded Service Water piping components for Generic Letter 90-05 submittals.

Yankee Atomic Electric Company (1988 - 1990) Senior Engineer, Vermont Yankee Project.

Responsible for development of a long term Piping Erosion-Corrosion (FAC) Inspection Program, evaluations of plant piping systems for erosion-corrosion using the EPRI CHEC and CHECMATE codes, and for E/C inspection scope and on-site engineering support for both the 1989 and 1990 refueling outages. Designed seismic modifications and developed finite element models for the control room panels. Provided mechanical/structural support for a number of plant design changes. Developed ASME Code Case N-411 Seismic Response Spectra for the Turbine Building.

Yankee Atomic Electric Company (1986 - 1987) Mechanical Engineer, Vermont Yankee Project.

Provided engineering support for a number of plant design changes to both structures and mechanical systems. Projects included: Modifications to the Torus RHR and Core Spray suction strainers, Seismic Re-analysis Program for safety class piping, Revised LOCA pressure loads in the Steam Tunnel, and the design and installation of New Spent Fuel Racks. Performed evaluation for corrosion of the bottom plates in the Condensate Storage Tank and assisted in preparation of the response to NRC Bulletin 87-01 - Pipe Wall Thinning.

Stone and Webster Engineering Corporation(1984 - 1986)

Mechanical Engineer, Engineering Mechanics Division - Beaver Valley Unit No.2 Project, Responsible for qualification of safety related equipment for deadweight, thermal, seismic, and attached piping loads. Duties included the supervision of an engineering group developing allowable piping reactions for Safety Class equipment and performing ASME III stress analyses of tanks and vessels. Responsible for resolution of piping nozzle overloads between the pipe stress analysis and equipment qualification groups.

CYGNA Energy Services(1980 - 1984)

Senior Engineer(1983-84) - Performed engineering studies, analyses, and developed new designs for a number of modifications at both the Maine Yankee and Vermont Yankee plants. Typical projects included; MY 79-02 Base Plate Reanalysis, MY Auxiliary Feedwater Modifications, VY RCIC Room HVAC and Structural Modifications, and VY Torus Attached Piping Modifications.

Lead Engineer - Group Leader(1882-83) - Group Leader for the Diablo Canyon pipe Support Design Review. Responsible for review and approval of design calculations, supervision of pipe support analysts, conceptual pipe support modifications, and providing technical direction to engineers.

Lead Engineer - Group Leader(1981-82) - Supervised on-site engineering group responsible for the analysis and design of over 100 new pipe rupture restraints for Midland units 1 and 2. Responsible for development and implementation of design criteria and work instructions, providing technical direction to engineers, review and approval of calculations and drawings, resolution of interference's with other groups, and the preparation of status reports and schedules.

Staff Engineer(1980-81) - Responsible for development of computer models and amplified response spectra curves for six structures and the NSSS at Maine Yankee . Developed artificial acceleration time histories to envelope NRC R.G.1.60 Ground Response Spectra. Performed analyses and designed seismic modifications for masonry block walls as required by NRC Bulletin 80-11 for Millstone Unit 1.

Stone and Webster Engineering Corporation(1977 - 1980)

Support Engineer, Engineering Mechanics Division - Assigned to the Structural Mechanics Section on the Beaver Valley Unit 2 Project. Developed computer models for generation of seismic floor response spectra curves used for design of plant structures and equipment. Performed design review of the concrete containment internals structure for increased seismic and pipe rupture loads. Reviewed ASME III Stress Reports for design of containment liner, overlay and insert pads, and containment hatches. Developed finite element models for analysis of ASME III Code Class MC containment piping penetrations. Assisted in the development of TVB, an in-house computer code to determine tornado wind and pressure drop effects on structures. Developed models to perform tornado venting studies for BV-2 plant structures.

PROFESSIONAL AFFILIATIONS:

Member, American Society of Civil Engineers

Summary of Observations During VY Site Visit

Introduction
On April 4 & 5, 2007, I visited the Vermont Yankee Nuclear Power Station. The purpose of this visit was to perform a technical assessment of the Flow-Accelerated (FAC) Program at Vermont Yankee and to evaluate the program against U.S. industry standards on the implementation of FAC programs.

Approach
I met with James Fitzpatrick, the current program owner, and Ryan Lane, the soon-to-be-program owner. I interviewed them, reviewed reports and examined past assessments. A list of the documents reviewed is presented at this end of this letter. I compared the procedures and practices in place at Vermont Yankee with current U.S. standards and practices as described in EPRI report, "Recommendations for an Effective Flow-Accelerated Corrosion Program (NSAC-202L-R3)," EPRI Report 1011838, May 2006. This document is the currently accepted industry standard on FAC program implementation. I also reviewed Condition Reports written against the FAC program and determined that for the most part they dealt with administrative issues and did not bring into question the technical sufficiency of the program.

Conclusions
As a result of this visit and based on my experience with evaluating FAC programs at nuclear power plants, I conclude that the FAC Program at Vermont Yankee has ample strengths and no apparent weaknesses. This conclusion agrees with previous self-assessments and with assessments performed by other organizations such as EPRI.

I further conclude that there are no significant areas of program deficiency requiring correction. I do, however, have a several recommendations to increase the efficiency of the program. These recommendations will be presented later in this letter.

Program Strengths
The following program strengths were observed:

- **Personnel.** At Vermont Yankee, there is an experienced FAC lead with a trained backup. Both of these engineers have been in their current roles for more than 10 years. Further, an engineer is being trained to assume the lead role. The long transition program in place will assure a good turnover of responsibilities. The current lead, the backup and the future lead all have completed EPRI CHECWORKS™ training.

- **Plant Design.** The plant design at Vermont Yankee is relatively simple, featuring a Boiling Water Reactor having no reheaters and a relatively small number of feedwater heaters. These facts combined with the extensive use of FAC resistant (i.e., high chromium content) materials in the original construction (e.g., extraction lines) have resulted in only limited areas of the plant being susceptible to FAC.

- **Susceptibility Analysis.** A formal susceptibility analysis (see Document # 3) was performed to account for the changes of operating conditions found on implementing the Extended Power Upgrade (EPU). As the operating parameters governing the rates of FAC change as a result of the EPU, the implications on FAC susceptibility was examined.
  The updated susceptibility analysis is one example of following industry best practices. Similarly, the impacts of changing water chemistry from Normal Water Chemistry to Hydrogen Water Chemistry on FAC rates were examined and documented.

- **Water Chemistry.** The maintenance of 40 parts per billion dissolved oxygen in the condensate and feedwater system limits the rate of FAC in these systems. Further, the long time use of Normal Water Chemistry was recently replaced with Hydrogen Water Chemistry (HWC). While HWC provides protection to stainless steel portions of the reactor system from inter-granular stress corrosion cracking, its use does increase the susceptibility to FAC in the steam portion of the system.

- **Industry experience.** Good practices are being followed with incorporating industry experience into the FAC program. Operating experience reports are reviewed for applicability and incorporated into the program as necessary. An example of this process is the Vermont Yankee response to the Mihama accident (see document # 2, below).

- **Inspection Scope.** The number of required inspections is decreasing with time. This is an indicator of a successful program. This trend is partially due to the use of FAC resistant steels in replacements, and the pro-active replacement of susceptible small-bore lines with resistant materials.
  In the short term, it is planned to increase the number of inspections by 50% for the next three refueling outages. This increase is designed to obtain additional base line information to account for the EPU. This is a prudent, conservative approach to the change of operating conditions.

- **Emergent Work.** There have been a very limited number of FAC-related, emergent work items (e.g., sample expansions) being identified as necessary during outages. This too is an indicator of a successful program.

- **Inspection Balance.** There appears to be a good balance between new inspection locations (i.e., areas not previously inspected) and old inspection locations. Selection of new areas comes from several sources including industry experience. The criteria for selecting the new areas for inspection are appropriate and consistent with those utilities at other sites and with EPRI's recommendations. Old inspections locations are included based on past inspection results.

- **Inspection Coverage.** Inspection coverage (i.e., number of components inspected) is excellent. Most of these inspections have multiple sets of inspection data.

- **Outage Reporting.** The reports prepared following an outage are well done. These reports are notable as they provide a detail explanation of why each component has been selected for inspection. This feature greatly assists in program turnover.

- **Replacement Material.** Planned piping replacements and pro-active replacements are made with resistant material. This further reduces the scope of FAC susceptible piping. Note that piping constructed of resistant material need not be inspected for FAC degradation because it is not susceptible to FAC.

- **Assessments.** There have been numerous, favorable program assessments by external reviewers (e.g., EPRI) and self-assessments performed. See, for example, documents #4, 6, 7, & 8 in the list below.

- **Organization.** As part of Entergy's fleet of operating reactors, the FAC program at Vermont Yankee uses common, corporate procedures (e.g., documents #1, 13 and 14). Further, periodic communications between FAC program owners at various plants allow for experience sharing with the other Entergy sites.

Program Weaknesses
No program weaknesses were identified.

Areas for Improvement
There were no areas of required improvement identified that are not included in the current plans.

Recommendations
Based on this visit, the following recommendations are submitted. They are intended to increase the efficiency and effectiveness of what is already a good program.

- The CHECWORKS™ program should be updated from the current version (Version 1.0G) to the Steam Feedwater Application Version 2.2. Version 2.2 was released late last year, and incorporates technical changes as well as user convenience improvements. The technical changes should not impact the results at VY. However, EPRI plans to discontinue support for Version 1.0G in the near future. I understand that this conversion activity is in the current plans for 2008.

- The results of the CHECWORKS™ analysis and of the FAC implications of the Extended Power Uprate, already in the process of being documented (document #9), should be released in a final, formal report. I understand that this action is in process.

- Measurements of the alloy content of components subject to FAC have been found to beneficial at a large number of plants. It is recommended that the acquisition of an alloy analyzer be considered. Alloy data would probably resolve some of the data outliers and could result in a reduced inspection scope.

- It is recommended that the outliers present in the CHECWORKS™ model be examined with the aim of better understanding the reasons for them not agreeing with the model's predictions. Similarly, it is recommended that lines with out of range line correction factors (LCF) be reexamined to try to resolve the reasons for the LCFs being out of range. These actions would provide more confidence in the CHECWORKS™ predictions and result in a reduced inspection scope. Note that the use of CHECWORKS™ SFA Version 2.2 will facilitate the handling of multiple sets of inspection data. This too will help provide more accurate LCFs.

Documents Reviewed

The following documents were reviewed in the course of this assessment:

1. "Flow Accelerated Corrosion Program," EN-DC-315, December 1, 2006.
2. "VY Response to USNRC Information Notice 2006-08 (LO-OEN-00122 CA 6)," March 16, 2006.
3. "Vermont Yankee Piping Flow Accelerated Corrosion Inspection Program – FAC Susceptibility Review," VY-RPT-05-00012, October 25, 2005.
4. Letter from the Nuclear Regulatory Commission, October 19, 2005. This letter had "no significant findings" on the FAC program.
5. "Vermont Yankee Condition Report," CR-VTY-2005-02239.
6. "Focused Self-Assessment Report," October 2004, Condition Report LO-VTYLO-2003-00327.
7. Quality Assurance Audit, QA-8-2004-VY-1.
8. EPRI Letter February 28, 2000.
9. "Vermont Yankee Piping FAC Inspection Program EPU Wear Rate Study," draft, VY-RPT-05-00107 Rev 0.
10. Program Health Reports, various dates.
11. Chemistry Monthly Report, July 2006
12. Vermont Yankee Piping FAC Inspection Program Wear Rate Analysis Results, Cycle 25 with Inspection Data up to RFO 25," preliminary, September 28, 2006.
13. "Flow Accelerated Corrosion Component Scanning and Gridding Standard," ENN-EP-S-005, Rev 0, August 11, 2004.
14. "Pipe Wall thinning Structural Evaluation," ENN-CS-S-008, Rev 1, December 11, 2006.

This letter is respectfully submitted, May 29, 2007,

Jeffrey S. Horowitz, ScD