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October 31, 2000
BVY 00-99

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Subject: **Vermont Yankee Nuclear Power Station**
License No. DPR-28 (Docket No. 50-271)
Request For Alternative Testing Per 10CFR50.55a(a)(3)(i)
Inservice Testing Program – Excess Flow Check Valves

Pursuant to 10CFR50.55a(a)(3)(i), Vermont Yankee (VY) hereby requests approval to perform alternative testing to that specified by the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, and ASME/ANSI OM, "Operation and Maintenance of Nuclear Power Plants." The proposed alternative would allow relaxation of the frequency of surveillance testing of excess flow check valves in certain small diameter instrumentation lines. Attachment 1 provides Relief Request RR-V19, which describes the alternative testing and lists the applicable components. Attachment 2 provides a safety assessment and information supporting the request for relief from performing surveillance testing every refueling outage for each excess flow check valve.

Approval for the use of the alternative testing is requested by March 31, 2001 in order to support scheduled testing. Upon approval, this alternative test frequency will be incorporated into the VY Inservice Testing Program Plan.

If you have any questions on this transmittal, please contact Mr. Thomas B. Silko at (802) 258-4146.

Sincerely,

VERMONT YANKEE NUCLEAR POWER CORPORATION

Robert J. Wanczyk
Director of Safety and Regulatory Affairs

Attachments

cc: USNRC Region 1 Administrator
USNRC Resident Inspector - VYNPS
USNRC Project Manager - VYNPS
Vermont Department of Public Service

A047

Docket No. 50-271
BVY 00-99

Attachment 1

Vermont Yankee Nuclear Power Station

Request for Alternative Testing per 10CFR50.55a(a)(3)(i)

Inservice Testing Program – Excess Flow Check Valves

Relief Request RR-V19

RELIEF REQUEST

Number: RR-V19, Revision 0 (Sheet 1 of 4)

SYSTEMS: Nuclear Boiler
High Pressure Coolant Injection
Reactor Core Isolation Cooling
Recirculation Pump Cooling Water

COMPONENTS:

Valve Number	OM Cat.	Safety Class	Drawing Number	Dwg. Coord.
SL-13-55A	A/C	2	G-191174 Sh 1	B-08
SL-13-55B	A/C	2	G-191174 Sh 1	C-08
SL-13-55C	A/C	2	G-191174 Sh 1	B-08
SL-13-55D	A/C	2	G-191174 Sh 1	C-08
SL-14-31A	A/C	2	G-191168	F-07
SL-14-31B	A/C	2	G-191168	E-07
SL-2-62A	A/C	2	G-191167	I-13
SL-2-62B	A/C	2	G-191167	I-13
SL-2-62C	A/C	2	G-191167	J-13
SL-2-62D	A/C	2	G-191167	J-13
SL-2-64A	A/C	2	G-191167	K-13
SL-2-64B	A/C	2	G-191167	K-13
SL-2-64C	A/C	2	G-191167	K-13
SL-2-64D	A/C	2	G-191167	L-13
SL-2-73A	A/C	2	G-191167	F-12
SL-2-73B	A/C	2	G-191167	F-12
SL-2-73C	A/C	2	G-191167	G-12
SL-2-73D	A/C	2	G-191167	G-12
SL-2-73E	A/C	2	G-191167	G-12
SL-2-73F	A/C	2	G-191167	G-12
SL-2-73G	A/C	2	G-191167	H-12
SL-2-73H	A/C	2	G-191167	H-12
SL-2-2-7A	A/C	2	G-191159 Sh 5	G-02
SL-2-2-7B	A/C	2	G-191159 Sh 5	G-02
SL-2-2-8A	A/C	2	G-191159 Sh 5	G-02
SL-2-2-8B	A/C	2	G-191159 Sh 5	G-02
SL-2-3-11	A/C	2	G-191267 Sh 1	C-06
SL-2-3-13A	A/C	2	G-191267 Sh 1	D-06
SL-2-3-13B	A/C	2	G-191267 Sh 1	C-12
SL-2-3-15A	A/C	2	G-191267 Sh 1	D-06
SL-2-3-15B	A/C	2	G-191267 Sh 1	D-12
SL-2-3-17A	A/C	2	G-191267 Sh 1	E-06
SL-2-3-17B	A/C	2	G-191267 Sh 1	E-12
SL-2-3-19A	A/C	2	G-191267 Sh 1	F-06
SL-2-3-19B	A/C	2	G-191267 Sh 1	F-12

RELIEF REQUEST

Number: RR-V19, Revision 0 (Sheet 2 of 4)

Valve Number	OM Cat.	Safety Class	Drawing Number	Dwg. Coord.
SL-2-3-21A	A/C	1	G-191267 Sh 1	H-06
SL-2-3-21B	A/C	1	G-191165	C-13
SL-2-3-21C	A/C	1	G-191267 Sh 1	I-12
SL-2-3-21D	A/C	1	G-191165	C-13
SL-2-3-23A	A/C	1	G-191267 Sh 1	G-06
SL-2-3-23B	A/C	1	G-191267 Sh 1	G-06
SL-2-3-23C	A/C	1	G-191267 Sh 1	G-12
SL-2-3-23D	A/C	1	G-191267 Sh 1	G-12
SL-2-3-25	A/C	2	G-191267 Sh 1	I-04
SL-2-3-27	A/C	2	G-191267 Sh 1	I-06
SL-2-3-31A	A/C	1	G-191267 Sh 1	F-06
SL-2-3-31B	A/C	1	G-191267 Sh 1	F-06
SL-2-3-31C	A/C	1	G-191267 Sh 1	F-06
SL-2-3-31D	A/C	1	G-191267 Sh 1	F-06
SL-2-3-31E	A/C	1	G-191267 Sh 1	F-06
SL-2-3-31F	A/C	1	G-191267 Sh 1	F-06
SL-2-3-31G	A/C	1	G-191267 Sh 1	F-06
SL-2-3-31H	A/C	1	G-191267 Sh 1	F-06
SL-2-3-31I	A/C	1	G-191267 Sh 1	F-12
SL-2-3-31J	A/C	1	G-191267 Sh 1	F-12
SL-2-3-31K	A/C	1	G-191267 Sh 1	F-12
SL-2-3-31L	A/C	1	G-191267 Sh 1	F-12
SL-2-3-31M	A/C	1	G-191267 Sh 1	F-12
SL-2-3-31N	A/C	1	G-191267 Sh 1	F-12
SL-2-3-31P	A/C	1	G-191267 Sh 1	F-12
SL-2-3-31Q	A/C	1	G-191267 Sh 1	F-12
SL-2-3-33	A/C	2	G-191267 Sh 1	I-12
SL-2-3-35	A/C	2	G-191267 Sh 1	J-06
SL-2-305A	A/C	2	G-191167	M-02
SL-2-305B	A/C	2	G-191167	M-02
SL-23-37A	A/C	2	G-191169 Sh 1	F-05
SL-23-37B	A/C	2	G-191169 Sh 1	F-05
SL-23-37C	A/C	2	G-191169 Sh 1	F-05
SL-23-37D	A/C	2	G-191169 Sh 1	F-05

EXAM OR TEST CATEGORY:

Category A/C

RELIEF REQUEST

Number: RR-V19, Revision 0 (Sheet 3 of 4)

FUNCTION:

These valves are instrumentation line excess flow check valves (EFCVs) provided in each instrument line process line that penetrates primary containment. The EFCVs are designed to close upon rupture of the instrument line downstream of the EFCV and should otherwise remain open. A flow-restricting orifice is installed just inside the drywell on all but the jet pump instrument lines. Because the jet pump instrument lines are small diameter, orifices are not needed. In the unlikely event where an EFCV fails to function properly concurrent with a postulated line break outside containment, orificing and small tube diameters limit flow rates, thus ensuring that the integrity and functional performance of secondary containment is maintained. The coolant loss under such a scenario is well within the makeup capability of reactor coolant supply systems, and the potential off-site radiological consequences have been evaluated to be substantially below the limits of 10CFR100.

CODE REQUIREMENT:

EFCVs are required to be inservice tested pursuant to VY Technical Specifications 4.6.E.2 and 10CFR50.55a, which specify testing in accordance with the applicable ASME Code Section. Paragraph 4.3.2.1 of ASME OM-10 requires examining or exercising check valves nominally every three months to the positions in which they perform their safety functions. Paragraph 4.3.2.2(e) allows deferral of this requirement to at least once every reactor refueling outage. Paragraph 4.2.2.3 requires Category A valves, other than containment isolation valves to be tested at least once every 2 years.

The EFCVs are classified as ASME Code Category A and are also considered to be containment isolation valves. However, these valves are excluded from 10CFR50 Appendix J Type C leak rate testing due to the size of the lines and upstream orificing.

PROPOSED ALTERNATIVE:

Rather than test each EFCV every refueling outage, this relief request would provide that only a representative sample of EFCVs be tested each refueling outage, such that all EFCVs are tested within a 10-year interval (nominal).

JUSTIFICATION:

A representative sample of these excess flow check valves will be exercised closed and open each refueling outage during performance testing done in accordance with Paragraphs 4.2.2.3, 4.3.2.2(e), and 4.3.2.2(h) of Part 10 of the Code. All valves will be tested within a 10-year interval (nominal).

These valves cannot be exercised closed during normal (power) operation since closing these valves would isolate instrumentation required for power operation. These valves can only be verified to close by leak testing performed during the primary system inservice pressure test performed each refueling outage. This test cannot be repeated during cold shutdown since reactor vessel pressurization is required to test the valves.

EFCVs are simple devices, the major active components being a poppet and spring. The spring holds the poppet open under static conditions. The valve will close upon sufficient differential pressure across the

RELIEF REQUEST

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poppet. Functional testing of the valve is accomplished by venting the instrument side of the line. The resultant increase in flow imposes a differential pressure across the poppet, which compresses the spring and decreases flow through the valve.

EFCVs have been extremely reliable throughout the industry[1]. In the first 27 years of operation at VY, only one excess flow check valve has failed. VY has evaluated the consequences of a postulated instrument line break without crediting EFCV function, and the calculated off-site radiological consequences are sufficiently low and acceptable considering the probability of an instrument line break coincident with the functional failure of the associated EFCV. Any increase in risk due to the relaxed frequency of EFCV testing is insignificant. Therefore, the alternative testing of a representative sample, rather than each EFCV during every refueling outage, provides an acceptable level of quality and safety.

[1] NEDO-32977-A, "Excess Flow Check Valve Testing Relaxation" (June 2000)

Attachment 2

Vermont Yankee Nuclear Power Station

Request for Alternative Testing per 10CFR50.55a(a)(3)(i)

Inservice Testing Program – Excess Flow Check Valves

Supporting Information and Safety Assessment

INTRODUCTION

The following supporting information and safety assessment provide the basis for alternative testing of excess flow check valves (EFCVs) in instrument lines connected to the reactor coolant pressure boundary at Vermont Yankee (VY). Due to the high degree of EFCV reliability and the low consequences of an EFCV failure, a relaxed test frequency is justified. The proposed alternative testing will provide an acceptable level of quality and safety.

10CFR50.55a requires inservice testing (IST) of certain nuclear power facility components in accordance with Section XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code and applicable addenda, except where alternatives have been authorized or relief has been granted by the NRC.

VY Licensing Basis

VY Technical Specification (TS) 3.7.D.1 requires that instrument line flow check valves shall be operable during reactor power operations. TS Bases 4.7.D states that these EFCVs are tested for operability in accordance with TS 4.6.E, and TS 4.6.E.2 requires inservice testing (IST) of safety-related pumps and valves in accordance with the ASME Code and 10CFR50.55a. EFCVs in reactor instrument lines are among those safety-related valves subject to these provisions. Unlike Standard Technical Specifications[1] (i.e., Surveillance Requirement 3.6.1.3.10), there is no VY TS surveillance requirement solely specific to EFCV testing. The safety-related EFCVs fall under the provisions of VY's IST program and are considered containment isolation valves, although Type C testing is not required by Appendix J of 10CFR50.

Currently ROJ-V01 allows testing of EFCVs every refueling outage, rather than the code required frequency of every 3 months. The refueling outage frequency is based on the need to perform this surveillance under the conditions that apply during a plant outage while avoiding the potential for an unplanned operational transient if the surveillance were performed with the reactor at power.

Proposed Alternative

The proposed alternative would allow relaxation of the frequency of surveillance testing by allowing a "representative sample" of EFCVs to be tested every refueling outage, such that all EFCVs are tested within a 10-year interval (nominal), rather than testing each EFCV during every refueling outage. The intent is to test approximately equal numbers of EFCVs during each refueling outage. For the current 18-month (nominal) operating cycles, this equates to testing approximately 17% of the EFCVs during each refueling outage. Operating experience has demonstrated that these components are highly reliable and that failures to isolate are infrequent. Furthermore, the radiological dose consequences would be low if an instrument line broke and the associated EFCV failed to close during normal operation.

VY does not need a license amendment or change to the Technical Specifications to implement the Relief Request when approved and incorporated into the IST program. The safety significance of EFCVs is very small and therefore does not need to be addressed by plant Technical Specifications.

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[1] NUREG 1433, Revision 1, "Standard Technical Specifications for General Electric Plants, BWR/4 (April 1995)

Licensing Topical Report (LTR)

The NRC has previously reviewed and accepted[2] for generic application a Boiling Water Reactor Owners Group (BWROG) topical report which provides justification for relaxed testing requirements for EFCVs in instrument lines connected to the reactor coolant pressure boundary. Following NRC approval, the BWROG published the accepted version of the LTR as NEDO-32977-A[3]. This topical report provides EFCV reliability information, provides an acceptable methodology for justifying a reduced EFCV test frequency, and generically demonstrates that any increase in risk due to the reduced testing would be insignificant.

Pursuant to 10CFR50.55a(a)(3)(i), the NRC has previously authorized[4] a Relief Request for a reference plant to allow alternative testing, which is similar to VY's proposed alternative described herein.

VY was one of the BWROG participants in the preparation of the LTR and has applied the methodology and reliability evaluations contained in Sections 3 and 4 of NEDO-32977-A to support VY's plant-specific relief request. With respect to VY-specific data and evaluations, conclusions similar to those made in the LTR can be drawn relative to the risks associated with relaxed EFCV testing. In addition, the LTR identified the potential for reductions in outage schedule, costs, wastes, and worker risks associated with less frequent EFCV testing. Similar potential savings would apply to VY, although the estimates may vary.

BACKGROUND

EFCVs are used in VY instrument lines that penetrate containment to limit the release of reactor coolant in the event of an instrument line break. EFCVs are located outside primary containment, but close to the containment penetration (i.e., within one foot). Attachment 1 lists the 69 safety-related EFCVs currently in service at VY. Instrument lines containing EFCVs are 1 inch or less in diameter, and except for jet pump instrument lines, contain ¼ inch flow restricting orifices upstream of the EFCVs (i.e., inside primary containment). The VY jet pump instrument lines contain a section of pipe upstream of the EFCVs that is ¼ inch diameter (see also FSAR Section 5.2.4.8). The subject instrument lines include reactor pressure vessel level and pressure, HPCI and RCIC steam flow, and recirculation system flow and pressure instrumentation. Instrument lines that connect to the containment atmosphere do not contain EFCVs since such lines are not subject to high pressures, and their failure is not postulated concurrent with a loss-of-coolant accident (LOCA).

EFCVs are designed to mitigate, but are not credited to function in the evaluation of an instrument line rupture. The VY analysis of a postulated instrument line break shows that the resulting off-site dose would be well below regulatory limits. Further discussion on the radiological impact of a postulated instrument line break is provided in the accompanying "Safety Assessment."

VY EFCVs consist of three similar models from a single manufacturer. The valves are of similar design, similar application, and similar service environment. Information on the design and testing of VY EFCVs

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[2] Safety Evaluation of General Electric Nuclear Energy Topical Report B21-00658-01, "Excess Flow Check Valve Testing Relaxation" (TAC Nos. MA7884 and M84809) (March 14, 2000)

[3] NEDO-32977-A, "Excess Flow Check Valve Testing Relaxation," (June 2000)

[4] Duane Arnold Energy Center – Safety Evaluation of Relief Request for the Pump and Valve Inservice Testing Program Regarding Excess Flow Check Valve Surveillance Requirements (TAC No. MA6777) (March 28, 2000)

is included in NEDO-32977-A. As indicated in the LTR, one EFCV test failure was identified as having occurred at VY. No additional failures have occurred at VY since the data were provided for the LTR.

Corrective Action Program

In accordance with VY's corrective action program, all identified component failures require the generation of an Event Report (ER). In addition, any EFCV failure and associated corrective action will be addressed in accordance with the VY IST program's administrative and implementing procedures. Component failures require immediate evaluation, including the determination for retest, repair, replacement, and whether the potential for common mode failure exists. When the potential exists for common mode failure, the test sample will be expanded. The failure cause or mode will determine the expanded sample size and potential increased test frequency.

SAFETY ASSESSMENT

Safety Function

Although EFCVs are designed to automatically close in the event of a rupture of an instrument line, EFCVs are not required to close in response to a containment isolation signal and are not postulated to operate under post-LOCA conditions. Furthermore, EFCVs are not needed to mitigate the consequences of a design basis accident since an instrument line break coincident with a LOCA is of sufficiently low probability to be outside the design basis.

Surveillance Frequency

Operating experience has demonstrated that EFCVs are highly reliable and that failures to isolate are very infrequent. The proposed alternative, relaxing EFCV test frequency, is based on principles similar to other performance-based testing programs being implemented at VY, such as inservice testing of snubbers (in accordance with TS 4.6.I) and Option B of Appendix J to 10CFR50 (in accordance with TS 6.7.C). Under the revised IST program a representative sample will be tested during every refueling outage, such that each valve is tested at least once every 10 years (nominal). For the current 18-month (nominal) operating cycles, this equates to testing approximately 17% (i.e., approximately 12 out of a population of 69 EFCVs) during each 18-month operating cycle. This establishes an effective nominal 10 year test interval for all EFCVs. The sample selected for testing during each test interval should be representative of the various plant configurations, models, and operating environments. This ensures that any potentially common problem with a specific type or application of EFCV is detected at the earliest possible time. Any failures will be evaluated in accordance with VY's corrective action and IST Programs to determine if additional testing or other actions are warranted to ensure maintenance of overall reliability.

Operational Impact

The operational impact of an EFCV failing to close following an instrument line rupture would be the environmental effects of a steam release in the vicinity of the instrument racks. The magnitude of the release of steam through a VY instrument line has been determined to be within the pressure control capacity of reactor building ventilation systems, and the functional integrity of secondary containment would continue to be met. The separation of redundant equipment in the reactor building is also expected to minimize the impact of such a break due to such factors as jet impingement. However, continuously

monitored variables such as area radiation or temperature would alert operators and require reactor shutdown and depressurization to limit the release and allow manual isolation of the line.

EFCV Reliability

Industry and VY EFCV failure data are listed in the LTR. The LTR provides detailed information on EFCV testing and reported 11 observed failures in over 12,400 valve years of service. This is comparable to VY's one EFCV failure in (now) approximately 2,000 valve years of operation[5]. LTR Table 4-1 documents an industry composite EFCV failure rate of 1.01 E-07/hr and a VY failure rate of 6.62 E-08/hr. Therefore, it can be concluded that VY's EFCV failure rate is no worse than the industry average and the probability of a VY EFCV failing to close is less than the industry average failure rate reported in the LTR. These data demonstrate the high reliability of EFCVs in reactor instrumentation lines at VY, as well as the industry as a whole.

Instrument Line Break Frequency

Another factor in estimating the probability of a radiological release is the estimated frequency of an instrument line break. The subject LTR considered small pipe failure rates based on WASH-1400 data, but was later updated to adopt use of more conservative estimates based on pipe failure rate data published by the Electric Power Research Institute[6]. Additional conservatisms were included in the final estimate to account for other failure mechanisms (such as age related factors, although industry data do not indicate any increase in failure rate with time in service). The BWROG assumed a single instrument line break frequency of 3.52 E-05/year. Since VY's instrument lines are 1 inches in diameter or less and otherwise similar in design and application to those considered in the LTR, the conservatively calculated line break frequency failure rate of the LTR would also be applicable to VY.

Release Frequency

The risk impact from EFCV failures can be evaluated as the product of the instrument line break frequency and the probability of the EFCV failing to close—the release frequency. With a shorter test interval (i.e., 18-month cycles) and fewer instrument lines and EFCVs than the LTR reference plant (69 vs. 94), VY's release frequency is expected to be comparable to or less than the reference plant. Also, since VY's EFCV failure rate and expected instrument line break frequency are consistent with or less than industry averages, additional plant-specific analysis need not be made in the estimation of the release frequency. For both the LTR reference plant and VY, the release frequency due to an EFCV surveillance test interval increase to 10 years is acceptably low.

Off-Site Radiological Consequences

The off-site dose consequences of an EFCV failure coupled with a break of the associated instrument line have been evaluated for VY. The relatively low radiological consequences of such an event have been found to be acceptable and less than the dose consequences reported in the subject LTR. VY FSAR Section 5.2.4.8 documents the results of this analysis, which assumes an instrument line break occurs outside primary containment, but upstream of the EFCV. For this scenario, no credit is taken for filtration by the Standby Gas Treatment System. Calculated VY off-site doses are 2.6 rem thyroid and 11 mrem

[5] Since startup in 1972, as the result of design changes, some VY instrument lines containing EFCVs have been removed from service, thus reducing the actual number of safety-related EFCVs in service today to 69.

[6] EPRI Technical Report No. 100380, "Pipe Failures in U.S. Commercial Nuclear Power Plants" (July 1992)

whole body, which are less than 1% of the limits of 10CFR100. This analysis assumes a continuous discharge of reactor water through an instrument line with a ¼ inch orifice for 30 minutes at rated power, followed by reactor shutdown and depressurization at which point the release is terminated. The VY specific analysis is consistent with the subject LTR generic analysis and confirms that the radiological consequences of an instrument line break without EFCV function are sufficiently low to be considered insignificant.

Conclusion

The risk impact of an increase in the VY EFCV surveillance test interval to 10 years is acceptably low. This determination has previously been made in NRC's review of the reference plant, as documented in NEDO-32977-A. The expected instrument line break frequency and EFCV failure rate for VY are not expected to be higher than industry averages used in the LTR.

The consequences of a VY instrument line break have been analyzed and, similar to the LTR's off-site radiological analysis, the impacts of such a break are sufficiently low and bounded by the design basis LOCA. Based on the relatively low release frequency and negligible consequences of a release in the reactor building, any increase in overall risk associated with this change in EFCV surveillance test interval is insignificant.

Therefore, it may be concluded that the proposed alternative testing provides an acceptable level of quality and safety.