UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D. C. 20555-0001

December 15, 2000

NRC INFORMATION NOTICE 2000-21: DETACHED CHECK VALVE DISC NOT DETECTED BY USE OF ACOUSTIC AND MAGNETIC NONINTRUSIVE TEST TECHNIQUES

Addressees

All holders of operating licenses for nuclear power reactors, except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to the potential that nonintrusive testing (NIT) of check valves may not provide accurate results if the NIT method was not qualified and if baseline performance was not established when the valve was known to be operating acceptably. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

During an inservice test of high-pressure safety injection pump P-66A at the Palisades Plant on June 21, 2000, the pump failed to achieve its hydraulic reference values. The probable cause of this condition was that piston check valve CK-ES3340 in the P-66A recirculation line was stuck in mid-position. A simplified system diagram of the Palisades safety injection system is included as Attachment 2.

The Palisades inservice testing (IST) program designated check valve CK-ES3340 as having safety functions in both the open and closed positions. Upon discovery of this valve stuck in mid-position, the licensee designated swing check valve CK-ES3332 to provide the safety function to close, previously performed by CK-ES3340, in addition to its originally-designated safety function to open. The open safety function of CK-ES 3332 had been tested previously under the IST program by verifying that the valve passed the maximum accident condition flow. NIT had been performed in 1997, and the licensee concluded then that the acoustic monitoring data provided indications of valve closure. The valve had never been disassembled for internal inspection.

On June 21, 2000, Palisades performed NIT, using acoustic and magnetic monitoring techniques, to verify the closure capability of check valve CK-ES3332 as a substitute for the closure function performed by CK-ES3340. The licensee concluded that the acoustic test data provided closure indications of the check valve disc impacting its seat and also provided open

indications of the disc impacting the backstop. The analysis of magnetic test data also indicated that the valve disc had moved to the open position. However, because of changes that were made to the Palisades NIT data collection software between 1997 and 2000, the licensee could not trend the data between these tests. No additional testing or examination was performed on June 21, 2000.

On September 5, 2000, the licensee radiographed valve CK-ES3332 to obtain more actual data. Radiography revealed that the valve disc and connected swing arm had separated from the hinge pin and were resting on the bottom of the valve. Opening the check valve to perform an internal inspection confirmed the radiography and revealed that the swing arm and disc were intact. There was no indication of service wear on the hinge pin. A subsequent licensee event report (LER, Reference 1), attributed this condition to improper assembly of the valve during the plant's construction. In addition, the LER stated that "the actual condition of CK-ES3332 was not ascertained in June 2000, during acoustic testing, because the results obtained from the acoustic testing corresponded with generically expected open and closed indications."

NRC and Industry Guidance on Check Valve NonIntrusive Testing

In accordance with the Code (References 2, 3 and 4), a check valve that is required by 10 CFR 50.55a to be included in the IST program must be exercised to the positions in which it performs its safety functions. Attachment 1 to NRC Generic Letter 89-04 (Reference 5), details 11 separate NRC Staff Positions on potential generic deficiencies related to IST programs and procedures. Position 1, "Full Flow Testing of Check Valves", states that a check valve's full stroke to the open position may be verified by passing the maximum required accident-condition flow through the valve. Position 1 also provides guidance on qualifying other techniques (e.g., establishing a baseline when the valve is known to be in good working order and specifying adequate acceptance criteria). For backflow testing of check valves, Position 3 states that check valve closure may be verified by visual observation, by an electrical signal initiated by a position-indicating device, by observation of appropriate pressure indication in the system, by leak testing, or by other positive means.

Section 4.1.2 of NUREG-1482 (Reference 6) provides guidance on exercising check valves with flow and on using NIT. It states that nonintrusive techniques may be used to verify the capability of check valves to open, close, and fully stroke in accordance with quality assurance program requirements. These techniques are considered "other positive means" in accordance with requirements for testing the check valve obturator movement (References 7, 8, and 9).

Information on qualification of NIT is given in the summary of NRC public workshops on the revision of Inspection Procedure 73756 (Reference 10). In response to a question about expectations for qualification of an NIT method, the NRC stated that a "qualified" NIT method is a technique that has been successfully and reliably demonstrated for the examination method and for the specific valve application.

In the late 1980's and early 1990's, the Nuclear Industry Check Valve Group conducted an experimental research and testing program to evaluate the available NIT technologies to determine their acceptability and reliability for use in check valve testing (Reference 11). The group obtained baseline information on check valves and concluded that, with baseline information available, the NIT methods investigated could detect a missing disc. Their report also indicates that having a complete operational history of the valve will improve accuracy of the data evaluation.

Discussion

In accordance with the guidance in Reference 6, the NRC considers NIT acceptable for inservice testing of check valves provided that the method used is qualified. Qualification includes establishing a performance baseline when the check valve is in good operating condition. A check valve's performance can then be assessed against this baseline. In order to meet the check valve obturator testing requirements, the NIT technique must be repeatable. Both the NRC and industry have provided guidance on the use of NIT, as referenced above.

The only means to determine if an NIT technique will provide accurate and repeatable results for a specific check valve is to qualify the technique prior to its use. The qualification process may reveal that certain NIT techniques give inconclusive results for a particular application. For example, other plant noise sources may affect the sound pattern of the disc striking the valve backstop or seat, which may affect the results of the acoustic monitoring test. Such issues are typically addressed in the NIT qualification process and are documented for future reference.

In the case of Palisades, check valve CK-ES3332 had not been verified to be in good operating condition prior to the use of NIT. When NIT was performed on June 21, 2000, the technique had not been properly qualified. The individuals who examined the results of the test concluded incorrectly, based on their experience, that the valve was moving properly to its open and closed positions. Had the NIT method been qualified for valve CK-ES3332, the initial examination should have identified the valve's improper assembly.

Generic Implications

If NIT techniques used to verify the opening or closing capability of safety-related check valves are not properly qualified and a baseline established for each individual valve when the valve is known to be operating acceptably, potentially inadequate valve performance may be undetectable in the analysis of NIT results.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact the technical contact listed below or the appropriate Office of Nuclear Reactor Regulation (NRC) project manager.

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Attachments:
1. List of References
2. Palisades Safety Injection System Simplified Diagram
3. List of Recently Issued Information Notices

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRC) project manager.

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References

1. LER 50-225/00-04, “Discovery of Inoperable Check Valve Results in Plant Shutdown,” October 4, 2000. (Accession No. 9810270327)

2. American Society of Mechanical Engineers (ASME) Code, 1986 Edition, Section XI, Subsection IWV, “Inservice Testing of Valves in Nuclear Power Plants,” paragraph IWV-3522.

3. ASME/American National Standards Institute (ANSI), Operations and Maintenance Standard (OM), Part 10, “Inservice Testing of Valves in Light-Water Reactor Power Plants,” 1988 Addenda, paragraph 4.3.2.2(a).

4. ASME OM Code 1996 Addenda, Subsection ISTC, paragraph 4.5.4(a)(1). NUREG-1482, “Guidelines for Inservice Testing at Nuclear Power Plants,” April 1995.

5. Generic Letter 89-04, “Guidance on Developing Acceptable Inservice Testing Programs,” April 3, 1989.

6. NUREG-1482, “Guidelines for Inservice Testing at Nuclear Power Plants,” April 1995.

7. ASME Code, 1989 Edition, Section XI, Subsection IWV, paragraph IWV-3522(a).

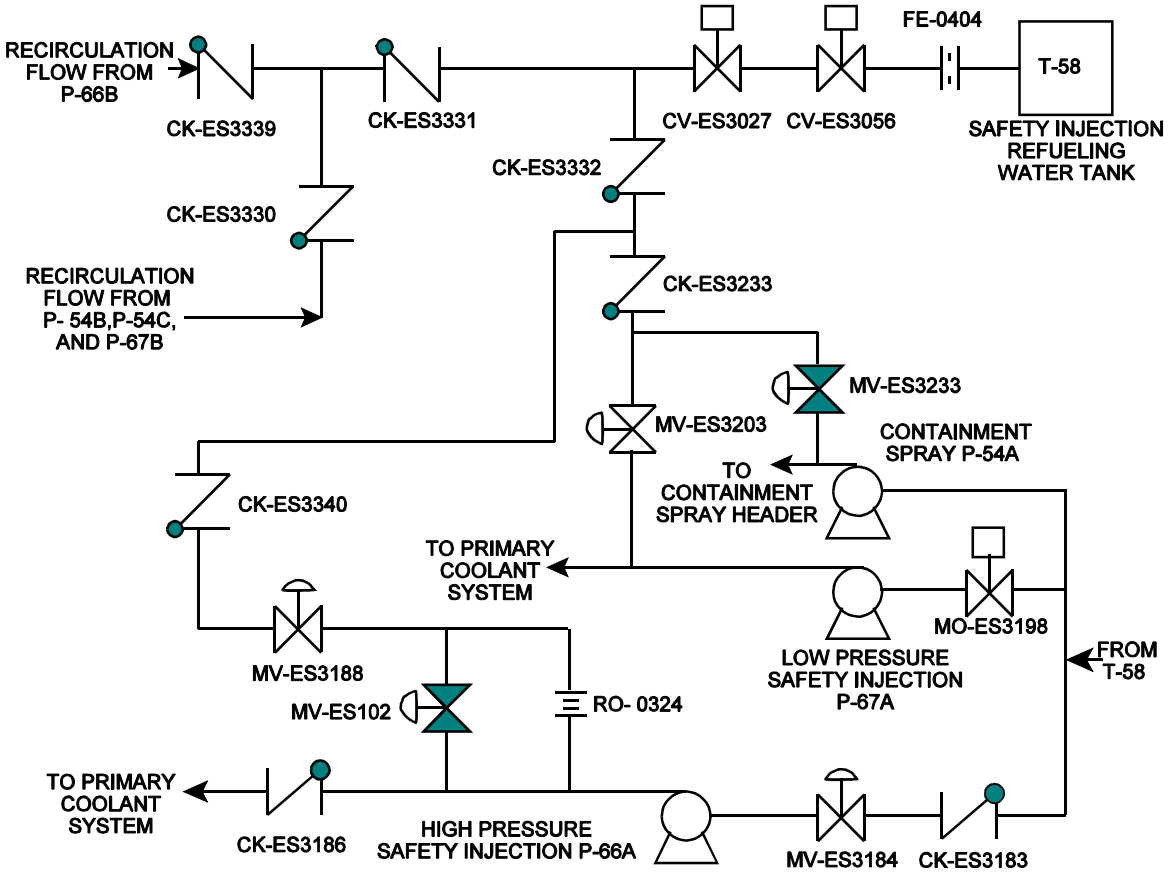
8. ASME/ANSI OM Part 10, 1988 Addenda, paragraph 4.3.2.4(a).

9. ASME OM Code, 1996 Addenda, Subsection ISTC, paragraph 4.5.4(a)(3).

10. Memorandum from Joseph Calycina (NRC) to file, “Summary of Public Workshops Held in NRC Regions on Inspection Procedure 73756, ‘Inservice Testing of Pumps and Valves,’ and Answers to Panel Questions on Inservice Testing Issues,” Question 2.3.1, July 18, 1997. (Accession No. 9810270327)

11. “Evaluation of Nonintrusive Diagnostic Technologies for Check Valves (NIC-01),” Volume 1, February 1991, transmitted by a letter dated February 20, 1992, to Francis Grubelich, NRC, from the Nuclear Industry Check Valve Group. (Accession No. 9205280219)

Palisades Safety Injection System Simplified Diagram



LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
2000-20	Potential Loss of Redundant Safety Related Equipment Due to Lack of a High-Energy Line Break Barrier	12/11/2000	All holders of operating licenses or construction permits for nuclear power reactors
2000-19	Implementation of Human Use Research Protocols Involving U.S. Nuclear Regulatory Commission Regulated Materials	12/05/2000	All medical use licensees
2000-18	Substandard Material Supplied by Chicago Bullet Proof Systems	11/29/2000	All 10 CFR Part 50 licensees and applicants. All category 1 fuel facilities. All 10 CFR Part 72 licensees and applicants
2000-17 S1	Crack In Weld Area of Reactor Coolant System Hot Leg Piping At V.C. Summer	11/16/2000	All holders of OL for nuclear power reactors except those who have ceased operations and have certified that fuel has been permanently removed from the reactor vessel
2000-17	Crack In Weld Area of Reactor Coolant System Hot Leg Piping At V.C. Summer	10/18/2000	All holders of OL for nuclear power reactors except those who have ceased operations and have certified that fuel has been permanently removed from the reactor vessel
2000-16	Potential Hazards Due to Volatilization of Radionuclides	10/5/2000	All NRC licensees that process unsealed byproduct material
2000-15	Recent Events Resulting in Whole Body Exposures Exceeding Regulatory Limits	9/29/2000	All radiography licensees
2000-14	Non-Vital Bus Fault Leads to Fire and Loss of Offsite Power	9/27/2000	All holders of OL for nuclear power reactors

OL = Operating License
CP = Construction Permit