Proceedings of the ASME/NRC 2014 12th Valves, Pumps, and Inservice Testing Symposium
NRC2014
June 23-25, 2014, Rockville, Maryland, USA
NRC2014-5001

Review of the Applicability of Nuclear Regulatory Commission Information Notice (IN) 2012-14, "Motor Operated Valve Inoperable because of Stem-Disc Separation," to Constellation Energy Nuclear Group's Ginna Station

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Abstract

U.S. Nuclear Regulatory Commission (NRC) Information Notice (IN) 2012-14, "Motor-Operated Valve Inoperable Because of Stem-Disc Separation", was issued to inform nuclear power-plant licensees of recent operating experience involving a motor-operated valve (MOV) that failed at the connection between the valve stem and disc. The NRC expectation was that recipients would review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. Additional regulatory suggestions and insights contained in the IN are not NRC requirements.

On closer examination of the events involved, it became apparent that the undetected stem-disc separation observed with the subject MOV was not necessarily limited to that type or style of valve. In fact, the vast majority of inservice testing (IST) valves, and the manner in which they are tested, could also be susceptible to loss of functionality going undetected. The intent of the compliance project performed at the R.E. Ginna Station nuclear power plant was to examine the current testing performed on each IST program valve and determine the level of confidence that stem-disc separation would be detected. If the level of confidence was deemed less than acceptable for a subject valve, one or more augmented actions, as deemed both practicable and viable, were recommended for implementation.

The purpose of this presentation paper is to describe the systematic methodology that was employed to validate the effectiveness of the current periodic IST valve testing conducted at the R.E. Ginna Station and the corrective-action recommendations that

were made as deemed appropriate. The corrective action(s) were designed to preclude the occurrence of future stem-disc separation issues going undetected, which could result in the loss of valve and potentially the loss of the associated accident-mitigation system's operational readiness condition.

Background

IN-2012-14 was issued on July 24, 2012, following the stem-from-disc separation event (at TVA-Browns Ferry) that it describes. The NRC's independent review panel charged with reviewing the event concluded that the use of ASME's *Operation and Maintenance of Nuclear Power Plants* (OM Code) wording "where practicable" and "should", in relation to valve position-indication testing, results in ambiguity and creates the potential for inaccurate obturator-position verification. Two ASME OM Code inquiries were submitted asking for clarification on the Code's current guidance and intent regarding ISTC-3530, "Valve Obturator Movement," and ISTC-3700, "Position Verification Testing."

ASME OM Code Interpretation 12-1 answered both inquiry questions as follows:

QUESTION #1 - If it is practicable, is it a requirement of ISTC-4.1 (ISTC-3700) that local observation of valve operation be supplemented by other indications to verify obturator position? RESPONSE-No

QUESTION #2 - If remote indicating lights provide confirmation of changes in obturator position, is it a requirement of ISTC-4.2.3 (ISTC-3530) to also observe other evidence, such as changes in system pressure, flow rate, level, or temperature, that reflects change of obturator position? RESPONSE-No

The ASME OM Code Committee and the NRC are working together to provide clearer direction in the various sections of the Code which delineate valve obturator movement and position-verification testing requirements. In the interim, licensees are encouraged to review their IST-program valve population to identify any areas of susceptibility to the stem-disc separation concerns expressed in the IN and consider actions, as appropriate, to avoid similar problems.

Ginna Station currently uses a mix of valve indicating lights, local valve observations, observation of other forms of evidence (including changes in system pressure, flow rate, and level), disassembly and inspection, and non-intrusive technology (including ultrasonic testing and radiography) to provide reasonable assurance that the intent of ISTC-3530 and ISTC-3700 is being met.

Because the application of other indications/observations other than valve indicating lights, although not a Code requirement, is not inclusive to all IST program valves, Ginna Station chose to perform a valve-by-valve review to identify valves where testing could

be enhanced and operating experience similar to that discussed in IN-2012-14 could be avoided.

Review Purpose

One purpose of the review was to assess the information contained in IN-2012-14 for its applicability to Ginna Station and to consider actions, as appropriate, to avoid similar problems. Another purpose was to ensure compliance with Criterion V, “Instructions, Procedures, and Drawings,” in Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants,” to Part 50, “Domestic Licensing of Production and Utilization Facilities,” of Title 10, “Energy,” of the *Code of Federal Regulations* (10 CFR) when reviewing or revising test procedures for safety-related components by ensuring that they include qualitative or quantitative acceptance criteria, as required, to ensure that the test activity has been successfully completed.

The NRC’s closing statement in the IN is as follows: “To determine whether additional regulatory action is necessary, NRC staff plans to continue its evaluation of licensee implementation of the provisions in the ASME OM Code for valve position verification and obturator movement.”

Review Scope

The scope of the review was to perform an analysis of the Ginna IST valve population subject to the requirements for valve obturator movement and position-verification testing during valve exercising in accordance with the 2004 edition (no addenda) of the ASME OM Code, with specific focus on:

Section ISTC-3530, “Valve Obturator Movement”

“The necessary valve obturator movement shall be determined by exercising the valve while observing an appropriate indicator, such as indicating lights that signal the required changes of obturator position, or by observing other evidence, such as changes in system pressure, flow rate, level, or temperature that reflect change of obturator position.”

Section ISTC-3700, “Position Verification Testing”

“Valves with remote position indicators shall be observed locally at least once every 2 years to verify that valve operation is accurately indicated. Where practicable, this local observation should be supplemented by other indications such as use of flow meters or other suitable instrumentation to verify obturator position. These observations need not be concurrent. Where local observation is not possible, other indications shall be used for verification of valve operation.”

Analysis focused on identifying valves whose valve obturator movement/position (VOM/P) and position-verification (PV) testing, despite complying with the ASME OM Code, did not clearly demonstrate sufficient evidence that the obturator operational readiness issues and concerns identified in IN-2012-14 had been satisfactorily addressed.

The following valve types were included:

- check
- manual
- solenoid-operated (SOV)
- air-operated (AOV)
- motor-operated (MOV)
- safety
- relief
- vacuum-breaker
- rupture-disk

Review Approach

Review the current VOM/P and PV ASME OM Code testing being performed for each IST valve to determine:

1) Current ASME OM Code compliance status.
2) The presence of additional existing or potential appropriate supplemental indicators/alternative parameters which signal the required changes of obturator position, including changes in system pressure, changes in system flow rate, changes in level, changes in temperature (direct measure/thermography), or other existing or potential appropriate supplemental indicators/alternative parameters:
    a) operational data/parameters such as ability to establish/maintain RCS chemistry, pressure, level, and temperature; to accomplish various plant startup and shutdown Mode changes; and to routinely use valves to support system functions during daily plant operation, etc.;
    b) leak-rate testing (ASME OM Code, Technical Specifications/PIV, or Appendix J);
    c) seat-tightness testing (for pressure-relief devices);
    d) diagnostic test data from the MOV/AOV/SOV program;
    e) valve disassembly/inspection; and
    f) non-intrusive test/examinations (radiography, ultrasonic, acoustics, etc.).
3) The presence of valve position verification and obturator movement deficiencies/concerns as delineated within IN-2012-14.

Valve (ASME OM CODE & IN-2012-14) Status Project Classifications:

1) Dual Compliant (DC) - A valve for which the associated IST testing currently being performed complies with the 2004 ASME OM Code VOM/P & PV requirements and contains appropriate supplemental indicator(s)/action(s) that provide enhanced assurance of obturator movement. **RESULTS: No further justification or action required.**
2) Justified Compliant (JC) - A valve for which the associated IST testing currently being performed complies with the 2004 ASME OM Code VOM/P & PV requirements; however, additional existing appropriate supplemental indicator/action(s) contained in other program tests/inspections (MOV, AOV, Appendix J, Check Valve Condition Monitoring, routine plant operational manipulations, etc.) not currently credited by the IST program can be credited to provide enhanced assurance of obturator movement. **RESULTS: Formalize taking credit for the existing supplemental appropriate indicator(s)/action(s).**
3) Required Action for Compliance (RAFC) - A valve for which the associated IST testing currently being performed complies with the 2004 ASME OM Code VOM/P & PV requirements, but appropriate supplemental indicator(s)/action(s) that could provide enhanced assurance of obturator movement were not currently being performed. **RESULTS: Identify and implement the conduct of appropriate supplemental indicator(s)/action(s) which will provide enhanced assurance of obturator movement.**

Review Conduct

IST Program Valve Reviews

A total of (526) program valves are included in the Ginna IST program.

Valves exempted from review:

a) A program sub-total of (29) augmented valves, with a sub-total of (11) of those valves having an associated safety-related function. Remaining (18) augmented valves were **not included** in the IN analysis scope. Basis for exclusion: The valves did not have a safety-related function.
b) A program sub-total of (113) check valves, with a sub-total of (44) of those valves placed in the Check Valve Condition-Monitoring Program. All 113 check valves were **not included** in the IN analysis scope. Basis for exclusion: The valves currently are being 100 percent bidirectionally tested in accordance with the ASME OM Code by employing, as applicable, supplemental indicators/alternative parameters previously described.
c) A program sub-total of (104) pressure-relief devices. A total of (94) safety and relief valves were **not included** in the IN analysis scope. Bases for exclusion: For

(78) relief valves, Table ISTC-3500-1, “Inservice Test Requirements,” defers exercise-test requirements to ISTC-5240, which in turn defers to Mandatory Appendix I, which does not have an exercise-test requirement. These relief valves do not have position indication and are exempt from ISTC-3700. For (16) rupture disks, Table ISTC-3500-1 defers exercise-test requirements to ISTC-5250, which in turn defers to Mandatory Appendix I, which does not have an exercise-test requirement. These rupture disks do not have position indication and are exempt from ISTC-3700.

NOTE: It is important to recognize that obturator position and integrity is being verified during relief valve set-pressure and seat-tightness testing performed in accordance with Mandatory Appendix I.

Exceptions for Safety & Relief Valves

(8) Class 2 Main Steam Safety Valves (MSSVs) are tested in accordance with Mandatory Appendix I, which does not have an exercise-test requirement. However, these MSSVs do have remote position indication and are tested in accordance with ISTC-3700 and therefore were included in the IN-2012-14 review scope.

(2) Class 1 System Pressurizer Safety Valves are tested in accordance with Mandatory Appendix I, which does not have an exercise-test requirement. However, these safety valves do have remote position indication and are tested in accordance with ISTC-3700 and I-7310 of Appendix I and therefore were included in the IN-2012-14 review scope.

d) A program subtotal of (58) Category A and B Passive valves. All (58) Category A and B valves were **not included** in the IN analysis scope. Basis for exclusion: Table ISTC-3500-1, “Inservice Test Requirements,” does not require an exercise test or position-indication verification test for Category A or B passive valves that do not have remote position indicators, which these valves do not.

A combined total of (283) valves were **not included** in the review. The remaining (243) valves (less than 50 percent of the total IST valve population) were subject to review.

IST Program Valve Review Results

1) (67) valves classified as DUAL-COMPLIANT (DC)
    a. Current IST testing complies with the 2004 ASME OM Code.
    b. Current IST testing includes appropriate supplemental indicator(s)/actions which provide enhanced assurance of obturator movement and position. RESULTS: No further justification or action required.
2) (82) valves classified as JUSTIFIED COMPLIANT (JC)
    a. Current IST testing complies with the 2004 ASME Code.

b. Other existing appropriate supplemental indicator(s)/actions were identified and will be credited to provide enhanced assurance of obturator movement and position.
RESULTS: Formalize taking credit for the existing supplemental appropriate indicator(s)/action(s).

3) (94) valves classified as REQUIRED ACTION FOR COMPLIANCE (RAFC)
   a. Current IST testing complies with the 2004 ASME OM Code.
   b. Appropriate supplemental indicator(s)/action(s) that could provide enhanced assurance of obturator movement and position were not currently being performed.
   c. Appropriate potential supplemental indicator(s)/action(s) that could provide enhanced assurance of obturator movement and position have been identified for each valve.
   RESULTS: Evaluate potential supplemental indicator(s)/action(s) for IST program inclusion with consideration given to practicability.
   d. Subset breakdown of the (94) valves based on direction of concern: (8) RAFC-OPEN direction only, (33) RAFC-CLOSED direction only, and (53) RAFC-OPEN and CLOSED direction.

Observations

The following are the primary observations from this process:

- Numerous potential appropriate supplemental indicator(s)/actions were identified that could readily be incorporated into the IST program.

- A significant number of such potential indicator(s)/action(s) are related to plant operations which proved to be best identified/validated by an SRO.

- The simple reordering of or minor addition to existing test/operations procedure instructions often can provide the necessary supplemental indicator(s)/action(s).

- Existing indicator(s)/action(s) related to plant operations may need to be made into “hardened” steps to ensure their continued and consistent performance.

- A very significant number of IST program valves “screen out” based on other IST testing options and their associated test requirements, or simply as defined by Table ISTC-3500-1, “Inservice Test Requirements,” based on valve category.

- Differences between test frequencies for VOM/P and PV required by the ASME OM Code and those of potential appropriate supplemental indicator(s)/actions need to be reconciled, with practicability also being a key consideration.

- Technical positions which delineate the basis for taking credit for certain non-IST-related appropriate supplemental indicator(s)/action(s) may be required to justify as well as provide a historical record of their adequacy.

- The review team should consist of one or more persons knowledgeable in ASME OM Code inservice valve testing requirements and valve testing methods, an Operations representative (preferable that he/she be a senior reactor operator (SRO)), and a valve/component engineer knowledgeable in valve design and performance capabilities.

- Treating the review as a project and employing a systematic approach creates uniformity and consistency and produces a comprehensive end product. The review produces a number of action item decisions that need to be made by the appropriate level of supervision/management. By maintaining an "issues register" or record of testing issues that need resolution, such issues can clearly be presented for disposition at the conclusion of the review.

Conclusion

The IN-2012-14 applicability review performed for the Ginna IST program accomplished the following:

1) Verified the current status of each valve (as applicable) regarding the manner in which the valve is currently being VOM/P and PV tested.
2) Identified **existing** appropriate supplemental indicator(s)/action(s) for which credit could be taken to provide enhanced assurance of obturator movement and position indication (and therefore integrity).
3) Identified appropriate supplemental indicator(s)/action(s) that, if implemented, would fill the current gap for valves categorized as RAFC.

The applicability review addressed the following NRC statement contained in the IN-2012-14 purpose section: "The NRC expects that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems."

The Ginna applicability review of IN-2012-14 provides an added measure of confidence that affected valves will be more effectively monitored for the presence of stem-disc separation both in manner and timeliness.