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United States Nuclear Regulatory Commission
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Subject: Validity of Instrumented Inspection Technique (IIT) Tests Performed As An Alternative to ASME Section XI Hydrostatic Tests

Gentlemen:

Toledo Edison was informed by letter dated November 2, 1989 (Log Number 1-2174) that the NRC had concluded that those pressure tests reviewed by the NRC, which were conducted using the Instrumented Inspection Technique (IIT) as an NRC approved alternative to the hydrostatic pressure tests required by Section XI of the ASME Code, were invalid. Toledo Edison was requested to evaluate its examination procedures and the IIT test data. If tests were confirmed to be invalid, the Company was requested to identify all ASME systems and components subject to the hydrostatic pressure testing requirements of ASME Section XI which were tested using the IIT and to determine whether the affected systems could be judged functionally OPERABLE. If the tests were determined to be valid, the NRC was to be informed of the basis for this determination and a description of the system or component tested and the date of the test.

Due to the potential safety significance of the underlying issues Toledo Edison pursued a parallel course of action. A Potential Condition Adverse to Quality Report (PCAQR) was initiated to resolve the system operability concern conservatively assuming that the tests would be determined to be invalid. At the same time, an in-depth review of Toledo Edison procedures and the IIT test data, as well as the approved HAFA Topical Report and HAFA procedures, was conducted.

Toledo Edison has concluded that all IIT testing performed at Davis-Besse was in accordance with the NRC approved HAFA Topical Report 135 (P-A) and subsequent plant specific approvals. Therefore, all tests and test results remain valid. In addition, Toledo Edison has determined that all affected systems are operable and fully capable of performing their intended safety functions notwithstanding the eventual outcome of the IIT issue. The bases

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for system operability are documented in PCAQR Number 89-0558 and are available at Davis-Besse for NRC review. A discussion of the bases for IIT test validity is provided below.

Toledo Edison and other affected licensees have reviewed the approved Topical Report to reassess the critical criteria identified in the report which would constitute compliance with the Topical. It was determined that the following must be completed in order to comply with the Topical.

1. A determination of impracticality must be made for each system or portion of systems to be tested using the IIT methodology in lieu of the requirements of the ASME Section XI.

2. The determination of impracticality must be submitted to the NRC.

3. All personnel utilizing the IIT equipment must be certified in accordance with HAFA 9.2 and a qualification program that meets the intent of ANSI N45.2.6. Personnel are certified based on written examination with the exception of the "grandfathering" of specific HAFA personnel approved by the NRC.

4. IIT Testing procedures must be reviewed and approved by the Site Safety Review Committee or, for Davis-Besse, a Qualified Reviewer as subsequently identified to the NRC in Serial Number 1590 dated September 24, 1988.

5. An IIT test must include a walkdown for the identification of external or through wall leakage to assure integrity of the system. The walkdown must be performed by ASME Section XI VT-2 certified personnel. IIT testing results must be reviewed and accepted by an individual certified in IIT as Level II or III.

6. The instrumentation requirements for a defined test scope are that an inlet LMD be present. In addition, a selected set of boundary valves, appropriate for the system being tested, may be instrumented with LMDs and/or AE sensors for the purpose of identifying locations of suspected leakage, coupled with the VT-2 inspection described above.

7. The hold time at test pressure is to be in accordance with ASME Section XI criteria except that the Topical Report allows a 2 hour hold time in lieu of the Section XI hold time of 4 hours for insulated piping. If hold times are different from the above noted criteria a specific relief or acceptance by the NRC is required.

8. The minimum IIT Test Pressure is normal operating pressure.

IIT Testing using AE sensors only is not bounded by the Topical Report. Toledo Edison received separate approval from the NRC to use this methodology on the Main Steam System. This testing was also reviewed and found to be acceptable.

As stated above, Toledo Edison has reassessed IIT testing against these criteria and has determined that the testing remains valid. Attachment 1 provides the data requested on specific systems and components tested as well as the test dates. Attachment 2 provides a discussion of issues raised in the Summary of NRC Inspection Conclusions attached to the NRC's letter of November 2, 1989.

Should you require additional information concerning this matter, please contact Mr. R. W. Schrauder, Manager - Nuclear Licensing at (419) 249-2366.

Very truly yours,

EBS/ssg

Attachments

cc: P. M. Byron, DB-1 NRC Senior Resident Inspector
A. B. Davis, Regional Administrator, NRC Region III
T. V. Wambach, NRC/NRR DB-1 Senior Project Manger

********** DAVIS BESSE - IIT TEST SUMMARY **********

SYSTEM	TEST PROCEDURE	TRAIN	TEST TYPE	TEST DATE
MAIN STEAM	DB-PF-10019	ALL	STEAM	11/25/88
AUX.FEED STEAM	TP-850.81	1-1	HYDRO	04/04/86
		1-2	HYDRO	04/10/86
		ALL	STEAM	01/06/87
AUX. FEED WATER	DB-PF-03944	1-1	HYDRO	09/28/88
	DB-PF-03946	1-2	HYDRO	10/03/88
	TP-850.80	1-1	HYDRO HYDRO HYDRO	04/17/86 07/31/86 04/18/86
		1-2	HYDRO HYDRO HYDRO	04/18/86 04/18/86 04/19/86
DECAY HEAT	DB-PF-03926	1-1	HYDRO	04/15/88
	DB-PF-03927	ALL	HYDRO	06/14/88 06/14/88
	DB-PF-03928	1-2	HYDRO	06/12/88
SERVICE WATER	DB-PF-03900	1	HYDRO	04/14/88
	DB-PF-03901	2	HYDRO	06/24/88

********** DAVIS BESSE - IIT TEST SUMMARY **********

SYSTEM	TEST PROCEDURE	TRAIN	TEST TYPE	TEST DATE
CCW	TP-851.29	1	HYDRO	07/01/86
		2	HYDRO	06/13/86
		BACKUP	HYDRO	07/02/86
HPI SYSTEM and CHECK VALVE REVERSE FLOW	TP-851.16	1-1	HYDRO	03/21/86
		1-2	HYDRO	03/21/86
	TP-851.37	1-1	HYDRO	05/14/86
		1-2	HYDRO	05/15/86
CORE FLOOD/ DECAY HEAT	TP-850.85	1-1	HYDRO	12/08/86
			HYDRO	12/09/86
		1-2	HYDRO	12/10/86
			HYDRO	12/10/86
WASTE GAS DECAY TANK	TP-851-34	1-1	HYDRO	06/10/86
		1-2	HYDRO	06/09/86
		1-3	HYDRO	06/06/86

Attachment 2
Response to NRC Inspection Conclusions

Types of Pressure Tests (4.1)

NRC Conclusion

Actual plant conditions differ from those of the test model approved. Small amounts of leakage through pressure boundary may not be detected. Further, the licensee's examination procedure does not address required action when maintenance is performed on the boundary valves after the test.

TE Response

While the actual plant test conditions may be somewhat different than the test model, IIT can still detect leakage, both internally and externally. The purpose of submitting the "Discussion" section of the HAFA Topical along with the more detailed test procedures and test results in the Appendices to the Topical Report was to demonstrate that IIT performs acceptably on actual systems under actual plant conditions. VT-2 examinations were to detect external leakage performed during all tests, as required by the Topical. The LMDs monitor total leakage. Any hydrostatic testing performed under actual plant conditions is conducted under some type of dynamic condition.

TE's QA program and implementing procedures specify actions to be taken when maintenance is performed. The test leader is responsible for evaluation of leakage and determining the appropriate course of action for resolution (e.g., increase AE monitoring or repair or replacement). For example, during pressure testing of the High Pressure Injection (HPI) System, TE discovered a valve leaking beyond the acceptance criteria. A maintenance work order was issued and the valve was repaired. A subsequent test was then performed satisfactorily.

Site Inspections (4.2)

Toledo Edison has no comments.

Review of Implementing Procedures (4.3)

NRC Conclusion

Based on the recent NRC activities, the staff concluded that the examination procedures were not adequate to control significant test parameters, as explained in subsequent sections of this report.

TE Response

See TE response to NRC's detailed discussion of significant test parameters provided below.

Significant Test Parameters (4.4)

NRC Conclusion - HAFA personnel had considerable discretion with regard to implementation of the licensee's examination procedure.

TE Response - Toledo Edison disagrees with this conclusion. Test parameters were specified in Davis-Besse controlled plant procedures. Specific requirements related to IIT testing were controlled by HAFA procedures. IIT testing was conducted under the supervision and control of a qualified test leader designated by Toledo Edison. HAFA employees were not utilized. However, TE did use staff augmentation contractors for this purpose.

Acoustic Leak Sensing Equipment (ALSE) (4.4.(a)1)

NRC Conclusion - A technical justification is not available that shows the distance between transducers mounted at the plant site which are consistent with the qualification test described in the topical HAFA 135 (P-A) and, therefore, the claim that leakage through the pressure boundary could be located by acoustic sensors cannot be substantiated.

TE Response

ALSE was used for informational purposes only during all testing conducted at D-B except the Main Steam test. On water tests, LMDs were used to monitor overall leakage and a visual examination (VT-2) was conducted for acceptance. The AE data was reviewed to determine valve leakage and initiate or plan necessary maintenance. AE was also utilized to check for check valve back flow leakage in selected tests.

The conclusion that ALSE is normally installed one per boundary valve is not correct. This is not required by the Topical or D-B procedures.

For the Main Steam test, AE was utilized and the ALSE locations were identified on a sketch and were located at the designated distances (approximately 20 feet). These test results were reviewed and accepted by HAFA and TE personnel and separately by an independent acoustic emission expert who concluded the results were acceptable.

ALSE (4.4(a)2)

NRC Conclusion

The frequency and characteristics of the acoustic sensors are not defined.

TE Response

This information is provided in the manufacturer's instructions and complies with ASTM E 750-80, Standard Recommended Practice for Measuring the Operating Characteristics of AE Instrumentation, which is referenced by HAFA procedures. Each sensor is calibrated by the manufacturer and verified by HAFA after installation in the field. The field calibration ensures proper sensitivity for each sensor and the response of the adjacent sensors ensures proper location of all sensors.

ALSE (4.4(a)3)

NRC Conclusion

Written guidance is not provided regarding acceptable background noise, the number of measurements, or the interval of time between measurements.

TE Response

Acoustic background noise was checked in accordance with HAFA Operating Procedure 13.02, Section 12, which requires each sensor channel to be tested after setup and the noise level recorded as part of the calibration process. During AE testing on the Main Steam System, the background noise was recorded prior to the test and throughout the test by the Electro-Acoustic Ranging System (EARs). The data was then analyzed and accepted by HAFA. As stated by HAFA during the February 1, 1990 meeting with the NRC, HAFA training provides the guidance used for background noise measurements taken for IIT testing on water-filled systems.

ALSE (4.4(a)4)

NRC Conclusion

The inspector observed the ALSE transducers attached to the valve body with adhesive tape. The acceptable method for transducer attachment should be defined for different size valves, surface conditions and test temperatures.

TE Response

HAFA procedures are utilized to install sensors properly. At Davis-Besse, the sensors were attached to valve bodies with epoxy. Tape was used to hold the sensors in place until the epoxy set-up and was apparently left in place. If this observation refers to Davis-Besse, perhaps the NRC inspector was not aware that the ALSE transducers were also being held in place by epoxy (leaving the tape in place does not affect testing). Nonetheless, ASTM Standard E 650-85 does allow the use of tape only.

Placement of Test Equipment (4.4(b)1)

NRC Conclusion

From the review of the test records at several plants, the staff found cases where some of the pressure test boundary valves were neither instrumented with LMDs or ALSE and, therefore, undetected leakage could have occurred through the boundary valves.

TE Response

The HAFA Topical does not require all boundary valves to be instrumented. The Appendices of the Topical Report clearly show that instrumentation location varies depending on the requirements of the individual test. The required LMDs and/or ALSE's were installed and the test properly conducted with acceptable results for tests performed at Davis-Besse.

Placement of Test Equipment (4.4(b)2)

NRC Conclusion

The staff also found cases where ALSE transducers were mounted at the boundary valves but LMD's were not installed. Therefore, the amount of pressure boundary leakage (i.e., crack or packing leakage) within the test boundary could not be quantified.

TE Response

See Response to Item 4.4(b) 1 above.

Test Results (4.4(c)1)

NRC Conclusion

"...the examination procedure does not have guidance for the evaluation of the data from IIT instrumentation."

TE Response

The acceptance standard to comply with the Topical Report is clearly delineated in D-B procedures. The acceptance standard(s) for the LMD type test is the visual examination (VT-2) and for the AE type test is the VT-2 examination and evaluation and acceptance of the AE data. D-B procedures require a review of preliminary IIT data at test completion and approval by TE personnel. HAFA Operating Procedure 13.02 requires a post-test data analysis and final report for AE testing. The acceptance criteria for HAFA personnel review was provided in HAFA report 1008-88 and 1009-88. This criteria has since been incorporated into HAFA procedures OP 13.02 and 12.14.

Test Results (4.4(c)2)

NRC Conclusion

Some licensees do not have plant personnel or other support staff who could make an independent assessment of the data from the IIT instrumentation.

TE Response

TE had an engineer qualified and certified level II in IIT during implementation of IIT testing. Other TE engineers had received training in the IIT methodology and were qualified to review the test results during implementation.

It is not unusual for licensees not to have employees that can make independent assessments of test results. This is common for ultrasonic and eddy current testing, and has been an accepted practice.

Test Results (4.4(c)3)

NRC Conclusion

The examination procedure does not define the required action in the event that instrumentation is known to have malfunctioned.

TE Response

Test anomalies were documented in the D-B test chronological log or test deficiency for each test and were resolved as required by D-B procedures. In addition, HAFA Operating Procedure 13.02, Section 6.12 requires that faulty acoustic equipment be replaced as required to maintain minimum detection levels.

Personnel Qualification/Certification (4.4(d) 1 & 2)

NRC Conclusion

"The staff's approval of the IIT concept...did not supersede the established code requirements for personnel qualification." HAFA "grandfathered" certain HAFA level III personnel based on an informal telephone conversation and construed this telephone conversation as NRC approval to replace a written examination requirement with "grandfathering".

TE Response

The NRC's approval of the HAFA Topical appears to supersede the requirements of ASME Section XI, IWA-2300 as an alternative to Section XI hydrostatic testing and the use of ANSI N45.2.6. Therefore, TE does not believe that IWA-2300 applies to IIT testing (only to the VT-2 exam performed by qualified personnel).

The NRC agreed that initial certification for Level III's would be waived due to the uniqueness of the concept and the few experts that existed at the time. This was documented in a telephone conversation memorandum and as an Addendum to HAFA Procedure QAP 9.2. The ASME at one time considered the addition of AE testing to the Code as a testing requirement but this had not been included as a requirement prior to IIT testing performed at D-B. TE believes that the HAFA personnel who performed IIT testing at D-B were adequately qualified and certified.

Inspection at the HAFA Offices (5)

NRC Conclusion

The staff concluded that a significant undetected pressure boundary leak could exist in a system that was instrumented with LMDs and ALSE in a manner typical to the installation used in the licensed facilities. (This was based on NRC's observation of demonstration of IIT on a test loop at HAFA which they considered as being conducted under the most favorable conditions.)

TE Response

TE was not present during this demonstration and does not know the specific details on which the NRC's conclusion is based. TE believes the IIT testing technique, as implemented at D-B, is a viable alternative to Section XI hydrostatic testing.

NRC Summary

NRC Conclusion

The NRC has reassessed its conclusion regarding IIT and determined that as implemented it is ineffective.

TE Response

The NRC did not provide any specific examples pertaining to testing performed at D-B. Based on the information and clarifications provided above, TE believes that IIT testing conducted at Davis-Besse was performed in accordance with the NRC approved Topical Report and subsequent plant specific approvals. Therefore, TE concludes the IIT was implemented effectively at Davis-Besse and that IIT tests and test results remain valid. TE believes that the IIT methodology has provided and will continue to provide a viable alternative to Section XI hydrostatic pressure testing to assure the capability of tested systems to perform their intended function.