ORGANIZATION: YANKEE ATOMIC ELECTRIC COMPANY
FRAMINGHAM, MASSACHUSETTS

REPORT NO.: 99901042/86-01	INSPECTION DATES: 09/15-19/86	INSPECTION ON-SITE HOURS: 35

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NUCLEAR INDUSTRY ACTIVITY: Engineering services for Yankee Rowe, Maine Yankee, Vermont Yankee, and under contract to other utilities.

ASSIGNED INSPECTOR: P. D. Milano, Special Projects Inspection Section (SPIS) — Date: 10-29-86

OTHER INSPECTOR(S): R. L. Pettis, SPIS; P. J. Prescott, SPIS; L. Cheung, Region I; J. Diperna, Consultant

APPROVED BY: J. W. Craig, Chief, SPIS, Vendor Program Branch — Date: 10-29-86

INSPECTION BASES AND SCOPE:

A. BASES: 10 CFR 50 Appendix B.

B. SCOPE: Review the implementation of the YNSD design control program for plant modifications.

PLANT SITE APPLICABILITY: Maine Yankee 50-309

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A. VIOLATIONS:

None.

B. NONCONFORMANCES:

None.

C. UNRESOLVED ITEMS:

None.

D. STATUS OF PREVIOUS INSPECTION FINDINGS:

Not applicable. This was the first Vendor Program Branch inspection of Yankee Nuclear Service Division.

E. OTHER FINDINGS AND COMMENTS:

This inspection was performed to review Yankee Nuclear Service Division (YNSD) activities in the area of design control. In order to perform this evaluation, selected Engineering Design Change Request (EDCR) packages were reviewed for technical accuracy and compliance with regulatory commitments and industry standards. The EDCRs for the Maine Yankee unit were selected for the period from 1983 to the present.

The process of preparation, review, and approval of the EDCR is detailed in the Engineering Manual Procedure, WE-100. In this process, the plant issues service requests to the YNSD organization describing the scope of the modification or engineering study that is to be accomplished. YNSD utilizes this scope of work to develop the EDCR which includes the applicable calculations and design output documents. In the case of Maine Yankee, however, revised drawings are prepared by the utility from the YNSD sketches. The EDCR receives independent reviews prior to being submitted to the Manager of Operations for approval. Subsequent changes to the EDCR, whether requested by the field or YNSD, are handled by Engineering Change Notices (ECNs).

As previously stated, the modification packages for work on Maine Yankee were selected for review. These facility modifications were reviewed by taking the perspective of an independent design verifier such as design

reviews or review of alternate/simplified calculations. In general, the design output documentation and basis were found to be technically satisfactory and in compliance with regulatory and industry standards. The specific details of these evaluations are outlined below.

1. EDCR 85-04, Installation of 1 inch Size Auxiliary Feedwater System Check Valve

   This EDCR was prepared to allow installation of a 1 inch check valve in line No. 1 inch-WAPD-15-151 to provide a seismic pressure boundary for a 1 inch branch line off the steam driven auxiliary feedwater pump suction line.

   This seismic upgrade was accomplished by installing a 1 inch 600 psi ANSI class lift check valve at location AFW-358 and analyzing the support loads with the NUPIPE code up to the first orthogonal restraint past the check valve. The piping system was to be safety class 3 up to the check valve inlet and non-nuclear safety past the valve. This Maine Yankee system redesign was performed in accordance with ANSI B31.1 1977 and ASME XI thru Winter 1980 Addenda. Their FSAR commitment is ANSI B31.1-1967.

   An ANSI 600 psi pressure class check valve (Stone & Webster I.D. #VCS-60A) was procured and installed in the ANSI 150 psi line being seismically upgraded. This is a conservative valve selection and the valve procurement was performed by Maine Yankee site personnel. Consequently procurement documents were not available for review. However, the required engineering design specifications (YAGEN-39-8) were reviewed and were adequate. NUPIPE system analysis was verified and found to be acceptable. Seismic response spectra used are a conservative application of Regulatory Guide 1.60 ground response spectra, which is twice the values specified in Maine Yankee's FSAR.

   The adequacy of a single valve as a seismic pressure boundary was questioned. Yankee engineering made this determination per ANSI N.18.2 definitions which state that a single valve can define a safety classification break if the valve is a normally closed "passive" valve. The valve installed at location AFW-358 fits this criteria since it is normally closed and the steam driven AFW pump has no emergency feedwater function at Maine Yankee. Although credit for this pump is taken for station blackout and

Appendix R conditions, these are not currently FSAR commitments for Maine Yankee nor are they related to seismic events. Yankee engineering Letter NMY85-101 discusses this issue and the NRC's review and approval of the use of a single valve pressure boundary in this application.

2. EDCR 83-28, New Condenser Surge Tank and Piping

Although this design modification was on a Yankee Design Grade 2, Non-safety Related system, it was reviewed to determine whether or not there were indications of an appreciable change in the design control process between safety-related and nonsafety-related modifications. This design change was implemented to provide a new 100,000 gallon tank (TK-122) to supply demineralized water to the condenser surge line so the existing demineralized water storage tank can be used exclusively for AFW pumps supply. A new 10 inch SCH 40 carbon steel pipe, Stone & Webster class 151 per MYS-442, was also installed as part of this design change. While not safety-related, the condenser tank does provide a volume that may be used in an emergency.

This change was found to have been implemented in a satisfactory manner consistent with the applicable requirements.

3. EDCR 84-38, Check Valve Installation in Water Treatment Makeup Lines

Two 4 inch swing check valves were installed to reduce piping safety class 3 to non-nuclear safety class on the discharge line from the demineralized water storage tank to the auxiliary feedwater pumps suction. This change permits filling the demineralized water storage tank without requiring a dedicated operator to monitor system integrity should a failure occur in non-seismic water treatment piping.

Two Velan 4 inch ANSI 150 psi class swing check valves were installed at locations AFW-345 and 346 to provide the piping safety class break. Two valves were required to meet ANSI N18.2 requirements which require redundant valves when the single failure of an active normally open valve is assumed.

Since a special bimetallic (P1-P8) weld was required and installation was performed at the plant site, YNSD obtained a weld data map confirming use of a qualified Bimetallic Weld Procedure. The welding procedure was in accordance with General Weld Specification YA-WP-6 specified in the EDCR and was found to be satisfactory.

The Piping system load calculations were acceptable based upon a review of calculation MYC-576, Rev. 1, ATT.C. Seismic analysis was performed using a conservative "Worst Case" combination of FSAR and Regulatory Guide 1.60 response spectra. All calculations and specifications reviewed were acceptable.

4. EDCR 83-29, Auxiliary Feedwater System Modifications

This modification adds a second air operated, fail closed valve in series with an existing normally open, fail closed valve on the motor driven auxiliary feedwater pumps discharge line to prevent dumping feedwater inside containment after a main steam line break (MSLB). Previously isolation occurred when the feedwater flow control valves to a disabled steam generator automatically closed. The modification will allow the intact steam generators to continue to receive AFW flow. Both of the closed isolation valves will reopen after restoring steam generator pressure. This design change eliminates automatic trip of AFW pumps and the five minute restart delay in the present control scheme and uses the signal to operate the solenoids for the new isolation valves. The new control logic permits the motor driven AFW pumps to start automatically when low steam generator level occurs; both isolation valves in each feed line automatically close to block AFW flow on a low steam generator pressure signal.

The flow vs. head loss characteristic of the motor driven auxiliary feedwater pumps was documented in calculation MYC-390 and verified to provide in excess of the minimum 475 GPM flow required at the calculated system resistance. This calculation was found to be satisfactory.

The applicable valve design requirements were adequately specified in the valve procurement (Design) specification.

The control Pilot Solenoid Valves for the valve pneumatic actuators are ASCO M/N 206-380-2U which were confirmed by Yankee engineering to be identical to M/N HVU-260-280 which were qualified in excess of specified (4g) input by ASCO Report AQS-21678/TR, Rev. A.

The Valve-Actuator Qualification Report No. 191316-84N did not show compliance with specified minimum natural frequency limit, although the valve did stroke satisfactorily during the static deflection test simulating the worst case (4g) earth quake load.

Yankee Atomic engineering reviewed the Action Test Report and justified the natural frequency in the 26 to 28 Hz range. Using NUPIPE calculations, YNSD documented that the actual installed piping system frequency was conservatively less than the valve extended structure frequency and resulting accelerations were much less than the (4g) test level. Their evaluation was reviewed and found to be acceptable.

5. EDCR 85-14, Siesmic Anchorage of the Ceiling and Light Fixtures in the Control and Battery Rooms

This EDCR was initiated as a result of a report prepared by an independent seismic consultant under contract to Yankee NSD. The report addressed the concern that the suspended ceiling and associated light fixtures may fall during a seismic event, causing possible injury to operations personnel and damage to safety-class equipment.

The EDCR provided a review which was limited to simple hand calculations. These calculations verified that the attachment wires and anchors for the ceiling and fixtures were sufficient to resist the anticipated seismic forces.

Peak response for the control room ceiling was specified at 2.2g. This was translated to a conservative estimate of seismic loading on the attachments of 1.5 (2.2g) (W), where W is the total weight of the ceiling and fixtures supported by the anchors.

The results of the analysis demonstrated that the as-installed anchorage system was adequate and no modification was necessary.

6. EDCR 83-22, IE Bulletin 79-02 Support Modifications

This EDCR was developed to address the Maine Yankee Plant Operating Review Committee (PORC) comments which required adding additional pipe support modifications to those previously performed under IE Bulletin 79-02, Revision 2, dated November 8, 1979. The Bulletin addressed the need to review all safety class pipe support base plates utilizing concrete expansion anchors to take into account flexibility characteristics of the plate. Additionally, the Bulletin discussed existing expansion anchors and their safety factor when compared to anchor loads as calculated using the plate flexibility characteristics.

YNSD performed a review of the associated piping loads and support functions which revealed that a small number of support modifications were necessary. The calculations to support these modifications,

prepared by Yankee and CYGNA Energy Services, were reviewed and found to address the major concerns of the IE Bulletin and appeared to be satisfactory.

7. EDCR 81-26, Installation of Differential Pressure Transmitters, EDCR 85-18, Primary Inventory Trending System

These EDCRs contained design documentation for modifications required to meet NUREG 0737, Item II.F.2 and Regulatory Guide 1.97.

The Primary Inventory Trending System (PITS) consists of three differential pressure transmitters used for level indication and other display services to trend the mass inventory in the reactor coolant system. The transmitters are used for the following levels: a) top of pressurizer to bottom of core, b) reactor vessel, and c) top of reactor vessel to bottom of hot leg. In accordance with Regulatory Guide 1.97, Table 3 "PWR Variables," these are Type A, Category 1 instruments and are required to be environmentally qualified.

The inspector found that two transmitters, PT 3001 and PT 3003, were shown on Figure 1 of EDCR 81-26 to be mounted at elevation 16'-2" in the sump. This would subject them to flooding during a post accident condition. From Environmental Qualification file No. 0138-3, the environmental data was found to be: a) submergence depth up to 17.7 feet per SCEW sheet, b) pressure of 60 psig for 80 seconds per Figure 4.3.2, and c) operating time of 30 days per SCEW sheet. However, the flooding water temperature was not specified. For a worst case condition, it can be assumed to be the saturation temperature at the maximum expected containment pressure.

The manufacturer of the two transmitters was Rosemount, model 1154. The qualification test reports indicated that this model had passed a LOCA test for steam environment followed by submergence testing. The submergence test conditions were: 130° F, 50 psig, at 2 ft. depth for a duration of 2 weeks. These conditions could not envelope those required for Maine Yankee. Also, there were no evaluation of documents in the EQ file to justify this deficiency.

During the exit meeting, YNSD stated that these transmitters needed to operate at a maximum of 5 psig instead of 60 psig. Even with this pressure reduction, the test conditions still do not envelope the required conditions.

The PITS has not yet been placed in an operational status at Maine Yankee. This item must be resolved prior to placing the PITS in an operational status, and will require future followup at the station.

8. EDCR 80-13, Containment Water Level Indication, and EDCR 84-02, Installation of Gems Level Transmitters

The purpose of these EDCRs was to upgrade the existing containment sump level system to meet the requirement of NUREG 0737, Item II.F.1(5), which calls for continuous monitoring of this level in the control room. The original design utilized two identical indicating systems with an indication span of 0 to 10 feet. The primary function was for flood level indication. These systems, however, could not meet the environmental qualification requirements of 10 CFR 50.49 and Regulatory Guide 1.97.

EDCR 80-13 involved the replacement of the original GEMS model XM 29400 transmitters with new GEMS model XM 36495 which are qualified to IEEE 323 and 344-1971. Also, the instrument cables inside containment were to be replaced with qualified cables. These level transmitters fed two multipen recorders shared with the containment pressure instruments.

EDCR 84-02 provided further upgrades to this system. The level transmitters were replaced with GEMS model XM 54854. However, this model had a shorter range resulting in a span of 0.5 to 8.0 feet. The seismic support and the stilling wells were also redesigned.

The limited design information within the scope of the YNSD work included sketches of seismic mounting details, wiring changes, safety evaluations, and independent review records which were found to be satisfactory. Procurement and installation information was not within the scope of these EDCRs and was not available for review.

9. EDCR 85-07, Pressurizer Level

This EDCR modified the pressurizer level indication to meet the criteria of Regulatory Guide 1.97, two independent channels both providing trending capability in the control room. The modification involved the addition of isolators, and changes to power supplies and wiring to achieve circuit independence. One channel, LT-101X, provided input to a recorder on the main control board and the other, LT-101Y, to the main plant computer.

10. EDCR 85-02, Pressurizer Panel Modification

This EDCR provided for the relocation and replacement of several components on the pressurizer panel section of the main control board based on a human factors review. Since the components affected are part of the reactor regulation system, a safety evaluation indicated that the system is Non-nuclear Safety Class (NNS). Seismic requirements were placed on the mounting hardware to ensure that the effects of an event would not cause damage to other Class 1E equipment within the control board.

This seismic analysis was required in particular for the Pressurizer Level Channel Selector Switch, HS-101-1, since the original model was being replaced by a Westinghouse model OT2S1 selector switch with 7 contact decks. This required a redesign of the mounting hardware. Additionally, the operability of this switch in the required application due to torsional deflection of the operating shaft with this number of decks was an issue identified by YNSD. Thus, YNSD requested that the purchase order documents require Westinghouse to prove the operability prior to shipment.

In an ECN written against this EDCR, it was noted that the contact decks supplied by Westinghouse exhibited a problem in the field which required Westinghouse to fabricate two new sets of decks. The ECN did not describe the problem which necessitated this rework or whether the testing done at Westinghouse could have identified this problem.

11. EDCR 83-509, Main Steam Non-Return Valve Opening Vacuum Assist System

This EDCR prepared a modification to allow condenser vacuum to be utilized to aid in maintaining the main steam non-return valves (NRV) open during plant cool down. During normal operations, the volume above the piston of this Y angle lift check valve sees downstream line pressure through an equalizing line. However, the EDCR adds a tee in the equalizing line, a line to the condenser, and valves to allow selecting between the two points.

Rockwell, the valve manufacturer, raised a concern that excessive differential pressure across the operating piston may cause erosion and recommended a limit on the differential pressure. Based on this, an Engineering Change Notice (ECN) added a pressure gage on the equalizing line to aid the operator when throttling open the condenser line valve. In a comment made by a design reviewer, it

was recommended that the valve be disassembled after a refueling cycle to verify that the valve was not being damaged by this operation. Also, the valve in the line to the condenser must be locked closed whenever plant temperature is above 365° F to ensure proper NRV operation as well as to prevent damage.

The design documentation for this EDCR was found to be satisfactory.

12. EDCR 83-20, Maine Yankee Pressurizer Safety and Relief Valve Piping Modifications

This EDCR was prepared by YNSD as a response to Item II D.1.A of NUREG 0737 which discussed test of safety and relief valve functionability for expected operating and accident conditions and the testing should also demonstrate that the valves would open and reclose under the expected flow conditions.

Onsite testing of the pressurizer SRVs during the hot functional test program (performed in 1972) indicated stable operation of the valves. However, because a longer than usual configuration of SRV inlet and outlet piping, Maine Yankee determined that the existing configuration of this piping with the Dresser 31790KA SRVs should be modeled and analyzed using the Couple fluid dynamic computer program. The resulting analysis indicated that unstable operation for that configuration could be expected. Thus, a redesign to achieve a configuration of inlet and outlet piping combination with the Dresser SRVs which would result in stable blowdown under all anticipated conditions was begun by YNSD in September 1982. Results were documented in EDCR 83-20.

During the review of EDCR 83-10, the NRC inspector noted two (2) redesign modifications which were initiated at YNSD and recommendations were made which required further follow-up at the Maine Yankee site. The first modification involved five (5) pressurizer nozzles, in which six-component envelope loads were constructed for thermal, seismic, fluid dynamic and dead load cases. Those nozzles were found to conform to the provisions of (1974) ASME III, paragraph NB-3227.5 under the envelope loading and work. However, the 10 inch quench tank nozzle did not meet the requirements of NB-3227.5, nor could it be shown to conform to the requirement of subsections NC, ND, or ASME Section VIII, Division 1.

Since the maximum calculated stress in the quench tank shell at the nozzle could result in yield, YNSD attempted to demonstrate conformance with some provisions of the ASME III code, paragraph NB-3113.3

(emergency conditions - infrequent incidents) in order to allow higher stress limits. Conformance of the 10 inch quench tank nozzle with the provisions of (1974) ASME III paragraph NB-3313.3 had been accomplished except for the assurance that the number of stress cycles not exceed 25.

In a memorandum from YNSD dated February 10, 1984, it was recommended that Maine Yankee maintain a record of the total number of discharges of the pressurizer SRVs and the power operated relief valves (PORVs) into the quench tank and to ensure that the total number of discharges does not exceed 25 for the remainder of the plant lifetime. The memorandum also stated that, should this limit be exceeded, YNSD would then reevaluate the adequacy of the quench tank nozzle and provide recommended action at that time.

The second modification was a result of an analysis performed on flow characteristics through the Dresser SRVs, accomplished by the Couple fluid dynamic computer program. The modifications required that the SRVs receive a new set of nozzle ring adjustments, referenced in EDCR 83-20 Section 7.0.

Based upon the review of this EDCR, several aspects of this EDCR will require followup at the station:

1. Has a record/log been established at the Maine Yankee site to ensure that the total number of SRV and PORV discharges does not exceed 25 cycles for the life of the plant?

2. Were the new SRV nozzle ring settings verified by engineering quality control at the Maine Yankee site?

3. Did the pressurizer SRVs undergo any functional or operational testing, utilizing the new piping configuration and nozzle ring settings?

In an irterview with YNSD personnel, it was stated that, recommendations are made by YNSD, to the site as part of the resolution to modifications. However, the follow-up to those recommendations which take place at the site, are not required to be documented as part of the EDCR package.