TOLEDO EDISON

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Director of Nuclear Reactor Regulation
Attention: Mr. John F. Stolz
Operating Reactor Branch No. 4
Division of Licensing
United States Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Stolz:

This is in response to Mr. Hugh Thompson, Jr.'s letter dated April 17, 1985 (Log No. 1731), concerning Staff Recommended Actions Stemming From NRC Integrated Program for the Resolution of Unresolved Safety Issues Regarding Steam Generator Tube Integrity (Generic Letter 85-02).

The Davis-Besse Nuclear Power Station Unit No. 1 is a Babcock & Wilcox 906 MW raised loop pressurized water reactor design with two Once Through Steam Generators. The corporate management of Toledo Edison is committed to maintaining high integrity and reliability of both the steam generators and turbine. This commitment was demonstrated during both conceptual and final design stages resulting in a secondary system design utilizing full flow feedwater deaerators, full flow condensate polishing demineralizers, and stainless steel tube construction of the feedwater heaters and main condenser. The placement of the condensate polishing system between the first and second low pressure feedwater heaters allows for polishing of both full flow condensate and low pressure feedwater heater drains. This results in polishing of 66% of total feedwater flow. Additionally, no copper alloys are present in the system, which allows operation at higher pH thereby providing optimum corrosion control. Additional details concerning the design and operation of Davis-Besse are contained in the attachments to this letter.

Toledo Edison's commitment regarding feedwater chemistry was further demonstrated by the early adoption of more restrictive administrative controls on feedwater cation conductivity specifications than specified by Babcock & Wilcox. Toledo Edison has adopted the guidance recently published in EPRI-NP-2704, "PWR Secondary Water Chemistry Guidelines", Revision 1 Final Draft, April 1984, (EPRI) with some exceptions for testing frequency and action responses. Toledo Edison subscribes to an ALARA (as low as reasonably achievable) approach to contamination and corrosion control. Original plant design considerations, facility modifications to further enhance plant chemistry, and proven steam generator integrity form the basis for Davis-Besse variances from the EPRI guidance.

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The importance of continued system surveillance and monitoring was further emphasized by the formation of a Chemical Engineering Section in 1982. This group periodically reviews system performance and recommends improvements involving corrosion control, chemical monitoring and water treatment. This group is responsible for monitoring the facility modification to install a remote actuation steam generator blowdown system for startup and low power levels and the installation of a high temperature polishing demineralizer on the moisture separator reheater drains.

The Davis-Besse Steam Generators have been in service since 1977. A total of 28 tubes have been removed from service. Of these, eighteen were removed from service by the manufacturer as a result of hydrostatic testing prior to delivery. Of the ten tubes plugged since initial plant operation, damage to nine has been attributed to mechanical damage from the internal auxiliary feedwater header separation from supports. This issue was previously discussed in our correspondence dated August 6, 1982 (Serial No. 845). Only one tube has required plugging as a result of tube wall degradation. We firmly believe our stringent chemistry control program and original design considerations are to be credited for the existing condition of our generators, a record we believe to be among the best in the industry.

Complete responses to the NRC staff recommendations in Generic Letter 85-02 are contained in the attachments to this letter. We appreciate this opportunity to provide you with the information you requested. If we may be of further assistance, please do not hesitate to call.

Very truly yours,

RPC:VJM

Attachments

cc: DB-1 NRC Resident Inspector

Toledo Edison's Response to Generic Letter 85-02 "Staff Recommended Actions Stemming from NRC Integrated Program for the Resolution of Unresolved Safety Issues Regarding Steam Generator Tube Integrity"

Toledo Edison's Response Concerning Item 1.a., "Prevention and Detection of Loose Parts (Inspections)"

Toledo Edison performs visual inspections of the primary and secondary sides of both steam generators during each refueling outage and after maintenance or modification activities. Administrative controls are in place to preclude the introduction of foreign objects into either the primary or secondary side (see Response 1.b. for details on administrative controls). Additionally, the design of the Davis-Besse Once Through Steam Generators (OTSGs) with full span tube support plates restricts the movement of all but the smallest objects. Foreign objects are expected to remain on the tube support plate directly below the point of access (manway, handhole, etc.) to the secondary side. Similarly, it is expected that foreign objects will remain on the lower tube sheet when access is made through the lower secondary manway or handhole.

Visual inspections are conducted utilizing fiberoptics, 35 mm camera, and videocassette recorders, as appropriate, to view regions into the tube bundle, the tube sheets and tube support plates. Loose parts identified are removed from the steam generators. Tubes observed to have visual damage are subjected to eddy current testing and plugging if determined defective. Visual inspections are focused on the tube sheet or tube support plate periphery in the vicinity of the work being performed. A significant investigation and evaluation for loose parts was undertaken as part of the 1982 evaluation, repair and replacement of the damaged internal auxiliary feedwater header. This has previously been documented in our August 6, 1982 transmittal (Serial No. 845). Additionally, the Davis-Besse Technical Specifications require augmented visual inspections of the secured internal auxiliary feedwater header, header to shroud attachment welds, and exterior header thermal sleeves. Toledo Edison evaluates all eddy current inspection results to determine cause of degradation and corrective action as required. Inspection results indicative of tube damage due to loose parts would result in additional investigation.

Davis-Besse is equipped with a Vibration & Loose Parts Monitoring (V&LPM) System. Sensors are located at the top and bottom of each steam generator outside the shell near the top of the tubesheet. This system is designed to provide indication of loose parts on the primary side of the steam generator and may provide indication of loose parts on the secondary side. On each shift Operations monitors the 8 channels of the V&LPM associated with loose parts. When loose parts are suspected, the V&LPM "crash cart" is dispatched to further analyze the noise and determine the location of the suspected loose part. With the addition of the "crash cart", the V&LPM system is capable of determining whether or not the loose part is between the upper and lower tube sheet.

Exposure of the tube bundle to atmosphere is strictly minimized at Davis-Besse. Appropriate precautions are taken to minimize the potential for corrosion of the tube bundle. The steam generators are normally drained only as far as required to perform the work or inspection. Openings of manway, handhole and inspection port covers are minimized to the extent practical. When repetitive access must be made, temporary covers are utilized and nitrogen overpressure maintained, until such time as personnel must access the area and a respirable environment is required.

Toledo Edison's Response Concerning Item 1.b., "Prevention and Detection of Loose Parts (Quality Assurance)"

Administrative controls are in place to preclude the introduction of foreign objects into either the primary or secondary side of the steam generator whenever it is opened for inspections, maintenance or modification. Accountability of all tools and equipment is maintained by entry and exit logs which are reviewed by supervisory personnel. All tools used are attached to lanyards.

Control of foreign objects such as dosimetry badges is maintained by the Health Physics Group and Radiation Exposure Permits. Typically, these items are double taped in place.

Components removed from the internals of the steam generators would be covered by the facility modification process and special procedures would be prepared to reassemble these items when the modifications occur.

Toledo Edison's Response Concerning Item 2.a., "Inservice Inspection Program (Full Length Tube Inspections)"

Section 4.4.5.4.a.8 of the Davis-Besse Technical Specifications defines the acceptance criteria for tube inspection as being an inspection from the point of entry completely to the point of exit. Under certain conditions special interest tube groups (e.g, peripheral tubes) are subject to less than full length inspection.

Toledo Edison's Response Concerning Item 2.b., "Inservice Inspection Program (Inspection Interval)"

Section 4.4.5.3 of the Davis-Besse Technical Specifications requires that Eddy Current Inspections of steam generator tubes be performed at intervals of not less than 12 nor more than 24 calendar months after the previous inspection. Under certain conditions, these inspections may be extended to a maximum of 40 months. Typically, one steam generator is selected for each tube sample inspection. This circumstance could result in an inspection interval of up to 80 months on an individual steam generator, but is not considered likely.

Section 4.4.5.3 of the Davis-Besse Technical Specifications is consistent with Section 4.4.6.3 of the Babcock & Wilcox Standard Technical Specifications, NUREG-0103, Revision 4. Toledo Edison does not anticipate changing the existing Technical Specifications and instituting a 72 month maximum inspection interval.

Toledo Edison's Response Concerning Item 3.a. "Secondary Water Chemistry Program"

The Toledo Edison commitment to maintaining high integrity and reliability of the steam generators and turbines is demonstrated through a strong secondary water chemistry program. Procedures are in place for all chemistry related activities and clearly identify specific functional responsibilities for chemical control activities.

The Davis-Besse secondary feedwater chemistry program incorporates the guidance recently published in EPRI-NP-2704, "PWR Secondary Water Chemistry Guidelines", Revision 1 Final Draft of April 1984 (EPRI) with some exceptions for testing frequency and action responses. The Davis-Besse action responses are not as detailed nor restrictive as the EPRI guidelines in corrective actions. For example, the EPRI guidance action response to reduce power level for exceeding 10 ppb oxygen in the condensate sample is generally not followed. Davis-Besse has operated in exceedance of this value for extended periods of time, but not at grossly high values. Action is taken to locate and eliminate the air inleakage, but Toledo Edison does not consider a power reduction to 30% appropriate for this condition given Davis-Besse specific design and operating parameters. Variations and enhancements on a typical secondary system design and operation that are specific to Davis-Besse are briefly summarized below. Toledo Edison has reviewed and determined these considerations justify departure from the action responses suggested in the EPRI report.

DESIGN CONSIDERATIONS OF THE DAVIS-BESSE SECONDARY SYSTEM

The Davis-Besse secondary system utilizes full flow feedwater deaerators, full flow condensate polishing demineralizers, and stainless steel tubes in the main condenser, low and high pressure feedwater heaters. Only the moisture separator reheater tubes are carbon steel. Another key design feature is the placement of the condensate polishing system between the first and second low pressure feedwater heaters which allows for polishing of both full flow condensate and low pressure heater drains. This results in polishing of 66% of total feedwater flow.

There is no copper or copper alloys in the system. This allows Davis-Besse to operate at a higher pH range providing optimum corrosion protection of the carbon steel surfaces. Davis-Besse typically operates in the 9.3 to 9.6 pH range versus 8.8 to 9.2 pH for systems where copper is present.

Since initial operation Davis-Besse has utilized a lower tube sheet drain line to manually blowdown the steam generators during startup operations until water chemistry stabilizes at acceptable levels. This system was recently modified to allow for full blowdown capabilities utilizing control room actuation.

Toledo Edison realizes the enormous impact of fouled steam generators and is further modifying the secondary system with the installation of a high temperature resin demineralizer on the moisture separator reheater drains. This modification is scheduled to be completed in 1986 and is expected to yield even better feedwater chemistry. There has been no indication of pressure buildup due to fouling of the steam generators.

Davis-Besse was one of the first B&W plants to institute a hot soak procedure during shutdowns. Repeated soaking and draining of the steam generators to low levels is used to remove soluble contaminants deposited on tubes during operations.

The Davis-Besse secondary system was also subjected to preconditioning during the extended period of hot functional testing prior to operation. This preconditioning period is believed to have resulted in a well-formed passive layer which has inhibited further oxidation of system surfaces.

Station management, the operating staff, and the Corporate technical staff (Nuclear Engineering) are all very aware of the impact of a good chemistry control program on steam generator availability, performance, and expected life. Plant chemistry personnel are all well trained in correcting out of specification conditions of chemistry parameters. Action responses such as those of the EPRI guidance detailed above associated with power reductions or shutdowns are normally held for the Plant Manager's disposition. Alarm procedures allow for the Shift Supervisor to take actions in situations immediately detrimental to the system.

The results of these efforts to date are evidenced by the fact that the Davis-Besse steam generators are the two cleanest OTSG's of all the B&W plants. There has been <u>no</u> indication of pressure drop buildup due to fouling. In addition, since initial operation, a total of only ten tubes have required plugging in both steam generators. Damage to nine of these tubes is attributed to mechanical damage from the internal auxiliary feedwater header separation from supports. The tenth tube (a lane tube) was plugged due to a reduction in wall thickness. The erosion of this tube is believed attributable to a phenomenon common to lane tubes--a chemistry initiated, flow induced vibration erosion.

We firmly believe our stringent chemistry control program and unique design considerations are to be credited for our existing steam generator integrity.

Toledo Edison's Response Concerning Item 3.b. "Condenser In-service Inspection Program"

The Davis-Besse Nuclear Power Station maintains a condenser in-service inspection program. This program includes preventative maintenance activities, sample inspections, metallurgical examinations, and analysis to determine root causes of defective tubes.

Preventative maintenance activities include the use of combination products (polyacrylate-polyphosphonate) to inhibit scale formation and disperse silt formation. Additionally, condenser tubes are cleaned during each refueling outage with shot plugs.

A representative sample of condenser tubes is selected for eddy current testing. Tubes are plugged based on percent through wall indications as a conservative measure against future failures. Thickness gauge measurements are taken as a measure of scale formation in the tubes. Tubes are pulled and subject to metallurgical examination if any question exists as to the failure mechanism.

During early operation, several condenser tube failures occurred, which were determined to be a result of excessive mechanical vibration. Extensive staking of the condenser has been done twice to correct the problem. Since that time there has been no new tube leaks attributable to either chemistry considerations or mechanical vibration. Stainless steel condenser tubes and extensive staking are credited for this performance.

The main condenser has sixteen sample points which can be analyzed to determine the location of tube sheet leakage. One half of the condenser can be isolated from service for analysis or repairs, if needed. Additionally, the plant operates a helium mass spectrometer for detection of air inleakage.

Toledo Edison's Response Concerning Item 4, "Primary to Secondary Leakage Limit"

Section 3.4.6.2.C of the Davis-Besse Technical Specifications limits the allowable primary to secondary leakage rates through the steam generators to 1 gallon per minute.

Toledo Edison's Response Concerning Item 5, "Coolant Iodine Activity Limit"

The Davis-Besse Technical Specification limits and surveillances for primary and secondary coolant iodine activity are identical to the B&W Standard Technical Specifications.

Toledo Edison's Response Concerning Item 6, "Safety Inspection Signal Reset"

This item does not apply to Davis-Besse Station. Our high pressure injection pumps are normally lined up to the Borated Water Storage Tank (BWST) and suction is switched manually to the Containment Sump if the BWST should empty.

Toledo Edison's Response to Enclosure 2, "Request for Information Concerning Category C-2 Steam Generator Tube Inspections"

Toledo Edison considers the existing Technical Specifications for steam generator in-service inspection requirements to be very comprehensive. Special interest tube groups specifically under scrutiny are included in Technical Specifications. When specific problems arise, such as the collapse of the Davis-Besse internal auxiliary feedwater header, the Technical Specifications are revised to incorporate the subsequent surveillance activities. In determining whether additional tubes should be inspected beyond what is required by Technical Specifications, we consider both the pattern and location of the defective tubes. We also keep abreast of experiences at other plants to determine whether or not a generic problem is likely. Davis-Besse evaluates the location and pattern of degraded tubes, prior operational experiences, trends, and previous inspection results to determine both the cause of degradation and whether the second generator should be inspected. Since both steam generators at the same plant have a tendency toward similar behavior, a better representation can be gained by expanding the sample size, as required, on the same steam generator. This practice is also consistent with good ALARA principles. In addition to degraded tube analysis, patterns of dings or dents are investigated. This could lead to the use of profilometry and debris inspection techniques, if necessary.

All these factors are taken into account in determining when the steam generators are reinspected. Generally, inspections are done in alternate steam generators each outage. If a deteriorating condition is suspected, Toledo Edison will take appropriate actions to investigate the potential problem and perform the required evaluations.

Toledo Edison carefully evaluates all eddy current inspection results for modes of tube degradation. This evaluation may result in further tube sampling, debris inspection sampling and profilometry. Surrounding tubes are investigated closely with the emphasis on the identification of patterns. Based on the analyses performed and an engineering evaluation, neighboring tubes could be considered for removal from service.