TU ELECTRIC

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W. J. Cahill
Executive Vice President

October 14, 1989

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION (CPSES)
DOCKET NOS. 50-445 AND 50-446
RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION
REGARDING AFW SYSTEM BACKFLOW EVENTS

REF: 1) TU Electric letter from W. J. Cahill to the NRC logged TXX-89596 dated August 18, 1989

2) NRC Letter from R. F. Warnick to William J. Cahill dated September 14, 1989

Gentlemen:

Reference 1 provided TU Electric's report on the Auxiliary Feedwater (AFW) System backflow events on April 23 and May 5, 1989, and described the lessons learned from and corrective actions for these events. Reference 2 provided the NRC's request for additional information related to that report.

Please find attached TU Electric's response to this request for information. In addition, minor points of clarification are provided after the Question and Response Section.

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As part of TU Electric's corrective action for the April 23 and May 5, 1989, events, BW/IP Inc. check valves are being disassembled, inspected, reworked as necessary, reassembled and post-work tested. As discussed with the onsite NRC staff, since June 1989, post-work testing and subsequent radiography have indicated that a number of these valves are not seating properly. The cause of improper seating is discussed for two valves, 1AF-075 and 1AF-078, in the attached response (see Responses to Question Nos. 11 and 15). The cause for improper seating of the other valves is under investigation. The final response to SDAR-CP-89-15 will identify the cause(s) and corrective action(s) for all of these valves, and any others, should they occur.

Sincerely,

William J. Cahill, Jr.

TLH/daj

Attachment

c - Mr. R. D. Martin, Region IV
Resident Inspectors, CPSES (3)

TU ELECTRIC'S RESPONSE TO NRC QUESTIONS ON AFW SYSTEM BACKFLOW EVENTS

On August 18, 1989, Texas Utilities Electric Company (TU Electric) submitted to the Nuclear Regulatory Commission (NRC) a report entitled, "Report on Events of April 23 and May 5, 1989 Involving Backflow through the Auxiliary Feedwater System," ("Report"). On September 14, 1989, the NRC requested additional information regarding the Report. This attachment responds to the NRC's request. Each of the NRC's questions (including reference to relevant paragraphs and pages in the Report) is listed below, followed by TU Electric's response.

NRC Question 1

General

Numerous commitments are stated in your response to the NRC Augmented Inspection Team (AIT) report regarding testing, engineering evaluations, calibration of instrumentation, procedural changes, etc. How will these commitments be tracked?

TU Electric Response

Each department assigned commitments in the Report reviewed and approved the Report prior to issuance. As such, each department is cognizant of and responsible for completing actions necessary to satisfy the commitments. In addition, each commitment identified in the Report was entered into the project-wide Commitment Tracking System administered by Licensing. Each commitment was assigned a specific number and copies of the computer generated Commitment Data Forms were provided to responsible departments. Licensing is monitoring progress on these commitments through periodic interaction with responsible departments.

NRC Question 2

Paragraph I.C, p.5

Your response did not clearly address the circumstances which permitted the April 23 event to be nearly identically recreated on May 5. Rather, the two events are treated, for the most part, as independent occurrences. Please provide a more complete assessment of how and why the May 5 event occurred given the (then) recent experience of the April 23 event.

TU Electric Response

The Report discusses the two events separately only insofar as the circumstances and specific effects of each event were slightly different; however, the Report states that the events shared common root causes.

The April 23 and May 5 events occurred because of simultaneous opening of AFW isolation valves coincident with a number of hung open check valves. This permitted backflow of steam generator water into the AFW system. Simultaneous

operation of these valves is not allowed by the approved procedures. Backflow would not have occurred if these valves had been operated in accordance with these procedures or if an additional hardware problem had not occurred (i.e., valve binding of 1AF-055 on May 5). The personnel who operated the valves in the improper sequence on May 5 were not made sufficiently sensitive to the implementation of procedure requirements for sequential valve operation prior to performing the valve manipulations. Further, these same personnel were not made aware of all the circumstances associated with the April 23 event. At the time, Operations management felt that the procedural noncompliance on April 23 did not represent a generic problem with valve operation (see TU Electric Response to NRC Question No. 14). Consequently, only routine methods were used to disseminate information relative to this event. In this case, the methods relied upon did not result in timely notification to all operating personnel on the causes of the problem. For example, the Plant Incident Report (PIR) for the April 23 event was placed in the control room for review by all shift personnel, but was removed prior to all crews reading it. Complicating this situation, Operations management focused its attention on the mechanical aspects of the emerging check valve failures and identification of backflow paths. Consequently, management did not follow-up sufficiently on the performance issues to ensure that other crews were made aware of the April 23 event through methods such as shift-to-shift communications. As discussed on pages 37 and 38 of the Report, TU Electric is taking several actions to improve communications among operators and to increase personnel awareness of operating events, equipment failures and operator noncompliances.

NRC Question 3

Paragraph II, p.9

Your letter states that the NRC was informed May 6, 1989, of the backflow events which occurred on May 5. Our information indicates that the AIT team and the Task team were notified by the system engineer of the additional pipe paint burning (and, therefore, the second event) at a team meeting on Monday, May 15, 1989, at 3:00 P.M. Please provide information and details to support your statement.

TU Electric Response

The referenced date of May 6, 1989, in the Report concerning NRC notification is based on the recollection of the AFW System Results Engineer. The engineer called the NRC Resident Inspector for Operations on May 6, as requested, to notify him that check valve testing was about to resume. During the telephone call, the engineer believes that he informed the inspector that an event similar to the April 23 event may have occurred on May 5. The Results Engineer also stated that he believes that he briefly discussed the May 5 event with the prospective AIT leader on May 7 while delivering requested drawings. Documentation is not available to substantiate these conversations.

Notwithstanding the above discussions, TU Electric acknowledges that it did not provide NRC with details of the May 5 event until later. The details of the second event were not promptly investigated. The apparent similarity to the April 23 event led Operations Supervisors initially, but incorrectly, to believe that the new event could properly be added to the existing PIR and the ongoing investigation of the previous event. For these reasons the details of

the second event were not immediately discussed with Operations management and consequently NRC was not briefed on the scope or significance of the event until mid-May.

Pages 35, 36, 37 and 38 of the Report discuss improvements that TU Electric is making to increase Operations management awareness of significant events. Implementation of these improvements should provide management with the information needed to more effectively communicate with NRC personnel. Additionally, the Report discusses improvements in future TU Electric Task Team evaluations, including improvements in communications with the NRC.

NRC Question 4

Paragraph III.A, p.12

It is not clear that the feedwater isolation bypass valves are suitable for service as installed. If they are not, what modification or administrative measures are going to be taken to lessen the probability of additional backflow events through these valves?

TU Electric Response

As previously discussed in the Report, the Feedwater Isolation Bypass Valves (FIBV) unseated and were, therefore, within the backflow paths during the April 23 and May 5 events. These valves normally isolate feedwater flow in the forward direction and provide for containment isolation. The FIBVs were not designed to prevent backflow from pressurized steam generators. That is the purpose of the check valves and other isolation valves. Testing performed after the May 5 event showed that the FIBVs remained closed at pressures in excess of containment accident pressure. Therefore, TU Electric does not believe that modification or replacement of the FIBVs to perform the additional function of preventing backflow is warranted. However, as discussed on page 72 of the Report, TU Electric is revising its procedures to require isolation of the FIBVs when the main feedwater pumps are not supplying flow to the steam generators as part of normal startup and shutdown. Additionally, TU Electric is conducting a review to determine whether similar valves exist in other safety-related systems and whether additional protection should be provided by requiring associated isolation valves to remain closed during particular plant conditions.

NRC Question 5

Paragraph IV.A, p.14

This paragraph provides the introduction to the root cause investigation and identifies certain areas which could have been improved by TU Electric. In part, one statement asserted that, "In addition, the Task Team did not fully understand the information needs or expectations of the AIT." As a matter of record, the complete scope of the NRC's AIT inspection at Comanche Peak relative to the multiple check valve failures in the AFW system were identified to TU Electric management by the AIT leader during the entrance conducted by the NRC on May 2, 1989. It would appear that plant management failed to recognize the significance of the NRC AIT inspection as revealed during the NRC entrance or that this information was not adequately

transmitted to the Task Team. In either case, please clarify your statement that the information needs and expectations of the AIT were not fully understood by the Task Team.

TU Electric Response

TU Electric does not take issue with the explanation of inspection scope or perception of event significance as explained by the AIT leader on May 2, 1989. The statement, "In addition, the Task Team did not fully understand the information needs or expectations of the AIT," was intended to convey that TU Electric's indoctrination of the Task Team members on AIT inspection needs and methods was insufficient. The Task Team did not fully understand or appreciate the need for rapid dissemination to the NRC of preliminary information, nor did the Task Team formalize communications channels with the AIT. Many team members initially did not anticipate AIT involvement in daily meetings or the need for continuous communications with the Task Team leader. As a result, Task Team communications with the AIT did not meet AIT expectations. As discussed on page 37 of the Report, an incident investigation procedure is being developed to help achieve improvements in this area.

NRC Question 6

Paragraph IV.C, p.15

Your letter states that you used "... the Computer Assisted Drawing (CAD) program to determine the actual measurements of critical valve internal components." This would appear not to be so as these dimensions are input to create the drawing. Please clarify what your statement intended to convey.

TU Electric Response

The statement made in the referenced paragraph is clarified as follows. As explained on pages 67 and 68 of the Report, CADs were used to create two-dimensional and three-dimensional models of the as-found conditions of the check valves. These drawing models were used to simulate the potential for hang up and improper closure of the check valves. The models were prepared with dimensions taken from disassembled valves and input received from the onsite BW/IP representative.

NRC Question 7

Paragraph IV.E, p.18

The summary presented states, in part, that the "Check valve failures occurred because of incorrect instructions for reassembly." This conclusion was also confirmed by the AIT; however, no mention is made in your response of the apparent inadequate post-maintenance testing of these valves; testing that would have detected the incorrect reassembly. Please provide additional information relative to the omission of this item and TU Electric plans for corrective action to strengthen post-maintenance and post-modification testing.

TU Electric Response

Post-maintenance backleakage testing would have detected the incorrectly reassembled check valves in 1983 and 1985. However, the lack of testing is not considered a root cause for incorrectly reassembled valves. Therefore, post-maintenance testing was not discussed in this section of the Report which deals with root causes. The Report acknowledges on page 25 that both TU Electric and the AIT noted that post-assembly backleakage testing had not been specified or performed for any of the aforementioned (1983 and 1985) valve disassembly operations. TU Electric believed Section XI of the ASME Code did not require that the AFW check valves be tested other than in the forward direction. Additionally, prior to issuance of Generic Letter 89-04 on April 3, 1989, TU Electric was unaware of any published regulatory guidance that required or recommended that check valves be tested for backleakage and believes that it was not common industry practice to test check valves for backleakage on a general basis. TU Electric believes, therefore, that its post-work test activities prior to 1988 were consistent with industry practice. Nevertheless, in 1988, based on an increasing body of information regarding problems with check valves, TU Electric revised its post-work test guidelines to include testing of check valves for backleakage.

As discussed in TU Electric's Response to NRC Question 12, TU Electric has revised its ASME Section XI Inservice Test Plan to include provisions for qualitative backleakage tests or other methods for verifying the operability of check valves. This has been discussed at length and is pending approval by NRC Office of Nuclear Reactor Regulation. Such testing, together with post-work testing, will ensure that check valves are operable prior to declaring the associated systems operable.

NRC Question 8

Paragraph V.A, p.20

This paragraph describes the "actual significance" of the April 23 and May 5 events; however, this section is incomplete. Specifically, the AIT report had identified a concern relative to the lack of objective evidence to support the applicant's statement that steam generator blowdown had been secured on all steam generators at approximately 6:25 a.m. on April 23, 1989. Please provide supporting evidence that steam generator blowdown was secured during the event.

TU Electric Response

A review of the operator log and steam generator level traces indicates that levels were restored in approximately 15-20 minutes. The operator log for April 23, 1989, states the following:

"0620 - While aligning to run T/D AFW pump [Turbine Driven Auxiliary Feedwater Pump] for hot alignment S/G [Steam Generator] LVLs [Levels] on #1, 2, 4 started lowering rapidly. Stopped S/G Bldn [Steam Generator Blowdown] by closing 1-PK-5180. AO reclosed 1AF-042 [Test Line Isolation]. No effects noted on RCS [Reactor Coolant System] press. [Pressure] or Tave [Temperature average].

0635 - S/G LVLs recovering. Stopped preps [preparations] for T/D AFW pmp hot alignment. Suspect AFW Test Line vlv [valve] leakage."

A review of steam generator water level traces substantiates the operator log entry that the water levels were recovering. These documents are contained within Plant Incident Report (PIR) 89-110 and are available for NRC inspector review.

NRC Question 9

Paragraph V.B, p.20 & 21

This paragraph describes the piping and pipe support stress analyses which were performed and inspections which were performed as a result of these analyses. Please provide the following additional information.

a. The report states that ultrasonic inspections verified that no plastic deformation had occurred in several areas where piping Code allowable stress was exceeded. Without baseline thickness measurements taken prior to the event, ultrasonic inspection can not establish whether plastic deformation occurred. Therefore, there is no basis for your conclusion that the piping stresses due to this event were in the elastic range.

b. This paragraph omits reference to the one support that was visibly damaged (see Executive Summary, paragraph ID, p.5). A discussion of this support is necessary. The discussion should clarify if damage to this support was predicted by the analysis and if not, why not. In addition, if failure of this support was included, please clarify the impact on the analysis in regards to load transfer to other supports.

TU Electric Response

a. The statement regarding plastic deformation should be clarified. Information does not exist to determine whether any plastic deformation occurred. Instead, ultrasonic and radiographic tests were performed on the piping components where yield stresses were exceeded to confirm that no deteriorative damage or deformation had occurred and that pipe wall thickness had not been reduced below minimum required values. The tests did not identify cracks or other rejectable indications and established that minimum piping thickness requirements continued to be met.

b. Worst case condition analysis which assumes that the strut is fully functional indicates that the predicted load (23.5 kips) exceeds the faulted load capacity of the failed strut (12 kips) by a factor of two. Furthermore, this high load in combination with observed bearing dislodgement caused bending of the paddle. Failure of the support results in no transfer of loads to other supports. In addition, elimination of the support from the piping stress analysis relieves the thermal constraint and results in lower pipe stresses and support loads.

NRC Question 10

Paragraph V.E, p.22

It is the position of the AIT that as a result of the precursor events on April 5 and 19, and again as a result of the backleakage events on April 23 and May 5, the backleaking check valves should have been considered inoperable and, therefore, the AFW system should have been considered inoperable. Please address operability.

TU Electric Response

The AFW System was in pre-operational testing when these events occurred. Therefore, the AFW system was not officially operable when the tests were initiated and principles governing operability of systems were not applicable. If the plant had been in operation, the check valves which were identified as hung open would have been inoperable. Consequently, the AFW system would have been required to be declared inoperable in accordance with Technical Specifications and TU Electric would have been required to comply with associated action statements.

TU Electric understands the importance of assuring that the plant operators and support organizations are properly sensitive to operability requirements, Technical Specifications and other fundamental operating mechanisms. These elements are continuing to be emphasized by TU Electric management as plant licensing approaches. Several of the improvements specified in the Report will assure this overall operating attitude is attained.

NRC Question 11

Paragraph VI.A, p.24

Your letter states that Diablo Canyon attributed its check valve leakage problems to the uncertainty involved in aligning the disc parallel to the seat during assembly. Your letter goes on to say in the same paragraph, that this problem is unrelated to the check valve failures of April 23 and May 5, 1989.

The AIT notes that two check valves reworked to the new height adjustments failed their reverse flow system leakage tests. The root cause was determined to be rotational misalignment of the bonnet disc and valve body seat during installation. This would appear to contradict your conclusion.

TU Electric Response

Following the April 23 and May 5 events, TU Electric radiographed twenty-one check valves and identified twelve valves in which the disc was not properly seated. Radiographs showed the following with respect to these twelve valves:

- Ten of the valves appeared to be hung open (i.e., the top of the disc hung up under the seat lip at the 12 o'clock position).

- In two of the valves (1MS-142 and 1MS-143), the discs were in contact with the seat over the top half, but not over the lower half; however, the discs did not appear to be hung up. TU Electric attributes improper seating of these valves to the fact that the seats for these valves were essentially vertical and the discs were hanging loosely against the seat. Therefore, TU Electric does not believe that these valves would have experienced backleakage during operation.

These results are shown on page 69 of the Report. Based upon these results, TU Electric concluded that the primary cause of the check valve failure was hang up of the valve disc due to a difference in elevation of the valve disc relative to the seat. This cause is different from and unrelated to the rotational misalignment of the valve disc and seat at Diablo Canyon.

In addition to the radiographs, TU Electric also compared the alignment of the valve body to the pattern of studs that hold the valve bonnet in place. Based upon this comparison, TU Electric determined that four of the ten failed valves exhibited rotational misalignment between the valve disc and seat. Since these valves were also hung open, it was not possible to determine whether the rotational misalignment alone resulted in any backleakage through these valves during the April 23 and May 5 events. However, this possibility was not discounted. Therefore, as discussed in TU Electric's Response to NRC Question 15, TU Electric took steps which it thought would assure the proper rotational alignment of the disc and seat when the check valves were reworked as part of the corrective action for the April 23 and May 5 events.

Following this rework, the valves were tested and two valves (1AF-075 and 1AF-078) experienced backleakage due to rotational misalignment. One of these valves (1AF-075) had been determined to be properly aligned prior to rework. Therefore, the misalignment of this valve must have resulted from the rework, and TU Electric believes that this misalignment did not contribute to the failure of this valve during the April 23 and May 5 events. It is unknown whether the rework of the other valve (1AF-078) exacerbated the pre-existing misalignment or whether the pre-existing misalignment would have been sufficient to cause backleakage during the April 23 and May 5 events.

As a result of the backleakage through these two valves, TU Electric is developing further improvements in the controls governing rotational alignment. These improvements are discussed in TU Electric's Response to NRC Question 15.

<u>NRC Question 12</u>

<u>Paragraph VI.B, p.25</u>

This paragraph states that "It is TU Electric's position that applicable provisions in Section XI of the ASME Code do not require that check valves be tested other than in the forward direction." Concerning this statement, it is the AIT's position that ASME Code requirements are minimum requirements and that it is imperative that safety-related systems be maintained operable. That is one reason preoperational testing and post-maintenance/modification testing are required by the NRC. If you feel your system would have detected

these failures, then please provide additional information clarifying your position and identify in detail your preoperational testing program which would have identified the check valve failures.

TU Electric Response

As discussed in TU Electric's Response to NRC Question 7, TU Electric revised its post-work test guidelines in 1988 to include provisions for backleakage testing for safety-related and nonsafety-related check valves. These post-work test guidelines are in addition to the provisions for backleakage tests under TU Electric's ASME Section XI Inservice Test Plan. As discussed in the TU Electric Response to NRC Question No. 13, this procedure revision was not applied to valves which had been previously reworked or modified.

In response to the Office of Nuclear Reactor Regulation initiatives and independent of the April 23 and May 5 events, TU Electric revised and submitted its ASME Section XI Inservice Test (IST) Plan to the NRC. This revised plan added additional check valves requiring reverse flow testing. Such valves will be tested in the reverse direction except where plant configuration does not permit such testing. Check valves in this latter category will be verified operable through partial disassembly as reflected in the ASME Section XI exception process.

The testing of valves covered by the IST Plan will be performed prior to declaring the associated system operable and periodically thereafter as prescribed by the TU Electric IST Plan. This testing will have the capability of detecting the potential for the type of backleakage that occurred during the April 23 and May 5 events.

NRC Question 13

Paragraph VI.B, p.25-26

The paragraph states that TU Electric revised its post-modification test procedures in 1988 to require post-work testing for backleakage. Please provide information as to why these post-modification procedures were not applied to previously modified check valves. Were they applied to check valve 1AF-069 after April 19, 1989?

TU Electric Response

As discussed in TU Electric's Response to NRC Question 7, TU Electric did not believe that Section XI of the ASME Code and NRC guidance required testing of these check valves for backleakage and it was not common industry practice to perform such testing. Therefore, TU Electric did not backfit the revised post-work test guidelines.

Backleakage testing was performed on valve 1AF-069 following rework of the valve after the April 19 event. The test recreated the April 19 conditions to verify that the check valve would prevent backflow. In addition, this valve has since been reworked to assure the adequacy of the swing arm material and therefore will be tested again.

Additionally, as discussed in TU Electric's Response to NRC Question 12, TU Electric has revised its ASME Section XI Inservice Test Plan to include testing of check valves which have a reverse flow safety function. This testing obviates the need to backfit the revised post-work test guidelines because the ASME Section XI testing will assure the operability of such check valves previously reworked.

NRC Question 14

Paragraph VI.B, p.27

Your letter states that the Manager of Operations felt that the valve positioning error of April 23 was isolated to the shift in question. How can this operator error, or any other, be considered isolated to one particular shift given the homogeneity of the training and certification process? It seems evident that any operator error must be considered a generic problem. Please comment on this and explain further how the original assumption was made that this error was isolated to one shift. Additionally, describe how management will ensure proper consideration of the generic implications of future incidents of personnel error.

TU Electric Response

TU Electric reviews personnel errors for potential generic problems. However, not every operator error indicates generic concerns. For instance, although operators receive essentially the same training and certification, the experience, knowledge retention, and ability of operators differ from individual to individual. Additionally, particular circumstances in question may contribute to operator error. Therefore, there may be unique or isolated factors that affect an operator's performance.

With respect to the event on April 23, Operations management did not feel that the operator error was reflective of common practice because: 1) investigations of operating incidents had not previously identified parallel implementation of steps as a contributing factor to any operator errors; 2) the operator in question admitted that he erred in operating valve 1AF-042 prior to operating valve 1AF-041 even though he had been briefed by the Reactor Operator prior to valve operation; and 3) the Auxiliary Feedwater System had been operated in various configurations prior to April 23 without evidence of operator error. Prior to May 5, Operations management did not recognize that sending more than one operator on a given task created the likelihood of parallel valve manipulation during the evolution. This was an important operational lesson to learn.

Although Operations management believed that the operator error was isolated, it did take steps to inform other operators of this error in order to minimize any potential for recurrence. For example, Operations management distributed a letter on May 1, 1989, to the operators stressing the need for procedure compliance, including the need to complete steps in sequence. Additionally, the PIR on the April 23 event was placed in the control room for review by operators. For several reasons, the crew involved in the May 5 event was not made aware of the April 23 event through these methods. The PIR was removed

from the control room prior to all crews reviewing it and no requirement existed for operators to review the May 1 letter prior to assuming the shift.

As discussed on page 36 of the Report, TU Electric is taking steps to improve the aggressiveness of investigations of plant events. One of these steps is refinement of the Plant Incident Report (PIR) system to include failure mode analyses and human performance evaluations. This will help ensure that proper consideration is given to generic implications. Additionally, page 37 of the Report discusses enhancements for communications between shifts and the dissemination of information as part of shift turnover process.

NRC Question 15

Paragraph VII.B, p.29-32

Paragraph VII.B.2.c states that a check valve was bench tested following adjustment of the bonnet elevation in accordance with the revised procedure and that the test showed the procedure was adequate. However, valves 1AF-075 and 1AF-078 failed the backleakage test following reassembly using the modified installation methods for correct bonnet elevation adjustment. Both valves were found to have been installed with rotational misalignment between the bonnet-disk assembly and the valve seat. The revised installation procedure was not adequate for valves 1AF-075 and 1AF-078. Please comment.

TU Electric Response

Prior to the April 23, 1989, the procedure for reassembly of the BW/IP check valves did not include provisions for ensuring the proper elevation of the valve disc. Following the April 23 and May 5 events, this procedure was revised to include provisions to ensure elevation was restored after assembly. Bench testing of a check valve demonstrated the adequacy of the elevation calculational methodology.

Prior to April 23, 1989, the reassembly procedure did include a provision for rotational alignment of the valve disc and seat (matchmarking the body and bonnet during disassembly). As discussed in TU Electric's Response to NRC Question 11, inspection of the stud pattern of the check valves following the April 23 and May 5 events showed that four valves had rotational misalignment of the valve disc and seat. Consequently, TU Electric took steps to help assure the proper rotational alignment of the valve disc and to the seat. Based upon discussions with BW/IP, TU Electric instructed its personnel also to utilize the stud patterns on the bonnet to help align the disc and seat. At the time, TU Electric believed that these provisions would be sufficient to assure the proper rotational alignment of the valve disc and seat.

When check valves 1AF-075 and 1AF-078 failed their backleakage test due to a rotational misalignment between the valve disc and seat, TU Electric realized that the existing procedures and instructions were not sufficient to guarantee rotational alignment. In particular, it became apparent that allowable tolerances on rotational alignment were smaller than previously believed. As a result, misalignment occurred in some cases when mechanics attempted to

visually align two marks that (even when properly aligned) were separated by a retaining ring of approximately one to two inches thick. As a result, the procedure is being revised to provide for longer match marks to help minimize the problem of parallax in aligning the match marks and to provide for the use of a centering tool to achieve greater precision in identifying the match marks. Post-work testing will be performed following rework. Based upon the results of this testing, further revisions to the maintenance procedure will be made if warranted.

NRC Question 16

Paragraph VII.B.1.b, p. 30

Your response states that following an evaluation that is in process, TU Electric will determine whether to increase the distance between orifices and check valves, and will base the timing of implementing design changes on a determination of whether check valve failure is imminent. Please provide additional information on this issue and explain how the probability of imminent failure will be determined. This issue should be resolved prior to fuel load.

TU Electric Response

Independent of the April 23 and May 5 events, Kalsi Inc. was contracted by TU Electric to evaluate check valves in response to SOER-86-03. This evaluation used anticipated flows and operating durations to predict wear in the valve internals and number of operating hours to valve failure. Kalsi has provided a preliminary report which identified that the AFW minimum flow recirculation check valves (1AF-045, 1AF-057 and 1AF-069) have the potential for a high wear rate and hence low service life. Therefore, TU Electric will modify the three check valves or increase the distance between the orifices and check valves prior to fuel load.

For all other valves examined, Kalsi predicted extended life and recommended an inspection interval of 5 to 10 years in the AFW system. Inspection of these valves will be consistent with Kalsi recommendations.

A copy of the report by Kalsi Inc. will be enclosed as part of our final response to SDAR-CP-89-15.

NRC Question 17

Appendix 1, paragraph B.3, p.49

Your letter states that Operations management, in light of the known check valve problems, decided to proceed with testing activities based on the conclusion that administrative controls in place would compensate for the identified deficiencies. Please explain which administrative controls were relied upon to provide this assurance and why they failed to prevent the May 5 event.

TU Electric Response

Operations management was aware that the April 23 event was caused, in part,

by leaking check valves and a noncompliance with procedures governing valve operation. Operations management met on April 24 and decided to proceed with testing for two reasons.

First, the cause of the check valve failures was being investigated and generic implications were being determined. Because of this, Operations management believed that it was appropriate to proceed with testing because, even if a generic problem existed with the check valves, isolation valves in the AFW system would prevent backflow through the system if the valves were aligned in accordance with then existing procedures (i.e., procedure SOP-304A, "Auxiliary Feedwater System"). Therefore, Operations management believed that sufficient controls were in place to prevent recurrence of the April 23 event.

Second, Operations management was aware of the noncompliance with the procedures governing operation of the isolation valves during the April 23 event. However, based upon initial interviews with the personnel involved in the April 23 event, Operations management believed that this noncompliance with procedures was isolated. (See TU Electric's Response to NRC Question 14).

TU Electric has identified several lessons learned as a result of the May 5 and April 23 events. In particular, TU Electric has identified lessons learned related to identification of the root causes of personnel errors and communication of plant events to personnel. As discussed on pages 36 to 38 of the Report, TU Electric is taking action to improve its investigations of plant events and equipment failures, including human performance evaluations, and to improve communication of plant events to personnel.

NRC Question 18

Appendix 2, p.53

It is our understanding that the main feedwater upper penetration check valves could not be backleakage tested individually and thus, perhaps only one out of each pair of valves held. Please clarify.

Does the "GPM Leakage" identified for the valves listed in the Table on page 53 (approximately 5.4 gpm) represent the true leakage or a minimum value due to limitations in the test equipment?

TU Electric Response

The main feedwater upper penetration check valves were tested in pairs during the initial investigation because there were no available test connections to test the valves individually. Radiography was also performed on each valve and confirmed that the valves seated properly. Following rework, forward flow testing and radiography of each valve will be used to confirm operability by verifying that the valve disc has returned to the valve seat.

The check valve leakage listed on the table on page 53 of the Report is a minimum value due to test method limitations.

Additional Clarification to the Report

Additional points of clarification, not requested by the NRC, are provided below.

Page 15 of 72 of the Report (and TXX-89424, SDAR CP-89-015) indicates that Unit 1 and 2 contain fifty-seven BW/IP pressure seal check valves. Unit 1 and 2 actually contain fifty-six BW/IP pressure seal check valves.

The table attached to App. 3, page 63 of 72 of the Report, identifies seven check valves in the Chilled Water system. The internals of six of these valves have been removed. This table also contains unclear wording in a column adjacent to 1CH-024. The wording should state "Leaked at ILRT pressure post rework." However, the wording is not applicable, as it applied to the ILRT that was performed in 1985.