Consumers Power Company

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80-06 #3

March 31, 1981

Mr J G Keppler, Regional Director
Office of Inspection & Enforcement
US Nuclear Regulatory Commission
Region III
799 Roosevelt Road
Glen Ellyn, IL 60137

MIDLAND PROJECT
DOCKET NOS 50-329 AND 50-330
COMPONENT COOLING WATER DESIGN
FILE: 0.4.9.43 UFI: 73*10*01, 10111(S) SERIAL: 11529

Reference: J W Cook letters to J G Keppler, Same Subject:

1) Serial 10053, dated November 7, 1980
2) Serial 11173, dated January 30, 1981

The referenced letters are interim 50.55(e) reports. This letter is the final 50.55(e) report concerning the effect of a failure of a nonessential portion of the component cooling water (CCW) on the essential (safety related) portion of the CCW.

A description of the discrepancy, probable cause and completed part corrective action are documented in the enclosure to this letter. There is no need for process corrective action for reasons which are discussed in the enclosure.

James W. Cook

JLW/lr

Enclosure: MCAR-43, Final Report, March 20, 1981 - "Component Cooling Water System Susceptibility to Loss-of-Coolant Accident-Induced Failures"

CC: Director of Office of Inspection and Enforcement
Att Mr Victor Stello, USNRC (15)

Director, Office of Management
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RJCook, USNRC Resident Inspector
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SUBJECT: MCAR 43 (issued 10/10/80)

Component Cooling Water System Susceptibility to Loss-of-Coolant Accident-Induced Failures

FINAL REPORT

DATE: March 20, 1981

PROJECT: Consumers Power Company
Midland Plant Units 1 and 2
Bechtel Job 7220

Introduction

This final report describes the project activities concerning component cooling water (CCW) system susceptibility to loss-of-coolant accident (LOCA)-induced failures.

Description of Deficiency

The Midland Units 1 and 2 CCW system is a dual-purpose system serving both safety and nonsafety-related equipment. For each unit, redundant CCW pump trains supply cooling water to the associated high-pressure injection (HPI) makeup pump lube oil coolers, reactor building spray pump, decay heat removal (DHR) pump seal coolers, and DHR heat exchangers following a LOCA; and to safety-related fuel pool heat exchangers, and other nonsafety-related heat exchangers during normal power operation. The nonsafety-related loads and fuel pool heat exchangers are supplied by either CCW train during normal power operation while the redundant CCW pump train is on standby. The 16- and 18-inch motor-operated butterfly valves isolating nonsafety-related loads from the CCW pump trains have a valve closing time of 60 to 75 seconds, exclusive of delay in the control signal to activate them. Each CCW pump train has a CCW surge tank with a total capacity of 1,000 gallons and a nominal minimum operating level of 300 gallons, with a nonseismic makeup from the demineralized water storage and transfer system.

Nonseismic CCW piping to the reactor coolant pump motor coolers, letdown coolers, and control rod drive mechanism in the reactor building may not be adequately protected from LOCA-induced failures such as jet impingement or pipe whip. Other CCW piping to the radwaste evaporator condenser in the auxiliary building is not designed as Seismic Category I. Therefore, the piping may not retain its integrity under LOCA-induced failures or during a seismic event.

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If a pipe break were to occur in CCW piping because of LOCA-induced failures or a seismic event where the line is not specifically designed to withstand such an event and its consequences, the CCW surge tank level would drop. For Unit 1, CCW train A, the CCW surge tank (1T-73A) low-low level signal will trip its associated CCW pump (1P-73A) and initiate closure of its associated motor-operated safety-related loop isolation valves (1M-1610A and 1MO-1623A) isolating all nonessential components and fuel pool heat exchangers from the CCW system. This scenario is analogous for each CCW train in both units. If an emergency core cooling actuation signal (ECCAS) occurs, the CCW surge tank low-low level trip signal to the CCW pump will be bypassed, the CCW pump will start, and the safety-related loop isolation valves will close.

With a pipe break in a line not specifically designed to withstand the postulated seismic event, the operating CCW surge tank level could drop to the low-low level setpoint and closure of the safety-related loop isolation valves would then be initiated. However, because of the slow (60 to 75 seconds) closure time of the isolation valves and because of potentially high CCW volume loss flowrates, enough water could be lost from the CCW system before the valves completely close so that the net positive suction head (npsh) available to the CCW pump would be inadequate. An ECCAS signal would restart the tripped CCW pump, which could result in loss of CCW flow and pump cavitation because of low npsh availability. The standby CCW train is postulated to be unavailable because of a concurrent single active component failure. Thus, the unit would have lost CCW heat transfer capability.

One fuel pool heat exchanger train is connected to the CCW system of each unit. The CCW to fuel pool heat exchangers is supplied by a common safety-related portion of the piping including the common non-safety-related heat loads connected by motor-operated valves 1MO-1610A and B (2MO-1710A and B) and 1MO-1623A and B (2MO-1723A and B) to either CCW pump trains. During a pipe break due to a LOCA-induced failure or seismic event along with a loss of offsite power, the motor-operated butterfly valves (for Unit 1, 1MO-1685A and B and 1MO-1687), which are powered from a non-Class 1E power source, do not receive an isolation signal and may fail to close. With a low point in the nonseismic portion of the ruptured pipe, the CCW pipes to and from the fuel pool heat exchanger may be drained. The net effect is that capability to provide CCW to the spent fuel pool heat exchanger is lost. Closing the common safety grade valves, 1MO-1685A, B and 1MO-1687, reestablishes the CCW pressure boundary to the spent fuel pool heat exchanger. Filling and venting of that pipe may be required prior to reestablishing CCW flow to the fuel pool heat exchangers.

Summary of Investigation of the Causes of the Deficiency

While conducting the investigation, only one principal factor contributing to the deficiency was identified. The sizing of the 1,000 gallon CCW surge tank was based on an allowance for volumetric changes in the

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total CCW inventory due to temperature variations from 40 to 200F. The original design criteria did not include a LOCA-induced pipe failure or a failure of nonseismic piping due to a seismic event in the CCW system concurrent with a single active failure and loss of offsite power. The original tank has volume available to tolerate small leakage from the system.

Potential Safety Implications

The design deficiency has no effect on the normal safe operation of the plant. However, following a LOCA, CCW capability is required to transfer heat from the DHR heat exchangers within approximately 22 minutes, and from the DHR pump seal coolers, reactor building spray pump seal coolers, and HPI makeup pump lube oil coolers within approximately 30 minutes. It cannot be ensured that these requirements allow sufficient time following a LOCA to restore the level in the surge tank and restore flow to required components. The capability of the engineered safety features pumps to operate without cooling water has not been evaluated. The capability of the containment air coolers to remove heat is not affected by this scenario.

With total loss of CCW to the fuel pool heat exchangers from both units, the fuel pool water temperature will increase at a rate of 8.7F/hr and the water will start boiling within a minimum of 10 hours. This condition can occur only when a seismic event and a CCW system pipe rupture occur simultaneously in both units.

The current design does not conform to the criteria and bases stated in the safety analysis report and could have an adverse impact on plant safety throughout the expected life of the plant. Because of this deficiency, the current design does not meet final design requirements for approval and release for construction. The design deficiency is reportable under 10 CFR 50.55(e).

Corrective Action

Corrective action has been taken to ensure that the CCW system surge tank level is maintained (to provide the required npsh for safe operation of the CCW pumps) and that the design conforms to the design basis stated in the final safety analysis report (FSAR). The surge tank capacity is increased from 1,000 gallons to approximately 3,000 gallons; the size of the pipe connecting the CCW surge tank to the CCW pump suction is increased to preclude cavitation at the CCW pump suction during an event resulting in significant water loss rates from the CCW system. The normal minimum CCW surge tank inventory will be increased to a value which will permit detection and isolation of any non-Seismic Category I or LOCA induced piping system break while retaining level in the CCW surge tank that provides the required npsh. Faster motor operators which provide a valve closure time of approximately 5 seconds will replace the existing motor operators on 16- and 18-inch butterfly

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valves 1MO-1610A and B (2MO-1710A and B) and 1MO-1623A and B (2MO-1723A and B) to isolate safety-related CCW pump trains from the nonsafety-related CCW loads. This will ensure the availability of at least one CCW train following a LOCA and/or a seismic event concurrent with a single active failure.

The fuel pool heat exchangers are located on the common safety-grade portion which also serves the common nonsafety-related heat loads. The motor-operated butterfly valves which isolate common nonsafety-related loads (e.g., letdown coolers, reactor coolant pump motor coolers, control rod drive mechanisms, and radwaste evaporator condenser) from a common safety-related load (e.g., fuel pool heat exchangers) are 1MO-1685A and B (2MO-1785A and B) and 1MO-1687 (2MO-1787). These valves receive non-Class 1E power and can be closed manually, either locally or remotely from the motor control center or control room. These valves will also be closed on a CCW surge tank low-level signal. With loss of offsite power, these valves may remain open. Operator action can be initiated with sufficient time available to close the failed-as-is valves manually, and to establish CCW flow to the fuel pool heat exchangers by adding service water (SW) makeup hose connections near the CCW piping to and from the fuel pool heat exchangers to refill the drained portion of the CCW piping. A permanent provision is made on each safety-related SW train (A and B) in the auxiliary building for emergency connection from the SW to the CCW system. Two corresponding connections per unit are provided downstream of the 16-inch butterfly valves 1MO-1623A and B (2MO-1723A and B) for refilling the drained portion of CCW piping. Approximately 2 hours could be required to refill this part of the system and reestablish CCW flow to the fuel pool heat exchangers if completely drained. Because the spent fuel pool will not boil for at least 10 hours, manual action is considered adequate to reinstate CCW to the spent fuel pool cooling system.

Because the above corrective actions ensure that the design conforms to the design bases stated in the FSAR, further high-energy line break analysis and seismic analysis of the nonseismic CCW system piping under question are not pursued as a resolution of the design deficiency. Incidental benefits gained from seismically analyzing and supporting nonseismic CCW system piping for reasons other than resolution of this discrepancy are acknowledged in implementation of corrective action.

It has been determined, after reviewing other systems for Midland plant, that similar problems would not occur in other systems because the CCW system is the only closed-loop dual-purpose system serving both safety-related and nonsafety-related loads in the Midland plant. All Midland project system design engineers in the mechanical, nuclear systems, and control systems groups will be sent a copy of this report along with an instruction noting that it is necessary to consider the effects of a failure of Seismic and non-Seismic Category I piping if induced by a

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LOCA or by failure of non-Seismic Category I piping due to a seismic event concurrent with a single active failure and loss of offsite power.

Design for this corrective action is proceeding. Drawing change notices issued on March 7, 1981, show the changes to be implemented on Piping and Instrument Diagrams 7220-M-416, Sheets 1A, 1B, 2B; 7220-M-417, Sheets 1A, 1B, 2B; 7220-M-419A; and 7220-M-419B. Control and electrical design modifications to implement this corrective action are underway The FSAR will be revised to include the description of the changes and operation of the system by the June 1981 amendment. The schedule for implementation of these design changes and other work remaining to complete the CCW system is being shown on a project production schedule which includes design, procurement, and construction activities. At an appropriate time, the project production schedule will be superseded by a system completion punchlist. All required design changes will be implemented before fuel load.

Submitted by: T Bellamy for D.R. Anderson

Approved by: [signature] for L H Curtis

Concurrence by: K D Bailey