Consumers Power Company

James W Cook
Vice President - Projects, Engineering and Construction

General Offices: 1945 West Parnall Road, Jackson, MI 49201 • (517) 788-0453

March 4, 1983 82-13 #2

Mr J G Keppler, Regional Administrator
US Nuclear Regulatory Commission
Region III
799 Roosevelt Road
Glen Ellyn, IL 60137

MIDLAND NUCLEAR COGENERATION PLANT -
DOCKET NOS 50-329 AND 50-330
POSSIBLE FRAZIL ICE FORMATION IN SERVICE WATER INTAKE STRUCTURE
FILE: 0.4.9.69 SERIAL: 20725

Reference: J W Cook letter to J G Keppler, Same Subject, Serial 19113, dated December 12, 1982

This letter, as was the referenced letter, is an interim 50.55(e) report concerning the possibility of frazil ice formation in the service water intake structure.

The attachment to this letter provides a description of the deficiency and the investigative and corrective actions underway with regard to this problem.

Another report, either interim or final, will be sent on or before May 20, 1983.

James W. Cook

JWC/WRB/lr

Attachment: MCAR-64, Interim Report 2, dated February 3, 1983

CC: Document Control Desk, NRC
Washington, DC

RJCook, NRC Resident Inspector
Midland Nuclear Plant

CBechhoefer, ASLB Panel
FPCowan, ASLB Panel
JHarbour, ASLB Panel
AS&L Appeal Panel
MMCherry, Esq
MSinclair
BStamiris
CRStephens, USNRC
WDPaton, Esq, USNRC
FJKelley, Esq, Attorney General
SHFreeman, Esq, Asst Attorney General
WHMarshall
GJMerritt, Esq, TNK&J

103704

Attachment to
Serial 20725
82-13 #2

Bechtel Associates Professional Corporation

103028

SUBJECT: MCAR 64 (Issued 11/16/82)
Possible Frazil Ice Formation in the Service Water Intake Structure

INTERIM REPORT 2

DATE: February 3, 1983

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

Description of Deficiency

The Midland plant cooling pond and service water system design contained no specific features to mitigate potential frazil ice formation.

Summary of Investigation and Historical Background

Background

Frazil ice is the term used for ice particles which in active state are ready to adhere to any underwater object having a minimum temperature of 32F. It has been known to block flow into intake structures by clogging trash racks. It forms as a result of supercooling of the surface water in conjunction with agitation, such as that caused by winds or flowing water. Conditions required for frazil ice formation and blockage of the service water intake include specific combinations of meteorological conditions (wind speed and air temperature) and pond turbulence when pond temperature is 32F. These conditions are in part dependent on plant heat rejection. Frazil ice formation is usually noted at intakes on rivers or large lakes rather than cooling ponds. Frazil ice formation has occurred at nuclear power plants (e.g., Nine Mile Point and Palisades) located on the Great Lakes. Frazil ice formation, to our knowledge, has not resulted to date in identified safety problems at operating nuclear plants.

Summary of Investigation

1. The extent to which frazil ice formation was considered in the Midland plant analysis and design prior to October 1981 is not clear. Specific design features to preclude frazil ice formation, such as a "warmup lines" or heating of the trash racks are not provided. FSAR Subsections 2.4.7 and 9.2.5 concerning design for ice forces and blockages by submerged floes or ice jams do not address frazil ice formation.

103704

Bechtel Associates Professional Corporation

103826

2. An October 1981 discussion between Consumers Power Company and Bechtel concluded that conditions for frazil ice formation may exist at Midland at certain power conditions. No further work was to be performed pending review of the issue.

3. In July 1982, Consumers Power Company issued Safety Concern and Reportability Evaluation (SCRE) 55 addressing the problem. Consumers Power Company also requested Bechtel to develop a response to a proposed public hearing contention concerning NRC Generic Issue B-32. This resulted in a program to quantitatively evaluate the potential for frazil ice formation.

4. Analyses to address the potential of frazil ice formation and subsequent blockage of the service water system intake were performed by Bechtel and reviewed by consultants, J.F. Kennedy (Director of Iowa Institute of Hydraulic Research) and F.E. Parkinson (Vice President of LaSalle Hydraulic Laboratory, LTD.). These analyses concluded that the potential for frazil ice formation at the intake is low (on the order of 10^{-2} events per year). This analysis was based on daily average conditions and on the assumption of a given plant power level equivalent to one unit operating at 100% power. Frazil ice is not expected with both units at 100% power. While the calculated frequency of occurrence is low, it is possible and should be considered in the design of the Midland plant.

Analysis of Safety Implications

The potential for frazil ice formation at the service water system intake is low. Furthermore, should frazil ice form, there is an even lower probability that its formation could significantly affect the safety of operations at the Midland plant. However, a possibility exists that blockage could happen and if it had remained uncorrected, could have adversely affected the safety of operations at the Midland plant. With the present design, the plant ultimate heat sink could become unavailable under normal or accident conditions, such as loss of offsite power. If the heat sink were not available, heat removal capability would be lost from the component cooling water system, safeguard chillers, reactor building air cooling units, spent fuel pool, diesel generators, and nonsafety-related components.

Although there is a potential for frazil ice formation, several features inherent in the Midland plant design mitigate the impact of frazil ice. Following a plant shutdown, plant safety would be ensured during the first several hours by use of the turbine driven auxiliary

feedwater pump and the main steam safety valves to remove decay heat. In this period, loss of UHS is no more severe than the station blackout scenario that has been considered in the design to the extent described in the FSAR. If offsite power were not available, continuous operation of the diesel generators would not be possible because of lack of cooling water. Gradual loss of dc power would eventually occur and result in loss of decay heat removal capability. Inability to provide makeup water to the reactor coolant system could also be a concern because of lack of cooling water for the makeup pumps. It is likely, however, that intermittent operation of the diesel generators and makeup pumps could be achieved and decay heat removal and reactor coolant inventory could be maintained indefinitely.

Several features of the Midland plant service water system design reduce the potential accumulation of frazil ice at the intake. These features include the use of the pond as a heat sink and the relatively deep location of the service water system intakes and the UHS, which is situated in the bottom of the cooling pond. As a heat sink, the cooling pond could normally be heated to a point where frazil formation is not possible. The relatively deep service water intake could reduce the probability that supercooled water conditions exist at the intake, because these conditions are the result of extreme meteorological conditions at the pond water surface.

Probable Causes

The reasons that frazil ice formation was not considered in the Midland design include the following:

1. Known studies and publications on frazil ice indicate that frazil ice formation usually is a concern on rivers and large lakes rather than cooling ponds. Additionally, there are no reported safety problems at operating nuclear power plants caused by frazil ice formation.

2. Features inherent in the Midland design that minimize the probability of the formation of frazil ice at the intake are as follows:

    a. Use of the cooling pond as a heat sink

    b. Deep location of the service water pump structure intake and the ultimate heat sink

Bechtel Associates Professional Corporation

3. Because there is continuous heat input to the cooling pond, frazil ice was not expected to be a problem.

Corrective Action

Corrective action has been initiated to ensure that frazil ice does not block the service water intake structure and that the service water system design, including the planned modifications, conform to the safety design bases stated in FSAR Subsection 9.2.1.1.1.

Options to prevent frazil ice formation currently being considered include the following:

1. Heated water injection at trash racks

   a. Recirculate all or a portion of the service water discharge flow to the service water intake structure during the winter months.

   b. Use a safety-grade auxiliary source of heating water, such as an auxiliary heating boiler to provide the necessary warm water at the service water intake structures.

2. Heating the service water trash racks

3. Providing an air bubbler system at the intake

Option evaluation and further actions, associated with the selected design will be addressed in the next interim report.

Reportability

Based on the potential safety concerns, this item was considered potentially reportable in accordance with 10 CFR 50.55(e).

Submitted By: JMS for CPA D. Nicolaus
for T.G. Ballweg
Mechanical Group
Supervisor

103704

Bechtel Associates Professional Corporation

103828

Approved By: for E.M. Hughes
Ann Arbor
Project Engineer

Concurrence By: for M.T. Fravel
Chief Mechanical
Engineer

Concurrence By: E.H. Smith
Engineering Manager

Concurrence By: for M.A. Dietrich
Project Quality
Assurance Engineer