A/ 10/06/78

REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)
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REC: DENTON H R
NRC

ORG: TILLINGHAST J
IN & MI PWR

DOCDATE: 09/29/78
DATE RCVD: 10/06/78

DOCTYPE: LETTER NOTARIZED: YES
SUBJECT:

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LTR 1 ENCL 1

RESPONSE TO NRC REQUEST OF 07/12/78...FORWARDING ADDL INFO CONCERNING SUBJECT FACILITY"S ICE-BASKET STRESS ANALYSIS...NOTARIZED 09/29/78.

PLANT NAME: COOK -- UNIT 1
COOK -- UNIT 2

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INDIANA & MICHIGAN POWER COMPANY

P. O. BOX 18
BOWLING GREEN STATION
NEW YORK, N. Y. 10004

September 29, 1978
AEP:NRC:00057

Donald C. Cook Nuclear Plant Unit Nos. 1 & 2
Docket Nos: 50-315 and 50-316
License Nos: DPR-58 and DPR-74
Supplementary Information on Ice Basket Stress Analysis

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Denton:

In his letter dated July 12, 1978 Mr. A. Schwencer of your office advised us that he would require additional information to complete the NRC staff's review of the Donald C. Cook Nuclear Plant's Ice -Basket Stress Analysis. He requested that we furnish information for all items contained in the request for additional information enclosed therein.

For further clarification of the items contained in the request for additional information, a conference call was arranged with Dr. Gluckman of your staff on August 4, 1978. Members of the American Electric Power Service Corporation staff and Westinghouse Electric Corporation staff along with M. M. Mlynczak of your office participated in this call.

Enclosed herein is an item by item response to your request for additional information, prepared by the Westinghouse Electric Corporation in a format agreed upon during the above mentioned conference call.

Very truly yours,

John Tillinghast
Vice President

JT:em

Sworn and subscribed to before me
this 29th day of September, 1978
in New York County, New York.

Kathleen Barry
Notary Public

KATHLEEN BARRY
NOTARY PUBLIC, State of New York
No. 41-4680792
Qualified in Queens County
Certificate filed in New York County
Commission expires March 30, 1977

cc: (Attached)

780740306

A001 1/1 S *

cc: R. C. Callen
G. Charnoff
P. W. Steketee
R. J. Vollen
R. Walsh
D. V. Shaller-Bridgman
R. W. Jurgensen

ENCLOSURE 1
SUPPLEMENTARY INFORMATION ON
DONALD C. COOK NUCLEAR PLANT
ICE BASKET STRESS ANALYSIS

Question No. 5

Provide Tables 2 through 7, referred to in ICE-TR-079, page 4, subsection 4.0.

Additional Response No. 5

Tables 2 through 7, which are referenced on page 4, subsection 4.0 of Test Report ICE-TR-079 are again submitted as an attachment to this response.

Question No. 6

There is still some concern that the test arrangement is not furnishing the most conservative results. It is correct that the ice has in some cases a stiffening effect. It is however possible to state that for certain buckling shapes the effect of ice pressure on the vertical ligament may make conditions worse. Discuss this possibility. Discuss also the adequacy of the cruciform supports inserts to carry the ice load for which they are not designed.

Additional Response No. 6

Assuming that the ice mass inside the ice baskets is fluid and generates an internal pressure (hydraulic) on the vertical ligaments of the basket, it is possible to state that for certain buckling shapes the test arrangement is less conservative. However, the internal force generated by a six foot head of ice, supported by the cruciform support inserts, when calculated would be a maximum of 0.4 lb/in acting against the vertical basket ligaments. The horizontal test qualification loads, as shown in Table 1, page 10 of ICE-TR-079, varies from 769 lbs to 1025 lbs. This corresponds to a uniformly distributed load, acting against the vertical ligaments of the ice basket, of 5.34 lb/in to 7.12 lb/in, respectively. The effect of the ice pressure on the vertical ligaments would mean a 7.5% to 5.6%, respectively, increase in horizontal test qualification loads.

The test results are conservative because the test qualification loads envelope the worst possible load combinations of horizontal and vertical design loads, and they were increased to include ice maldistribution, and single basket test factors. In addition, an examination of the actual test results shows that the baskets were tested to horizontal loads varying from 871 lbs to 1721 lbs which corresponds to increases of 13% to 68% over the required test qualification loads, which more than adequately reflects any increased load due to ice pressure.

The cruciform support inserts were designed, and have the primary function, to support the weight of ice above it. The cruciform inserts prevent the ice above it from falling down through into the next 6 foot basket section below, in the event of a meltout during LOCA conditions. The purpose of holding up the ice in the upper sections of the ice column is to maintain ice bed geometry

and not allow a bypass flow passage to open up due to some random configuration of various ice baskets having voids at various elevations.

Question No. 7A

The response does not include a discussion of the effect of concentrated loads in the hoop direction. Provide this discussion.

Additional Response No. 7A

The effect of concentrated loads (test load condition) is more conservative than uniformly distributed loads (actual load condition) in the hoop direction. A comparison of the shear diagram for the test case model versus the actual load model shows that on the test condition the shear loads on the hoop elements will be a minimum of 11% higher in the local area where the concentrated loads are applied as opposed to the same area on a beam with a uniformly distributed load. The test setup is therefore justified by the conservative load application to the basket hoop elements.

Question No. 7C

Discuss the effect of the semicircular bracket in the axial direction.

Additional Response No. 7C

The semicircular bracket distributes the concentrated traverse test loads on the ice basket, such that localized failure of the perforated metal is avoided. The application of concentrated test loads along the axial direction of the ice basket is more conservative than the actual load application where the load would be uniformly distributed. A comparison of the shear diagram for the test condition and actual load condition shows that the axial shear distribution is the same maximum value in both load cases with the maximum shear occurring at the ends of the basket. A comparison of the axial distribution of bending moment from the moment diagram shows that the maximum value occurs at the center span of the basket length for both cases, however, the maximum moment for the test case condition is 8.8% higher than the actual load case.

The concentrated traverse load application through the semicircular bracket is a more severe and conservative load condition for a buckling type failure since the vertical mesh ligaments are subjected to high shear loads locally in the area of the semicircular brackets.

Question No. 9B

Include a proof demonstrating that the requirements of General Ice Condenser Design Criteria, Section C-6: Experimental or Test Verification of Design are satisfied.

Additional Response No. 9B

The ice basket bottom end assembly test verification via Test Report ICE-TR-079 demonstrates that the requirements of the General Ice Condenser Design Criteria Section C-6 has been satisfied. For the test identified in ICE-TR-079, ice basket bottom end assemblies, which were manufactured to actual production drawings and procedures, with Q.A. releases (ref. para. 2.0 of TP-069), were tested to loads in excess of the required qualification loads. The qualification test loads identified in Table 1 of TP-069 were developed with the required test qualification load factors as identified in the General Ice Condenser Design Criteria, and were derated by 10 percent for single test sample.

The following table lists the actual test loads achieved in comparison to the required qualification test loads:

	Actual Test Loads	Qualification Test Loads
	D + 1/2 SSE Load Case	
Horizontal	1176	963
Vertical	5339	5133
	D + DBA + SSE Load Case	
Horizontal	1095	1025
Vertical	-5641	-4015

Question No. 10A

The concern is that a 2 span beam used as the model does not reproduce the same moment and shear distribution as obtained in the actual multiple span structure. Your response covered only the end connection. Cover the condition along the whole length of the structure.

Additional Response No. 10A

The 2 span beam referenced on Figure 9 of TP-069 does not reproduce the same moment and shear distribution as would be obtained in the actual multiple span structure. The actual structure would be a 8 span beam. A comparison of maximum shear and moment diagrams for the 8 span beam case versus the 2 span beam shows that; the maximum end support shear value for the 8 span beam would be 5% higher, the maximum moment at the supports would be 16% lower, and the maximum moment in the span would be 10% higher than the 2 span beam model.

Again, as in our original response to Question 10A, Figure 9 of TP-069 is only used to calculate the bottom connection reaction or shear load that the basket would see from the application of tare weights to the weight and pulley system used in applying the horizontal test loads, reference Appendix B of TP-069. The bottom connection reaction was calculated to verify, via a load cell at the basket bottom, that the required horizontal test load to the basket had been

achieved. The 5% load discrepancy on the shear load would have little importance on the reliability of the test results since the baskets were tested to horizontal loads in excess of 105% of the required qualification test loads as shown in our additional response to Question No. 9B.

Question No. 11

Prove that a basket which has not "failed" but is badly deformed can still perform its function.

Additional Response No. 11

By definition a basket which has not "failed" would not be badly deformed. Examination of ice baskets which have been successfully tested have not been deformed to any noticeable or measureable extent. Baskets which have been tested to failure have exhibited only small localized deformations since testing would terminate after the failure point was reached. Failure point being defined, as in our original response No. 11, as that point in the test when increasing the horizontal loads to the basket, the maximum vertical load cannot be maintained with the hydraulic jack at the top of the test fixture. That is, the vertical load drops down to some value below the maximum and cannot be held, after being re-established, without continual actuation of the hydraulic jack. Therefore, a basket which has not "failed", would not be deformed to any extent and would still be able to perform its function.

A 10/09/78

REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)
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REC: DENTON H R
NRC

ORG: TILLINGHAST J
IN & MI PWR

DOCDATE: 09/22/78
DATE RCVD: 10/02/78

DOCTYPE: LETTER NOTARIZED: YES
SUBJECT:
FURNISHING AUTHORIZATION TO INCLUDE COPY OF WESTINGHOUSE ELEC CORP DOCUMENT RE ANALYSIS TO INVESTIGATE THE LONG-TERM CONTAINMENT TEMPERATURE AND PRESSURE RESPONSE TO A POSTULATED STEAM LINE BREAK IN UNIT NO 2 USING THE LOTIC-3 COMPUTER CODE, ON SUBJECT F

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PLANT NAME: COOK - UNIT 2

REVIEWER INITIAL: XJM
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INDIANA & MICHIGAN POWER COMPANY
P. O. BOX 18
BOWLING GREEN STATION
NEW YORK, N. Y. 10004

September 22, 1978
AEP:NRC: 00090

Donald C. Cook Nuclear Plant Unit No. 2
Docket No. 50-316
License No. DPR-74
Containment Long-Term Temperature and Pressure Response

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Denton:

Please be advised that the Westinghouse Electric Corporation has submitted forty (40) copies of an analysis to investigate the Long-Term Containment Temperature and Pressure Response to a postulated steam line break in Unit No. 2 of the Donald C. Cook Nuclear Plant using the LOTIC-3 computer code. This analysis was performed to fulfill License Condition 2.C.(3)(g) of the Operating License of the above captioned facility.

This analysis was transmitted to you as an enclosure to the Westinghouse Electric Corporation letter (NS-TMA-1946) dated September 20, 1978 from Mr. T.M. Anderson to you.

This letter is to authorize the inclusion of the above Westinghouse document on our Docket No. 50-316, issued to the Unit No. 2 of the Donald C. Cook Nuclear Plant.

Very truly yours,

John Tillinghast
Vice President

JT:clb

Sworn and subscribed to before me this 22nd day of September, 1978 in New York County, New York

Gregory M. Gurican
Notary Public

GREGORY M. GURICAN
Notary Public, State of New York
No. 31-4643431
Qualified in New York County
Commission Expires March 30, 19[illegible]

cc: (attached)

A001 S *
1 1 0

cc: R. C. Callen
G. Charnoff
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D. V. Shaller - Bridgman

bc: S. J. Milioti
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