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PARKER,W.O. Duke Power Co.
RECIP.NAME RECIPIENT AFFILIATION
DENTON,H.R. Office of Nuclear Reactor Regulation

SUBJECT: Forwards addl info in response to NRC 791121 ltr re small break loss of coolant accidents.Complete response will be submitted by 800215.

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DUKE POWER COMPANY
POWER BUILDING
422 SOUTH CHURCH STREET, CHARLOTTE, N. C. 28242

December 28, 1979

WILLIAM O. PARKER, JR.
VICE PRESIDENT
STEAM PRODUCTION

TELEPHONE: AREA 704
373-4083

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

Attention: Mr. R. W. Reid, Chief
Operating Reactors Branch No. 4

Re: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287

Dear Sir:

With regard to my letter of December 3, 1979 and in response to the Staff letter of November 21, 1979, please find attached a response to the request for additional information concerning small break loss of coolant accidents.

As stated in the attached, a response to Item 1 will be provided by February 15, 1980.

Very truly yours,

William O. Parker, Jr.

RLG:scs

Attachment

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DUKE POWER COMPANY

Response to Request for Additional Information
Small Break Loss-of-Coolant Accident

Oconee Nuclear Station

1. Transitions from solid natural circulation to reflux boiling and back to natural circulation may cause slug flow in the hot leg piping. By use of analysis and/or experiment, address the mechanical effects of the induced slug flow on steam generator tubes.

Response

Duke Power Company has requested Babcock and Wilcox, the Oconee NSSS vendor, to assist in preparing a response to this concern. This effort is to be completed and submitted to Duke by mid-January 1980. Following our review, a response to this item will be provided by February 15, 1980.

2. This item is applicable to Davis-Besse 1 only.

3. Evaluate the impact of RCP seal damage and leakage due to loss of seal cooling on loss of offsite power. How long can the RC pump seals sustain loss of cooling without damage?

Response

The Reactor Coolant (RC) pump seals at Oconee are cooled during operation by High Pressure (HP) seal injection and Component Cooling Water (CC) systems. These two systems are powered from non-load-shed motor control centers. In the event of loss of offsite power, the RC pumps and the reactor trip. Seal cooling, momentarily interrupted by loss of power, is provided within 25 seconds by HP seal injection and CC systems upon reenergization of the emergency busses. Emergency power for Oconee on loss of offsite power is provided by two hydroelectric units, which are of greater load carrying capability and are considered to be of higher reliability than typical emergency diesel generators. During the momentary loss of power, no RC pump seal damage will occur.

Even though a complete loss of seal cooling is very unlikely, as discussed above, an evaluation of the consequences has been performed using engineering judgment and the limited experience applicable. The evaluation shows that leakage would not increase appreciably for approximately 10 minutes and would not be severe for up to 60 minutes. In this evaluation, it was assumed at time 0 that the pumps are stopped when both seal injection and seal cooling are lost, the seal flow return flow valve is open and initial leakage is at a normal maximum of 2 GPM for mechanical face type seals. (Note that pumps

Response to 3 (Continued)

with a first stage film riding - hydrostatic seal may leak up to 5 GPM but due to the large internal heat sink of this type of seal, the projected times in this evaluation will be about the same.)

The seal cavity temperatures and seal leak rates for the first 4 to 5 minutes from time zero, will remain essentially stable due to the mass of the heat sink at the shaft, seal cartridge and pump heat exchanger. This time period could be extended by about 2-3 minutes if the seal return valve is closed within 90 seconds.

With the seal return valve open, when the temperature in the seal cavity starts to rise, it will increase at a rapid rate. The seals will be passing steam in an additional 4 or 5 minutes. If seal injection can be gradually reinitiated or if the component cooling water flow is started within about 10 minutes the temperature ramp will be turned around, and although some internal damage may have occurred, the seal system will gradually stabilize and return to approximately the initial leakage rate. Closure of the seal return valve within this time frame is most effective in slowing the rate of temperature rise on those pumps that had low seal leakage at time zero and have not reached the point of rapid temperature increase. Closure of the seal return valve shortly after time zero would have reduced the heatup rate by as much as 75% for low leaking seals or 50% for high leaking seals.

If cooling continues to remain unavailable, the seal cavity temperature will continue to increase and is predicted to reach at least 350^{o}F in 20 minutes. At this time, the shaft directly above the seals will be about 300^{o}F and the heat exchanger will be at full system temperature ($\sim$540^{o}F).

The rapid restoration of cold seal injection water after the seals and pump parts are hot will shock all of the hot parts causing distortion and possible cracking of seal parts which could lead to an increased leak rate. However, it is felt that this will not cause an appreciable increase in leakage on a static pump. It is preferred that component cooling water be the first source reinstated until the temperatures in the seal cavity have returned to normal and have stabilized. If component cooling water cannot be reinstated then cold seal injection may be initiated, preferably at a gradual rate (increasing the rate at approximately one gallon per minute).

After steaming conditions are reached, significant seal degradation would not be expected up to a period of approximately one hour after time zero. The elastomers which make up a part of the seal assembly will start to soften at approximately 300^{o}F and can start to extrude before reaching 500^{o}F. The amount of extrusion is based upon time, temperature and annular clearances. Experience has shown that leakage of seals because of elastomer extrusion does not increase appreciably within the first 30 minutes. It is estimated that under the worst conditions, leakage on a static pump may reach 5 GPM in 30 minutes and 10 GPM in 60 minutes.

Based on the above, it is seen that interruption of seal cooling flow for a period of ten minutes can be tolerated without appreciable seal damage and leakage and possibly sixty minutes without serious damage.