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COMPANY: DUKE PWR LTR 1 ENCL 1

SUBJECT: SIZE: 4

Repts 2 steam generator tube plugs which were being installed during current refueling outage have not been located. Start up with plugs unrecovered presents no significant safety hazard.

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DUKE POWER COMPANY
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WILLIAM O. PARKER, JR.
VICE PRESIDENT
STEAM PRODUCTION

TELEPHONE: AREA 704
373-4083

October 19, 1978

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

Attention: Mr. Robert W. Reid, Chief
Operating Reactors Branch Number 4
Division of Operating Reactors

Re: Duke Power Company
Oconee Nuclear Station Unit 1
Docket Number 50-269

Dear Sir:

In recent conversations, the NRC staff has been appraised of details associated with the fact that two steam generator tube plugs which were being installed in the Oconee 1, "1B" steam generator during the current refueling outage have not been located. The startup of the unit with these plugs unrecovered has been evaluated and determined to present no significant safety hazard. Pursuant to discussions with the staff, a copy of this evaluation is attached. Your prompt attention to this matter is requested in order that timely and orderly operation of Oconee 1 may proceed.

Very truly yours,

William O. Parker, Jr.

DCH:scs
Attachment

cc: Director, Office of Inspection & Enforcement
Region II

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DUKE POWER COMPANY
OCONEE NUCLEAR STATION

Evaluation of Oconee 1
Startup with an Unrecovered Steam Generator Tube Plug

1. One plug installed in the top of a tube in the "1B" steam generator failed to discharge properly. Attempts to locate the plug have not been successful and it must be presumed to be within the Reactor Coolant System. An additional plug installed in the bottom of a tube in the "1B" steam generator is believed to have exploded but also has not been located.

2. Several items should be considered with regard to these unrecovered steam generator tube plugs:

   (a) The potential for a loose object in the RCS and the effects thereof.

   (b) The potential for decomposition of the plug filler material and the effects thereof.

   (c) The potential for detonation and the effects thereof.

3. With regard to 2(a) preceeding, the potential for a plug as a loose object must be considered to exist.

   (a) If a plug is in the reactor inlet portion of the RCS, it may travel to the lower region of the reactor vessel. If this should occur, the loose object would probably lodge in the lower internals or in the fuel assembly lower end fittings. The worst case assumption in this situation would be that the plug lodges within a fuel assembly in such a manner that fuel cladding failure occurs due to either fretting or departure from nucleate boiling. This would probably be detected by changes in RCS activity, thereby providing an indication of the status of the fuel with regard to continued operation. Only a limited number of fuel rods would be affected however, well within operating and safety analysis assumptions of one percent failed fuel. Therefore it is concluded that this possibility does not represent any significant safety hazard.

   (b) If the plug is in the reactor outlet portion of the RCS, it may travel to the upper head of the steam generator. Experience with loose objects in the steam generator upper head indicates that the plug would not become lodged but will continue to impact the upper tubesheet. If this should occur, any significant impact would be detected by the installed Loose Parts Monitoring System and the unit would be promptly brought to a shutdown condition for retrieval of the plug. Any damage to the steam generator would be minimal and not result in any primary system degradation. Therefore, it is concluded that this possibility does not represent any significant safety hazard.

4. With regard to 2(b) preceeding, plug filler components are wooden nose cone and caps, PETN and nitroguanidine explosive material, and an adhesive used in

assembly. Testing was conducted by the Oconee NSSS vendor, Babcock and Wilcox, in which two plugs were heated in pressurized (2250 psi) reactor coolant grade water (6000 ppm H_3BO_3, 1.0 ppm LiOH) to 620°F at approximately 64°F per hour. This testing indicated no evidence of detonation and examination at the conclusion of the testing determined no solids to be in the plugs. A pressure differential apparently due to the volume change associated with the decomposition of the plug filler explosive material was also observed in the small volume (approximately 50 cc) of the test system. The volume change associated with this decomposition is negligible compared to the volume of the RCS, however, and the chemical constituents of the filler material will have no adverse effect on the RCS. B&W consultation with Dupont Explosive Products Division and military explosive personnel also confirmed that decomposition will occur when the plugs are heated at temperatures and rates comparable to those existing during RCS heatup. It is concluded therefore that the plug filler material can be expected to decompose under RCS heatup and operating conditions and that this does not represent any significant safety hazard.

5. With regard to 2(c) above, testing by Babcock and Wilcox indicates that an unrecovered plug will not detonate. Testing in a wet, pressurized environment comparable to that in the RCS during heatup and operation is discussed in Item 4 preceeding and resulted in decomposition rather than detnotation of the plugs. Also four plugs were heated in air to 732, 750, 750 and 980°F respectively with no evidence of detonation. Impact testing with dry material indicated that PETN will detonate at 25 foot-pounds but that nitroguanidine does not. Under wet conditions, as would be present in the RCS during heatup and operation, tests of PETN and nitroguanidine at 185 foot-pounds did not cause detonation. Calculations indicate that this impact level (185 foot-pounds) upper bounds that which a plug would be subjected to in the RCS. It is concluded therefore that the probability of an unrecovered, undetonated plug remaining undetected, not decomposing and subsequently detonating during unit operation is negligible. The worst case assumption in this instance, however, would be that a plug detonation does occur:

   (a) If a plug detonated within a steam generator tube outside of the tubesheet area, the affected tube and approximately ten surrounding tubes could be affected. This would create a primary-to-secondary leak which would be promptly detected and the unit brought to a shutdown condition. The probability of this event simultaneous with a significant main steam line break accident is so remote that it can be ignored. Analysis has demonstrated however that such an accident concurrent with the double-ended rupture of approximately the same number of affected tubes does not result in offsite doses in excess of allowable limits—reference William O. Parker to Edson G. Case letter of September 9, 1977 with attached report entitled "Safety Assessment of Steam Generator Tube Leakage at the Oconee Nuclear Station."

   (b) If a plug detonated in the vicinity fo a fuel assembly, several fuel rods could be affected. The resulting RCS activity would probably be detected, providing an indication of the status of the fuel with regard to continued operation. Only a limited number of rods would be affected however, well within safety analysis and operating assumptions of one percent failed fuel and the mechanical integrity of the fuel assembly as a whole would not be adversely affected.

The above postulated incidents are considered to be incredible however and

it is concluded that this matter does not represent a significant safety hazard.

6. Based on the above it is concluded that startup of Oconee 1 with two unrecovered steam generator tube plugs, one of which may be undetonated, does not represent a significant safety hazard.