50-341 DMB

Detroit Edison

Donald A. Wells
Manager-Quality Assurance
(313) 237-9657

2000 Second Avenue
Detroit, Michigan 48226
(313) 237-8000

October 7, 1983
EF2-65284

Mr. James G. Keppler, Regional Administrator
Region III
U.S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, Illinois 60137

Subject: Final Report of 10CFR50.55(e) Item on Missing Swaglok Fittings in Reactor Vessel (#86)

Dear Mr. Keppler:

This is Detroit Edison's final report involving the missing Swaglok fittings in the Reactor Vessel. This item was originally reported to Mr. P. Pelke of NRC Region III by Detroit Edison's Mr. D. Ferencz, Acting Supervisor-Construction Quality Assurance on December 29, 1982.

During flow induced vibration testing, three (3) instrument line plugs (Swaglok Fittings) became detached, and six (6) others were found to be loose. The instrument lines are attached to the tops of eight (8) instrumented steam separators. The reactor was in the pre-fuel loading stage, at the time of the loss of the plugs; the control rod drive (CRD) housings, CRD guide tubes, fuel support castings, core plate, top guide and steam separators were in place. After an extensive search, one (1) plug was recovered from one of the guide tubes. The search was continued until it was concluded that the missing two (2) plugs are not in the CRD housings, guide tubes, fuel support castings, core plate, steam separators or top guide. Therefore, the only places in the pressure vessel where the lost parts may be are the annular region between the core shroud and the vessel wall or in the lower plenum.

The lost parts are comprised of a 1/4 inch instrument-line plug assembly consisting of three (3) separate pieces: plug, nut and plug keeper. The function of the keeper is to prevent the plug from falling through the bottom of the nut. All pieces of the assembly, except the keeper are made of stainless steel type 316. The keeper is carbon steel.

The following safety analysis is based on evaluations performed, taking the following conditions into consideration; the plug assembly remains intact, the plug assembly is disassembled and undamaged, and the plug assembly is disassembled and deformed. The areas considered in the safety analysis are, bundle inlet flow blockage, chemical reactions and corrosion, and control rod interference.

IE27 1/0

Any pieces in the annulus could exit through two (2) different paths. A piece could either enter a jet pump with the driven water flow or pass through the recirculation system (recirculation pump and jet pump). The result of either flow transit is transfer of the lost parts to the lower plenum, which coincides with the other assumed location of the lost parts.

Based on experience and engineering judgement, the lost parts would pass through the recirculation pump entrained in flow streamlines that would not allow contact with the impeller blades. In a worst case scenario, the parts might cause some blemishes on the blades as they are swept through the pump. However, there would be negligible reduction in pump performance. During its traverse, however, the plug assembly could be battered and separated into its three component pieces.

Since the material of the plug and nut is stainless steel and therefore, ductile, these pieces would not break into smaller parts, but under extreme battering could possibly ball up like dough. The keeper also is ductile enough so that breakage into smaller parts is not expected. In any case, this is a conservative assumption for the keeper with regard to flow blockage. The keeper might be flattened into a single piece or compressed into a spherical shape. Both extremes have been considered in the flow blockage analysis.

Assuming that a lost part is on the bottom of the vessel, it is possible, although unlikely, that it could be swept up from the bottom of the vessel. For example, the radial component of the velocity may turn the piece and the vertical component of the velocity could lift it up toward the bottom of the core. Calculations of the average vertical and radial components of velocities have been made for typical plants, and indicate that it would be possible to lift the entire plug assembly or any of the pieces individually. There are certain factors that tend to reduce this possibility, namely:

- There are very few locations where the radial velocity would be high enough to sweep the piece off the narrow 1.125" gaps between guide tubes.

- If an object fell to the bottom of the vessel, it would tend to drift toward the vessel centerline where horizontal velocities are low and the boundary layers on the vessel may be thicker than the object. Thus the boundary layer effect would reduce the capability of the fluid to sweep the piece up off the vessel bottom for the vertical components to carry it upward.

The dimensions are such that if the plug assembly or any of the component pieces were lifted, they could pass through the smallest area through which active bundle flow must pass; only this location need be evaluated for flow reduction.

Should a piece pass through a fuel orifice, it would have to pass through the lower tie plate nosepiece and the lower tie plate to enter into the fuel channel which requires passage through holes of only 0.410" diameter. The nut and plug could pass through the orifice, but would be stopped at the lower tie plate grid. Any resultant flow blockage would be insignificant and present no safety concern. Only the keeper is small enough to pass through the lower tie plate. If the keeper did pass through the lower tie plate it might cause local boiling transition and overheating. However, it would not significantly reduce the flow in the bundle or cause serious degradation of the heat transfer conditions in other areas of the fuel assembly. Even though it is possible for a minor blockage to occur by the keeper entering the fuel bundle and affecting the life of the fuel, no significant flow blockage will occur and, therefore, there is no safety concern.

To complete the safety analysis, this sequence of events has been carried one step further. Assuming that the keeper has been lifted up from the vessel bottom, passed through a fuel bundle, out the top onto the core support plate, and worked its way into the control blade opening, the consequences of impairing control rod operation were analyzed. Pieces of this size were considered in the safety assessment of lost parts and it was concluded that their interference with control rod operation was unlikely and therefore, they presented no safety concern.

Since the nut and plug are made of stainless steel they present no threat from chemical reactions or corrosion. The keeper will corrode and disintegrate with time, but will cause no damage. Harmful substances such as active sulfur, fluorine, and chlorine or embrittling metals such as mercury, silver indium, zinc, lead bismuth, etc., are not introduced by the plug assembly.

To correct the condition, the missing swaglok instrument line plug assemblies were replaced. All plug keepers were removed and discarded, followed by tightening of all swaglok fittings. To prevent future loosening, all fittings were tackwelded.

If you have any questions concerning this matter, please contact Mr. G. M. Trahey, Assistant Director-Project Quality Assurance.

Very truly yours,

cc: Mr. Richard DeYoung, Director
Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Mr. Paul By. Senior Resident Inspector
U.S. Nuclear Regulatory Commission
6450 North Dixie Highway
Newport, Michigan 48166