VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

R. H. LEASBURG
VICE PRESIDENT
NUCLEAR OPERATIONS

October 12, 1982

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
Attn: Mr. Robert A. Clark, Chief
Operating Reactors Branch No. 3
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Serial No. 574
NO/RCC,Jr.:acm
Docket No. 50-338
License No. NPF-4

Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION UNIT NO. 1
EVALUATION OF GUIDE TUBE SUPPORT PINS,
MAIN LOOP ISOLATION VALVE GUIDE AND
THERMAL SLEEVE FAILURES

The purpose of this letter is to provide the details of the examinations and evaluations performed by Vepco and Westinghouse Electric Corporation on the failure of the Guide Tube Support Pins, the Main Loop Isolation Valve Guide and Reactor Coolant System Thermal Sleeves for North Anna Power Station Unit 1.

In a meeting with the IE staff in Bethesda, Maryland on September 27, 1982, Vepco and Westinghouse provided a detailed review of the Guide Tube Support Pin problem. Attachment I provides a summary of information concerning the basic design improvements for the new designed pins which have been installed at North Anna Unit 1. The guide pin problem at North Anna Unit 1, as indicated in Attachment I, has been corrected by replacement of the control rod guide tubes and support pins.

Attachment II is the report on the failure of the Main Loop Isolation Valve Guide. The failure mechanism of the guide roll pin in the "A" Cold Leg Loop Main Isolation valve has not been identified. However, this valve has been repaired, and we have reviewed the operating histories for the other valves and found no problems indicative of guide bar failures in the other five valves. In addition, the bottom of the reactor vessel has been examined and pieces of the broken guide bar were recovered. Each valve has been cycled closed during the outage without problems that would indicate valve guide bar failure.

Also, provided in Attachment III you will find an evaluation of the thermal sleeve problem identified in North Anna Unit 1 Reactor Coolant System (RCS) piping. This evaluation describes the problem and provides a detailed evaluation of the safety aspects of operation with the affected thermal sleeves. The evaluation is based on the currently approved LOCA analysis. Attachment IV qualifies the evaluation for the most recently submitted LOCA analysis which is currently being reviewed by your staff.

A001

Vepco plans to remove during the present Unit 1 outage the three inch Charging System nozzle thermal sleeve in RCS Loop "B" which was identified as having a cracked weld. The six-inch Safety Injection (SI) thermal sleeve, which had broken away from its nozzle, was recovered from the bottom of the Reactor Vessel during efforts to recover RCS loose parts.

Since North Anna Unit 1 plans to continue power operation with other thermal sleeves in-place, Vepco will initiate a program of increased operator training and awareness as well as a program of increased surveillance to address the potential concerns of loose parts in the RCS. Attachment V provides a description of these programs and a description of a temporary, supplemental Loose Parts Monitoring System to be installed to monitor the remaining thermal sleeve locations until the removal of the thermal sleeves.

We will continue to keep you informed on the progress of our evaluations of the problems at North Anna. If you have any questions regarding the details of the examinations and evaluations provided by this letter, please contact us at your earliest convenience.

Very truly yours,

R. H. Leasburg

Attachments:

I. Guide Tube Replacement - North Anna Unit 1
II. Main Loop Isolation Valve Guide Failure
III. North Anna Unit 1 Loose Thermal Sleeve Safety Evaluation
IV. Impact of Postulated Blockage on 1981 Model LOCA Analysis
V. Operator Awareness Surveillance Program

cc: Mr. James P. O'Reilly
Regional Administrator
Region II

ATTACHMENT I

Westinghouse Electric Corporation
Water Reactor Divisions

Nuclear Service Division
Box 2728
Pittsburgh Pennsylvania 15230

September 30, 1982

VRA-82-549

Mr. F. M. Alligood, Jr., Manager
Nuclear Technical Services
Virginia Electric and Power Company
P. O. Box 26666
Richmond, VA 23261

Attn: Mr. M. L. Smith

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION
Guide Tube Replacement - North Anna Unit No. 1

During the period July 29, 1982 to September 10, 1982, the sixty-one (61) control rod guide tubes at North Anna Unit 1 were replaced with guide tubes containing improved support pins, similar to those presently installed in North Anna Unit 2. This replacement was initiated because two (2) of the original design/material 122 pins had broken in the shank area due to stress corrosion cracking. VEPCO elected to replace the complete guide tube/pin assemblies rather than just the pins due to outage time considerations.

The improved support pin design adequacy has been established for forward fit and back fit PWR plants, including North Anna Unit 1, and is based on Westinghouse design review and testing. Below is a summary of the basic design improvements in the new pins.

1) IMPROVED MATERIAL

Extensive accelerated corrosion testing conducted by WR&D has shown that the improved Inconel X-750 material, solution heat treated at 2000°F ±25°F, has less susceptibility to stress corrosion cracking. The previous North Anna pins, heat treated at only 1625°F, were more susceptible to this mode of failure.

2) REDUCED INSTALLATION TORQUE

The improved support pins have a single torque application of 120-130 ft-lbs, whereas the previous pins at North Anna were given an initial and final torque of 200-210 ft-lbs. This reduces the stress level in the pin shank and the potential for cracking in this area.

3) PARABOLIC SHANK RADIUS

The transition between the shank and the pin shoulder was previously a circular radius. The improved pin design uses a "parabolic" transition which reduces the stress concentration in this area, further reducing the potential for cracking in this region.

Very truly yours,

Joseph D. Cohen, Manager
Operating Plants
East Region

RRK/caf

cc: M. L. Smith
W. L. Stewart
W. R. Cartwright

ATTACHMENT II

Westinghouse Electric Corporation
Water Reactor Divisions

Nuclear Service Division
Box 2728
Pittsburgh Pennsylvania 15230

September 30, 1982

VRA-82-550

Mr. F. M. Alligood, Jr., Manager
Nuclear Technical Services
Virginia Electric and Power Company
P. O. Box 26666
Richmond, VA 23261

Attention: Mr. M. L. Smith

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION
Main Loop Isolation Valve Guide Failure

Dear Mr. Alligood:

Attached is a report outlining the failure of the main loop isolation valve guide failure at North Anna Unit no. 1. The failure mechanism of the guide roll pin has not yet been identified by Westinghouse. A stronger pin has been developed and tested, however, until the failure mechanism can be identified, no replacement recommendations can be made.

The results of the attached report indicate that if the subject valves have exhibited no closure problems related to guide failure, reasonable assurance exists that safe plant operation is not affected. Should you have any questions, please call Mr. R. R. Kent, 412-256-3833.

Very truly yours,

Joseph D. Cohen, Manager
Operating Plants
East Region

RRK/caf

Attachment

cc: M. L. Smith
W. L. Stewart
W. R. Cartwright

ATTACHMENT I

MAIN LOOP ISOLATION VALVE GUIDE FAILURE

Westinghouse is now investigating the main loop isolation valve guide failure at North Anna Unit No. 1.

The incident in Unit No. 1 was initiated when a retaining pin at the lower end of the guide failed. This is a roll pin which, for assembly purposes, projects from the end of the guide to engage a hole at the bottom of the guide slot in the body. Under normal conditions the guide remains stationary and imposes no direct structural loading on the pin. If the pin should fail (for reasons not yet understood), it is possible for the lower end of the guide to move laterally out of the guide slot and rest on an adjacent surface which would prevent its subsequent return to the original position within the guide slot. However, it is not possible for the guide to fall free of the valve at this stage because of its length and the constraining disc and body geometry.

Since part of the guide length must be removed before the guide can fall into the flow stream, a large force was required to break the guide into two or more pieces. Therefore, it is concluded that, after the retaining pin failed, the guide end moved out of its slot and became jammed in mid span by the valve disc during valve operation. It is documented that this valve was not able to close during a previous outage and that system maintenance was performed without having closed this valve. This displaced guide would have been bent and broken at this time. The valve was reopened and the system returned to service. Then, or in the interim between outages, the two pieces of the guide fell out of place and were carried away by the flowstream to a final resting place at the bottom of the reactor vessel. This last fact has been confirmed by television surveillance of the vessel, in which both pieces were identified. A further consideration is that the observed pieces were relatively large and dense and unlikely to be transported beyond the bottom of the reactor vessel.

An evaluation was done with the following conclusions made:

1. The valve guide cannot disengage from within the valve assembly without first being severed.

2. The guide can be severed if the valve closing thrust is exerted against it by the disc. Since this would also prevent the valve from closing completely, the condition would be noticed and, presumably, recorded.

3. If the valve closed and opened normally and completely during every operation, the guide would not be broken. Also, a broken valve guide resulting in potential loose objects would not be postulated.

The main loop isolation valves at North Anna Units 1 and 2 are closed only for system maintenance under shutdown conditions; the valves are always open when the NSSS is operating. If closure problems indicative of a broken guide are experienced during an outage, Westinghouse recommends disassembly of the valve for inspection and possible repair before allowing continued system operation. If there has been no indication of failure on Unit 1 as described above, the valve guides may be assumed to be intact and constrained within the valve assembly even when no roll pin restraint exists and, therefore, reasonable assurance exists that safe plant operation is not affected.