VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

September 2, 1992

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Serial No. 92-566A
NL&P/EJW
Docket No. 50-338
License No. NPF-4

Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION UNIT 1
SUPPLEMENT TO ASME SECTION XI RELIEF REQUEST

On August 24, 1992, NRC requested additional information concerning the ASME Section XI Code relief request submitted on August 26, 1992 (Serial No. 92-566) for a pinhole leak in a three inch Main Steam pipe at North Anna Unit 1. This request was discussed in telephone conferences between representatives of the NRC and Virginia Electric and Power Company on August 24 and 27, 1992. Our response to the seven questions is attachmented.

During the telephone conferences, a systems description was also requested by NRC and is provided in the attachment. One aspect of the system initially described to NRC during the telephone conferences needs to be clarified. At that time, we had stated that Unit 2's piping configuration was believed to be dissimilar to Unit 1 in that there were no elbows immediately upstream of the associated containment isolation valve. Based on further review, it has been determined that the design configuration of the Unit 2 piping is similar to Unit 1 in that both units have upstream elbows. However, the Unit 2 piping is in a horizontal configuration while Unit 1 piping has a vertical design. This issue is further discussed in our response to Question 5 in the attachment.

Should you have any additional questions regarding this request, please contact us.

Very truly yours,

M L Bowling

M. L. Bowling, Manager
Nuclear Licensing and Programs

Attachment

A047 1/1

cc: U.S. Nuclear Regulatory Commission
Region II
101 Marietta Street, N.W.
Suite 2900
Atlanta, GA 30323

Mr. M. S. Lesser
NRC Senior Resident Inspector
North Anna Power Station

Relief Request For Engineered Mechanical Clamp on Main Steam Line Drain Piping Supplemental Information

NRC Question

1. **TS 3/4.4.10 requires that an ASME Class 3 system must be isolated or repaired when structural integrity is violated. The NRC position is when a system is isolated because structural integrity is violated the system must remain isolated or a Code repair must be made to restore integrity. Provide your technical basis for determining the leaking elbow would not fail catastrophically when you put the line back in service and discuss the safety consequences of the failure as well as any potential personal hazards. From a licensing perspective provide your basis for re-entering the degraded configuration without taking corrective action.**

Response:

1. Technical Specification (TS) 3/4.4.10 is not applicable to the Main Steam System. North Anna Unit 1 Technical Specification 3/4.4.10 requires that the structural integrity of ASME Code Class 1, 2 and 3 components be maintained in accordance with Specification 4.4.10.1. This Limiting Condition for Operation appears in Chapter 4 of the Technical Specifications which applies to the Reactor Coolant System. However, the phrasing of the LCO is ambiguous with respect to its applicability. Clarification is provided by the applicable Bases. The Bases for TS 3/4.4.10 states: "The inspection programs for ASME Code Class 1, 2 and 3 Reactor Coolant System components ensure that the structural integrity of these components will be maintained at an acceptable level throughout the life of the plant." Therefore, it is clear from the Bases that TS 3/4.4.10 applies to Reactor Coolant System components, not Main Steam System components.

   The piping system containing the pinhole leak section of steam drain header 3"-SHPD-5-601-Q3 has been analyzed from anchor to anchor in its current degraded state prior to the proposed temporary repair. It was not possible to precisely characterize the flaw since wall thinning measurements could not be taken at the exact leak location due to operating conditions. A conservative and large size through-wall flaw was postulated at the leak location based upon limited NDE data and application of experience with wall-thinning. An analysis was performed for the pipe section with the postulated flaw subjected to a resultant moment and an axial force due to pressure, deadweight, thermal, and design basis earthquake loading. The result of evaluation indicated that the pipe section with a conservatively postulated flaw will not result in a double ended rupture when subjected to the specified loading. There exists a margin of at least 2.0 against a catastrophic failure without the proposed clamp installed. This analysis concluded that the pipe system will remain intact at the leakage location.

The consequences of the conservatively postulated flaw upon equipment in the surrounding area are discussed in our original relief request. As we stated at that time, the impact of flooding, pipe whip, jet impingement, and the spraying of steam on adjacent structures, systems, and components would be minimal considering the location of the pinhole leak and that the adjacent equipment has been qualified to operate in a steam environment. Under the conditions of administrative isolation described in the initial relief request, no significant personnel safety concern exists when draining the piping's accumulated moisture, because the operator is positioned behind a block wall with respect to the affected pipe and the time required for the blowdown evolution is minimized (between 2 and 5 minutes). Installation of the proposed clamp would further reduce the safety consequences, because the system would be returned to its original normal operating configuration. The only additional activities in this area after installation would be the weekly visual inspection discussed in the initial relief request.

The Unit 1 line has been partially isolated to comply with Technical Specification requirements. This was accomplished by administratively controlling the Main Steam isolation valves for traps T-5, T-7, and T-9, and the upstream traps for valves 1-MS-TV-111A and B. For the interim, valve 1-MS-TV-109 has been declared inoperable because the upstream piping is unable to perform its safety function (containment isolation). This is controlled in accordance with Action Statement "c" of TS 3/4.6.3. During the once-per-twelve-hour blowdown of two of the five administratively controlled lines that have been isolated, station actions are controlled by Action Statement "d" of the same specification. This ensures continued compliance with the applicable TS and has been discussed with the NRC Resident Inspector.

2. **Provide a copy of the P&IDs and isometric drawings for the degraded location. Include the physical locations of the manual isolation valves up-stream of the leak.**

Copies of the applicable Isometric drawing and the ISI Classification Boundary drawings are attached. These drawings have been marked to identify the leak location and affected isolation valves.

3. **Do you wish a waiver of compliance from the TS requirement prior to the staff considering your request for relief from the Code repair requirements? If so provide your JCO for the Waiver.**

As described in our response to Question 1, North Anna Unit 1 is in compliance with the applicable Technical Specifications. No waiver of compliance is required.

4. **Provide the results of any NDE performed to date.**

Nondestructive examinations performed on the affected section of line 3"-SHPD-5-601-Q3 consisted of initial ultrasonic examinations of several areas both upstream and downstream of the pinhole leak (primarily centered around the elbows immediately upstream of 1-MS-TV-109) and ultrasonic examinations of three circular cross-sections of the affected pipe. The results of these examinations are provided in Attachment 1 to this document.

5. **Provide a discussion of why this location was omitted from your erosion/corrosion program. Are any other similar locations subject to erosion/corrosion? What assurance can you provide that your erosion/corrosion program is adequate? What is your basis that a similar problem does not exist at Unit 2.**

The Secondary Piping and Component Inspection Program did not include this system because the small diameter piping and low operating pressures found in a majority of steam drain lines have resulted in a low priority being assigned to the evaluation and inspection of these lines. The high pressure rating of the steam drain lines upstream of 1-MS-TV-109 was not identified as sufficient reason for including the line in the Secondary Piping and Component Inspection Program. The high energy condition experienced by this line with 1-MS-TV-109 closed and the line's containment isolation function establish the need to include the line into the inspection program. Also, there has been no previous history of pipe degradation in this area at either the North Anna or Surry stations to indicate that the suspected failure mechanism (flow accelerated corrosion) was a concern with this piping or that additional nondestructive examinations were necessary.

We are currently performing an assessment of secondary lines that are subject to high energy conditions (pressure greater than 275 psig and temperature greater than 200° F), are safety-related, or where a through-wall leak could potentially cause the unit to shutdown. It is anticipated that this assessment will identify any additional lines which should be added to the Secondary Piping and Component Inspection Program.

Various internal and external reviews of the Secondary Piping and Component Inspection Program have been performed during the past few years to assure that FAC issues are adequately addressed. Virginia Electric and Power Company actively participates in the EPRI CHEC/CHECMATE Users Group. Additionally, we maintain an industry event database that contains information on known pipe wall thinning occurrences. This database helps assure that industry experience is factored into the Secondary Piping and Component Inspection Program. As a result of the reviews conducted of the program in 1992, we have decided to model the susceptible secondary systems with the EPRI computer code CHECMATE. This will assist in verifying that the appropriate components are included in the inspection program.

In the telephone conferences between the NRC representatives and Virginia Electric and Power Company, the question arose concerning the susceptibility of Unit 2. Originally, we stated that the design configuration for North Anna Unit 2 differed from that for Unit 1 in that the associated Unit 2 piping was believed to be a straight run with no elbows. Further review of the station piping drawings and walkdowns of the area identified that elbows do exist in the Unit 2 piping. Both Unit 1 and Unit 2 have two upstream elbows. The difference between the two units is that the Unit 1 has a vertical configuration while Unit 2 has a horizontal design. Therefore, the bases for concluding that a similar problem does not exist on Unit 2 is the absence of a pinhole leak during the visual inspections, the lack of evidence to indicate that the steam traps are operating in a manner other than they were designed, and that Unit 2 piping has been exposed to its operating environment approximately two years less than Unit 1. This determination is based upon engineering judgment of the available data at this time, as is the tentative conclusion that flow assisted corrosion is the prime contributor for the Unit 1 pinhole leak. A root cause analysis is intended to confirm or otherwise determine the actual failure mechanism during the upcoming refueling outage for Unit 1. Additional ultrasonic inspection will be conducted during the next scheduled refueling outage for Unit 2.

6. **Provide your basis for concluding the repair can be performed at power? If the manual isolation valves cannot be relied upon for isolation to allow a repair weld, why are they adequate for continued operation? Also why are they adequate for the installation of a temporary repair? Why can't a freeze seal be used in conjunction with the manual isolation valves?**

The design of the engineered clamp allows installation over a pinhole leak even with a small amount of flow through the pinhole. The integrity of the clamp is further augmented through injection of a liquid sealing compound, which will act similar to gasket material, into the clamp's housing. These features and the present low energy state of the pipe provide assurance that the repair can be performed at power.

The manual isolation valves relied upon to provide the containment isolation function are only five of twenty valves that would need to be isolated in order to perform a Code repair. No mechanism exists to ensure that complete isolation has been achieved prior to commencing removal of the affected piping section. Any condensate in the line from an isolation valve leaking-by would adversely affect our ability to successfully implement the welded Code repair. Because assurance of effective isolation cannot be obtained, a Code repair is considered impracticable.

Freeze sealing was considered as a potential course of action. Unfortunately, the distance of the pinhole leak from the point where the steam trap lines merge into the drain header is very short. This precludes freeze sealing at this point. Freeze sealing all twenty steam traps would be difficult because of the confined space, would require significant steam trap outage time (which would allow a considerable amount of water to accumulate in the Main Steam lines), and has a high probability of not achieving the desired isolation. For these reasons, the freeze sealing option was discarded.

7. **Provide your basis for concluding the containment isolation valve is inoperable?**

The containment isolation function is considered inoperable because 1-MS-TV-109 and the line upstream of the valve serve as a single integral unit to provide the isolation function. A failure of the valve to close is similar to having a small pinhole leak upstream of the valve because proper isolation would not be provided in either case. The requirements of the Technical Specification 3/4.6.3 Action Statement "c" for an inoperable containment isolation valve are appropriate because closure of the manual isolation valves for the steam traps ensures that containment isolation will be provided.

Discussion From A Systems Perspective

North Anna Power Station Unit 1 is a three loop Westinghouse pressurized water nuclear unit. One 32 inch diameter main steam line from each steam generator penetrates the containment and enters a structure called the Main Steam Valve House. This structure contains the direct atmospheric power operated relief valves and Safety valves from each of the three steam lines. It also contains the main steam line isolation trip valves (MSIV's) and non return valves (NRV's).

Upstream of each line's MSIV is a three inch supply line for the steam driven auxiliary feedwater steam lines, one from each of the Main Steam lines. The three supply lines join together into a single three inch header. This single header then splits into two lines, goes through parallel trip valves (1-MS-TV-111A and 1-MS-TV-111B), one in each of the two branch lines. These two supply lines then merge back into a single header. This header supplies steam to one steam-driven auxiliary feedwater pump.

The Main Steam lines in the Main Steam Valve House contain several areas that can collect water. Twenty traps are installed at the low points in these lines to collect the water. The discharge from the traps all feed into a three inch header. This header is routed back to the main condenser and is provided with a single trip valve, 1-MS-TV-109. This trip valve closes upon a containment isolation signal. A small erosion corrosion pinhole leak has developed upstream of 1-MS-TV-109.

There are six steam traps on each of the Main Steam lines, one upstream of the MSIV and five downstream of the MSIV; a total of eighteen for all three main steam lines. The steam driven auxiliary feed water pump steam supply line also has two installed traps, one just upstream of each of the supply trip valves 1-MS-TV-111A and 1-MS-TV-111B.

If a Main Steam Isolation Signal is generated, the MSIV on each steam line closes and 1-MS-TV-109 either closes simultaneously from a coincident phase A isolation signal or is already closed from a phase A isolation signal which preceeded the Main Steam isolation signal.

With a pinhole upstream of 1-MS-TV-109, only the traps downstream of the MSIV will be isolated from steam when the MSIV closes. The traps upstream will continue to feed the pinhole leak. In order to achieve the intended isolation, all five traps upstream of the MSIV's have been manually isolated. These traps consist of one trap on each steam line directly upstream of the MSIV and one trap directly upstream of each steam supply trip valve (1-MS-TV-111A and 1-MS-TV-111B) to the steam-driven auxiliary feedwater pump.

Since traps are installed directly downstream of each MSIV and the MSIV is open, isolation of the upstream trap has an insignificant effect on drainage of the line. Thus the isolated traps immediately upstream of the MSIV's are being maintained isolated. The traps immediately upstream of each steam supply trip valve (1-MS-TV-111A and 1-MS-TV-111B) to the steam-driven auxiliary feedwater pump are the only drainage provided for these areas. Once every twelve hours an operator goes into the Main Steam Valve House and opens a 3/4" bypass around each of these two traps for two to five minutes to drain accumulated water. He is under instructions to not leave the area until he has blown the traps down and reisolated. He is also under instructions to immediately close the manual isolation valves if so directed by the control room. Reisolation of the steam traps after blowdown is completed is being independently verified to ensure the plant is returned to the appropriate condition.

The area in which the operator performs the blowdown operation is shielded from the area of the pinhole leak. It is also an area where the noise and vibration of the MSIV's closing would be unmistakable.

ATTACHMENT 1

INITIAL READINGS TAKEN BY NDE

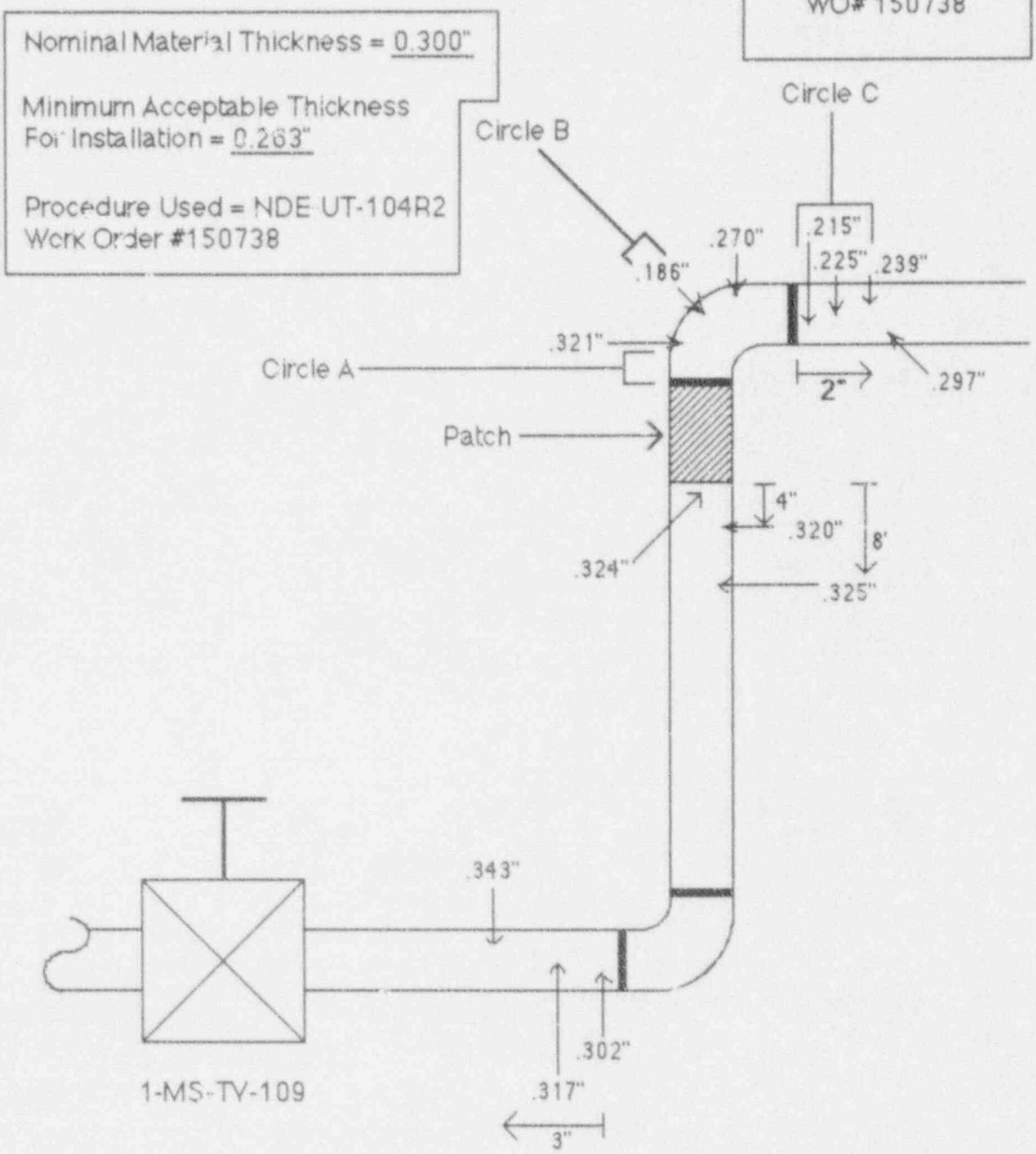
AUGUST 14, 1992

3"-SHPD-5-601-Q3
NDER-92-382
WO# 150738

Nominal Material Thickness = 0.300"

Minimum Acceptable Thickness
For Installation = 0.263"

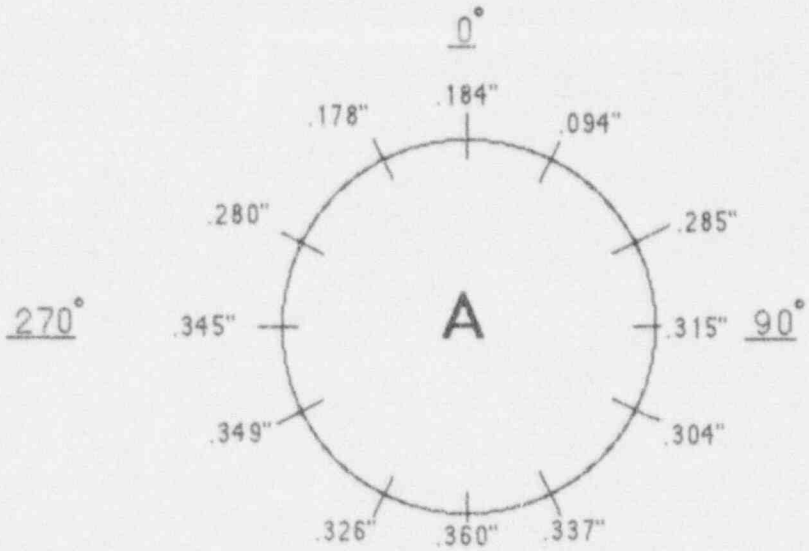
Procedure Used = NDE UT-104R2
Work Order #150738

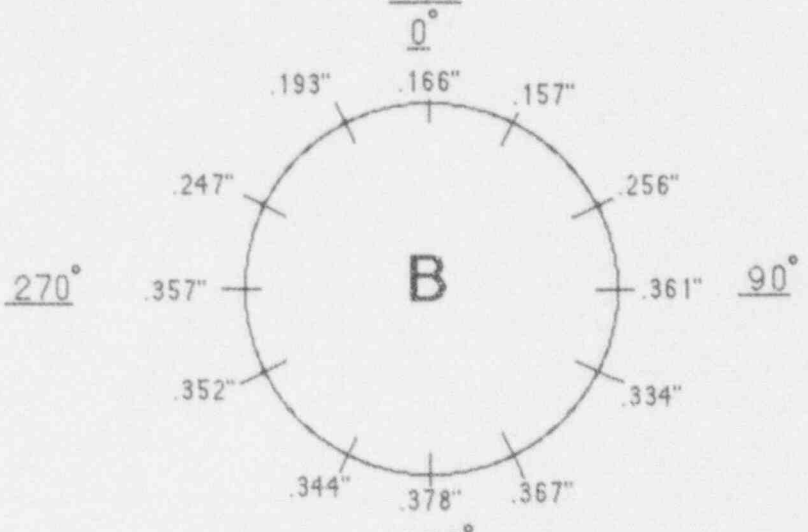


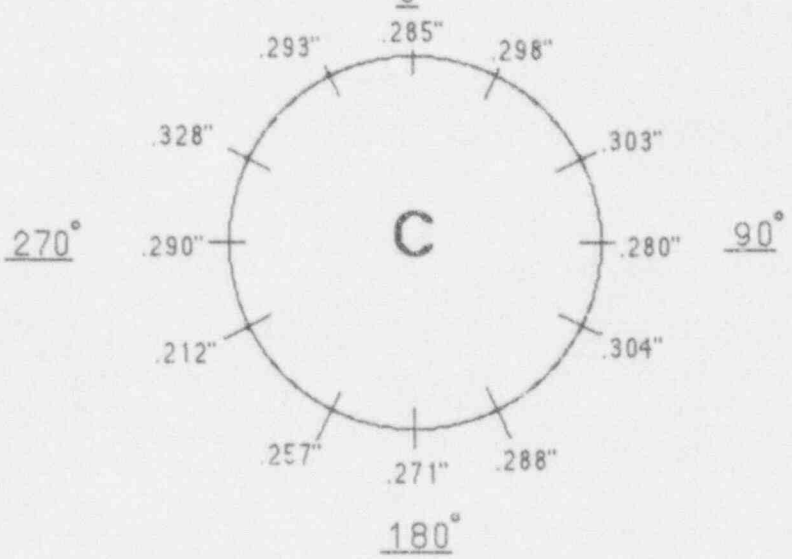
NOTE: Detailed readings were taken for the 'Circle' areas and are identified on Page 2 of 2.

CIRCLE READINGS
AUGUST 14, 1992

0° is Extradose of Elbow, readings taken every 30°, taken looking downstream.







OVERSIZE DOCUMENT PAGE PULLED

SEE APERTURE CARDS

NUMBER OF OVERSIZE PAGES FILMED ON APERTURE CARDS 6

9209220417
449
455
457
458
459

APERTURE CARD/HARD COPY AVAILABLE FROM

RECORDS AND REPORTS MANAGEMENT BRANCH