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New York Power Authority

July 19, 1994
JPN-94-031

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Stop P1-137
Washington, DC 20555

SUBJECT: James A. FitzPatrick Nuclear Power Plant
Docket No. 50-333
NUREG-0619 Inspection Program
for Feedwater Nozzles

Reference: NRC letter, H. Abelson to J. C. Brons (TAC 67829), dated September 13, 1988, "Relief From Augmented Inspection of Feedwater Nozzle/Sparger."

Dear Sir:

The attachment to this letter describes changes to the Authority's commitments concerning the NUREG-0619 inspection program performed for the reactor vessel feedwater (FW) nozzles at the James A. FitzPatrick Nuclear Power Plant. The changes involve: (1) the utilization of a Leakage Monitoring System to detect FW sparger seal leakage, (2) performance of a VT examination of the FW spargers and accessible portions of the FW nozzles during the next refueling outage, and (3) the elimination of the routine liquid penetrant test (PT) of all four FW nozzles during the next and subsequent refueling outages. An external ultrasonic examination of the FW nozzles every third refueling cycle will continue as previously approved by the NRC in the referenced letter.

Eliminating the need to perform a PT examination of the FW nozzles will avoid unnecessary radiation exposure to plant personnel, and potential damage to in-vessel components, without compromising plant safety. This conclusion is based on: (1) the effectiveness of the current UT examination techniques, (2) the use of an on-going diagnostic technique for determining FW bypass leakage of the FW sparger thermal sleeve seals, (3) the absence of reportable FW nozzle indications during previous nondestructive examinations, and (4) an acceleration in the VT examination schedule. The changes conform to the goals of NUREG-0619, para. 4.3.2.4, which recognizes elimination of the PT examination based upon development and use of on-line leakage monitoring systems, and advances in UT technology.

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The revised FW nozzle inspection program is consistent with similar changes in the inspection programs implemented at other plants. The Authority requests NRC review of this revised inspection program by mid-September 1994. This will allow the Authority to finalize plans for FW nozzle inspections to be performed during the outage scheduled to start in November 1994.

If you have any questions, please contact Mr. J. A. Gray, Jr.

Very truly yours,

W. A. Josiger
Acting Executive Vice President
Nuclear Generation

Attachment: Change to the NUREG-0619 Inspection Program for Feedwater Nozzles

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James A. FitzPatrick Nuclear Power Plant
Docket 50-333

ATTACHMENT TO JPN-94-031

Change to the NUREG-0619 Inspection Program for Feedwater Nozzles

NUREG-0619 Inspection Program:

The NRC recommended an augmented inspection program in NUREG-0619 (Reference 1) in response to the cracking problem in the bore and inner radius of feedwater (FW) nozzles. For the FitzPatrick plant, the augmented inspection program, as modified by the NRC in Reference 2, is currently as follows:

1. External ultrasonic examination (UT) of all FW nozzle bore areas susceptible to fatigue cracking, every third refueling cycle.

2. Visual inspection (VT) of the FW spargers every fourth refueling cycle.

3. Liquid penetrant test (PT) of all FW nozzle bores and blend radii every ninth refueling cycle, starting with the ninth cycle following the installation of the triple thermal sleeve, double seal, FW spargers.

The triple thermal sleeve, double seal, FW spargers were installed at FitzPatrick in 1978. The ninth refueling outage, during which the PT of the FW nozzle would normally be performed, is the refueling outage scheduled to start in November 1994.

Background:

FW flow enters the reactor vessel through four nozzle penetrations, and is directed by the FW spargers to mix with the downcomer flow from the steam separators before it contacts the vessel walls. Inspections of BWR feedwater nozzles at other plants revealed cracking of the nozzle internal bore and nozzle-to-vessel blend radius regions. Analysis revealed that the source of the crack initiation was high cycle fatigue due to feedwater leaking past the sparger thermal sleeve inlet seals. The NRC issued guidelines for addressing this potential for cracking in NUREG-0619 (Reference 1). The normal full power FW inlet temperature at the FitzPatrick plant is approximately 418°F, which is significantly higher than FW inlet temperatures at many other plants. This minimizes the thermal fatigue on the nozzles due to both normal FW temperature changes and thermal sleeve bypass leakage, and minimizes the potential for FW nozzle cracking at FitzPatrick.

The FitzPatrick plant conformed to NUREG-0619 by: (1) removing the stainless steel cladding from the FW nozzles, (2) installing triple thermal sleeve, double piston-ring seal spargers, (3) cutting and capping the control rod drive return line, (4) changing the internal valve trim in the low flow feedwater control valve, and (5) implementing an augmented inspection program. The Authority demonstrated to the satisfaction of the NRC staff (Reference 3) that rerouting the Reactor Water Cleanup System return flow to all FW lines, and installing new low flow FW controllers, was not necessary.

In response to a proposed change (Reference 4), the NRC, on September 13, 1988, approved (Reference 2) a change in the UT inspection frequency for the FW nozzles from every other refueling outage to every third refueling outage. The UT examination of the FW nozzles was performed in 1982, 1985, and 1990, in accordance with NUREG-0619, as modified by the NRC in Reference 2. The next FW nozzle UT examination will be performed during the Reload 12/13 refueling outage (currently scheduled for January 1997). The next FW sparger VT examination is required during the Reload 13/Cycle 14 refueling outage (currently scheduled for January 1999). The PT examination of the FW nozzles would need to be performed during the Reload 11/Cycle 12 refueling outage (currently scheduled for November 1994) to conform to NUREG-0619.

Changes to the NUREG-0619 Inspection Program:

The following changes to the NUREG-0619 Inspection Program for the FW nozzles have either been implemented or are scheduled for implementation during the Reload 11/Cycle 12 refueling outage scheduled to start in November 1994.

1. A Leakage Monitoring System (LMS) has been installed on all four FW nozzles, and is currently monitoring for feedwater leakage past the sparger thermal sleeve seals.

2. The schedule for performing a VT examination of the FW spargers and accessible portions nozzle will be accelerated from the Reload 13/Cycle 14 refueling outage to the Reload 11/Cycle 12 refueling outage scheduled to start in November 1994.

3. Eliminate the routine PT examination of all four FW nozzle bores and blend radii during the ninth refueling outage following installation of the triple thermal sleeve spargers (Reload 11/Cycle 12 refueling outage), and during all subsequent refueling outages.

Reason for the Change:

Eliminating the routine PT examination of the FW nozzle, scheduled for the next refueling outage, will avoid exposing many plant workers to substantial levels of radiation. The PT examination is coupled with a replacement of the sparger thermal sleeve seals. The dose survey for the FW sparger/thermal sleeve modification in 1978 was 415 person-rem. The potential radiation exposure during a PT examination/sparger replacement task is expected to be 50 to 200 person-rem, depending on the extent of the difficulties that may be experienced during this activity.

A PT examination involves in-vessel work associated with decontamination, installation of shielding, removal of the FW spargers, grinding of the inner nozzle surface, PT examination, replacement of the thermal sleeve seals, sealing surface machining, and sparger replacement. Removing the spargers is complicated by the restricted work area and complexity of the triple thermal sleeve, double seal, sparger configuration. There is presently limited industry experience in removing this type of thermal sleeve-sparger configuration. These in-vessel activities, in the absence of any evidence that a defect exists, expose the nozzles, spargers, and other core components to the unnecessary risk of damage.

The PT examination/sparger thermal sleeve seal replacement program represents outage critical path time estimated to be 10 to 14 days. This estimate assumes no unanticipated difficulties associated with the sparger removal/replacement task. The potential uncertainties associated with the spargers removal/replacement has an unknown impact on the 1994 refueling outage and its schedule. Once the spargers have been removed, chances that a sparger can be refurbished and reused is remote, considering the high radiation doses associated with the radioactive sparger material. This would require the fabrication of new spargers and their installation at an estimated cost of $2 to $3 million. This cost, and the power replacement cost resulting from an extended outage, represents a substantial expense to be absorbed by the Authority.

Performing the PT examination of the FW nozzles in accordance with NUREG-0619 would result in the risk of potential damage to in-vessel components, unnecessary radiation exposure to plant personnel, and impose an economic penalty on the Authority, without a compensating increase in the level of quality and safety.

Technical Bases for the Change:

The changes are based on: (1) the effectiveness of the current UT examination techniques, (2) the utilization of a Leakage Monitoring System to detect FW sparger seal leakage, (3) the absence of reportable FW nozzle indications during previous nondestructive examinations, (4) an acceleration of the VT examination schedule, and (5) a fracture mechanics analysis of the FW nozzle.

1. UT Examination Techniques

NUREG-0619, para. 4.3.1, stated that confidence in UT capabilities at the time (1980) the NUREG was issued was unacceptably low. The NUREG inspection requirements were based on the technology in use at that time. NUREG-0619 concluded that should future developments and the results of UT examinations demonstrate that UT techniques can detect small thermal fatigue cracks with acceptable reliability, these techniques could form the basis for modification of the inspection criteria.

Since NUREG-0619 was issued, significant improvements in UT technology have been made. Automated UT techniques, such as used by the Authority during the 1990 UT examination of the FW nozzle, are capable of detecting small (0.25 inch deep or smaller) fatigue cracks. Given that the PT examination requirements issued in 1980 (NUREG-0619) were based on limited confidence in the UT technology available at that time, and that areas of concern can be adequately examined using current UT techniques, a routine PT examination requirement for the FW nozzle adds no assurance of nozzle integrity beyond that provided by the UT, and is therefore unnecessary. If a crack is indicated by UT, a PT examination will not aid in determining the depth of the flaw, and will only serve to confirm the existence of the crack.

The General Electric GERIS automated UT system was used to perform NUREG-0619 examinations on the four FW nozzles during the 1990 FitzPatrick refueling outage. FW nozzle zones 1 through 3 (Figure 1), which is the expected area of cracking, were examined using the following techniques:

Zone 1: From vessel wall with shear waves
Zone 2A & 2B: From nozzle OD quarter point with shear waves
Zone 2A & 2B: From nozzle OD mid point with shear waves
Zone 2A & 2B: From nozzle OD three quarter point with shear waves
Zone 3: From nozzle OD with shear waves

General Electric demonstrated the capability of the GERIS system in a 1991 qualification test (Reference 5) to supplant the NUREG-0619 PT examination. The qualification tests, as proven on Electromagnetic Discharge Machining (EDM) notches, confirmed that the techniques used during the 1990 FitzPatrick inspections are capable of detecting a 0.250 inch deep flaw in the blend radius and bore regions of the FW nozzles. The modifications performed to the GERIS system between the 1990 FitzPatrick examinations and the 1991 qualification tests do not impact this conclusion. The modifications involve the addition of an A-scan digitizer that stores the A-scan data on optical disks, and the use of a new UT technique that scans the Zone 2A region from the nozzle OD blend radius.

The Authority will continue to use state-of-the-art technology for future UT examinations that is comparable or superior to past techniques, which will comply with the requirements of Section XI, Appendix VIII of the ASME Boiler & Pressure Vessel Code, when implemented. The New York Power Authority is currently a participant in the BWR Owners Group Committee monitoring NUREG-0619 developments.

2. <u>Leakage Monitoring System</u>

NUREG-0619, para. 4.3.2.4, recognizes elimination of the PT examination based upon the development and use of on-line leakage monitoring systems. A Leakage Monitoring System (LMS), that monitors for feedwater leakage past the sparger thermal sleeve seals, was installed on all four nozzles at Fitzpatrick in the spring of 1992. Maintaining bypass leakage levels less than about 0.5 gpm assures that fatigue usage is minimized (References 1, 5, and 6). Measured leakage rates in excess of 0.5 gpm will be evaluated to determine its impact on the fatigue usage factors.

The LMS includes three local temperature sensors (RTDs) mounted on each of the four feedwater nozzles, and a data collection recorder located outside the drywell (Figure 2). The RTDs are strapped to the nozzle at a location several inches downstream of the secondary thermal sleeve seal. For a nozzle with non-leaking thermal sleeve seals, the RTD located at the top of the nozzle (0° azimuth) is expected to track the reactor temperature closely. The two RTDs located near the bottom of the nozzle (180°, 210° azimuths) are expected to read slightly lower, due to the thermal stratification in the annulus between the thermal sleeve and the FW nozzle. Leakage is reflected by decreased RTD readings on the nozzle, with the maximum effect on the bottom RTDs.

In order to calibrate the leakage monitoring system against the actual conditions in the annulus between the thermal sleeve and the FW nozzle, a finite element analyses of the nozzle configuration was performed. The analyses used the FitzPatrick FW nozzle and safe-end geometry. In the annulus region, the heat transfer coefficient was varied to reflect varying leakage rates. In this manner, RTD indications are correlated to thermal and leakage conditions in the annular region.

Currently, the RTD data from the LMS confirms acceptable bypass leakage levels for all four FW nozzles. The RTD data from the A, B, and D nozzles confirms the absence of leakage. The data from the C nozzle corresponds to a leakage rate of approximately 0.75 gpm. NUREG-0619, Appendix C, endorses the use of General Electric Company report NEDE-21821-02 (Reference 7) in support of activities related to the issue of FW nozzle cracking. Based on NEDE-21821-02, figure 4-131, a seal bypass leakage of 0.5 gpm or less produces a fatigue usage factor of approximately 0.1 over the remaining 20 years life of the plant. Leakage of 0.75 gpm produces a fatigue usage factor of approximately 0.14 over the same 20-year period. This corresponds to an annual usage factor increment of 0.002 due to leakage which the Authorit does not consider significant.

The LMS data is recorded daily and evaluated at least every four months during periods of power operation to detect any degradation of the sparger thermal sleeve seals which could potentially lead to thermal fatigue related damage to the nozzles. If the trends of the LMS data suggest unacceptable seal degradation, corrective actions will be taken on a schedule to prevent any significant fatigue damage to the nozzles. The NRC will be notified, in writing, of an LMS evaluation implying unacceptable seal degradation, along with the plans and schedule for resolution. Further, the operating status of the LMS, and the measured leakage for the FW nozzles, will be reported in the Inservice Inspection Summary Report prepared in accordance with Section XI of the ASME Boiler and Pressure Vessel Code. This report is submitted following the refueling outages. A PT examination will be performed on a FW nozzle whenever its sparger is removed for refurbishment.

3. Inspection Results

Nondestructive examinations of the FW nozzles, in accordance with NUREG-0619, have not revealed any reportable indications to date. This incudes the UT examinations performed in 1982, 1985, and 1990; and the VT examinations performed in 1985, 1987, and 1990.

4. VT Examination Schedule

VT examinations of the FW spargers are required by NUREG-0619 to be performed at least once every fourth refueling outage. Since the last VT examination was performed during refueling outage Reload 9/Cycle 10 (1990), the next VT examination is required to be performed during refueling outage Reload 13/Cycle 14 (currently scheduled for January 1999). The next VT examination of the FW spargers and nozzles area, to the extent accessible, will be accelerated to the November 1994 refueling outage (Reload 11/Cycle 12) to provide additional assurance of sparger and FW nozzle integrity. This examination will be continued on a schedule of at least once every fourth refueling outage.

5. FW Nozzle Fracture Mechanics Analysis

A fracture mechanics analysis of the FitzPatrick FW nozzle concluded that stress cycling from conservative temperature and flow profiles, when added to those resulting from other crack growth phenomena, such as startup and shutdown cycles, do not result in the growth of an initial 0.25 inch crack to greater than one inch during the remaining life of the plant. The analysis (Reference 8) conservatively assumed failure of the first seal on the triple thermal sleeve sparger, and remains valid for the FitzPatrick FW nozzle. The results of this analysis were previously approved by the NRC (Reference 3).

Conclusions:

The current UT examination program for the FW nozzles, utilizes state-of-the-art inspection methods and equipment, and, along with the proposed VT examination schedule, provides an inspection program consistent with the intent of NUREG-0619. This inspection program is an acceptable alternative to the PT examination. The installation of the Leakage Monitoring System provides an on-going diagnostic technique for determining feedwater bypass leakage of the FW sparger thermal sleeve seals. In this manner, the absence of unacceptable fatigue usage due to rapid thermal cycling can be confirmed, and the need for sparger seal replacement can be assessed rather than relying on the originally estimated maintenance intervals. The higher normal FW inlet temperature minimizes the potential for thermal cycle fatigue usage even in the event of bypass leakage.

The improvements in UT technology, the utilization of a Leakage Monitoring System, and absence of any anomalies associated with the present FW nozzle configuration, supports elimination of the routine PT examination. Performance of the PT examination prescribed by NUREG-0619 presents an undue risk to plant personnel and in-vessel components, and imposes an unnecessary economic burden on the Authority, without a commensurate increase in plant safety.

References:

1. NRC NUREG-0619, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking," November 1980.

2. NRC letter, H. I. Abelson to J. C. Brons (TAC 67829), dated September 13, 1988, "Relief From Augmented Inspection of Feedwater Nozzle/Sparger."

3. NRC letter, H. I. Abelson to J. C. Brons, dated July 21, 1986, "Feedwater Nozzle Cracking in BWRs."

4. NYPA letter, J. C. Brons to NRC (JPN-88-010), dated March 25, 1988, "NUREG-0619, Feedwater Nozzle Inspections."

5. GE report NEDC-32019P (Class III), "Inspection and Monitoring of Feedwater Nozzles," dated May 1992.

6. Structural Integrity Associates Report No. SIR-94-021, Rev. No.0, dated June 1994, "Evaluation of Feedwater Bypass Leakage Monitoring System Results for J. A. FitzPatrick Nuclear Power Plant."

7. GE report NEDE-21821-02, "Boiling Water Reactor Feedwater Nozzle/Sparger Final Report," August 1979.

8. GE report NEDE-30799P, "James A. FitzPatrick Nuclear Power Station Feedwater Nozzle Fracture Mechanics Analysis to Show Compliance with NUREG-0619, December 1984.

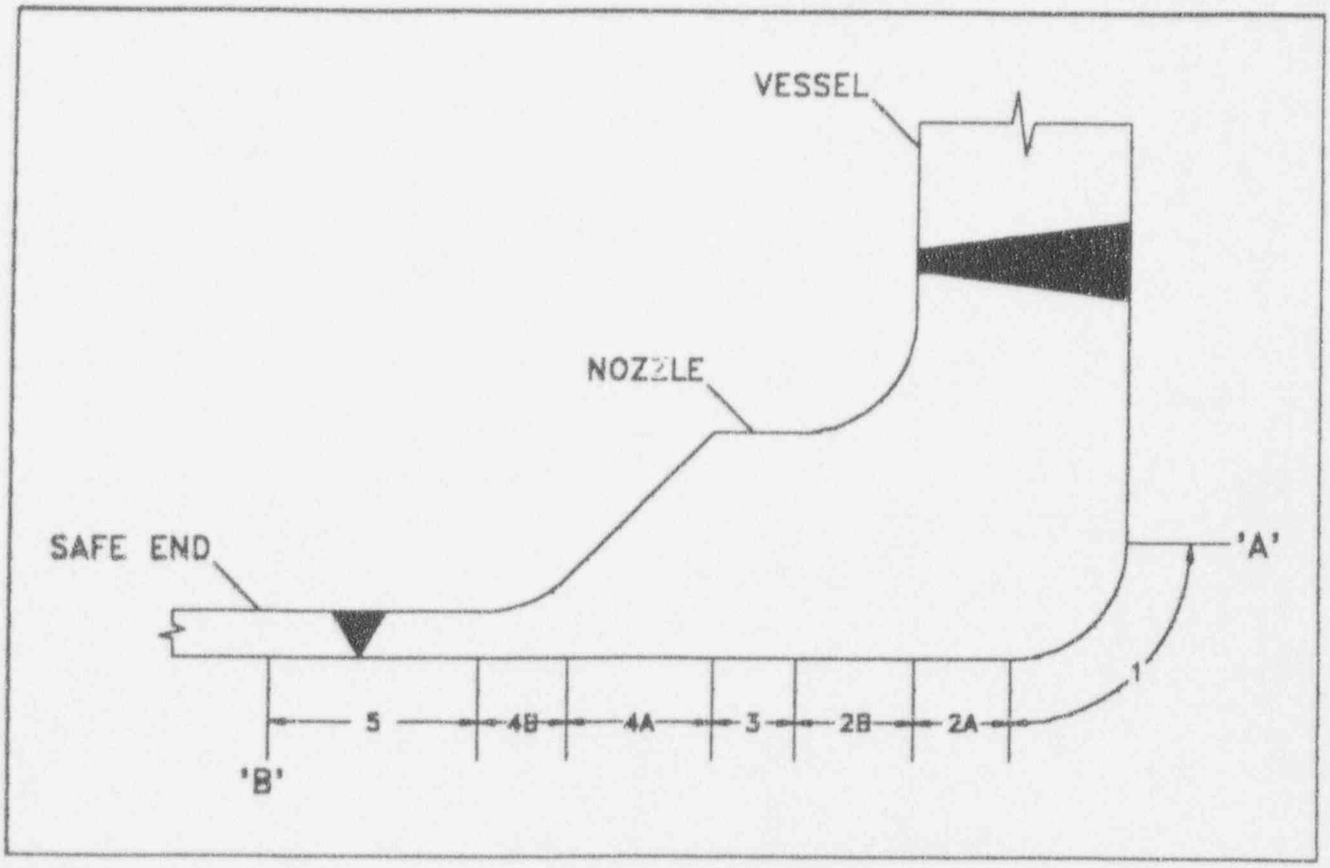
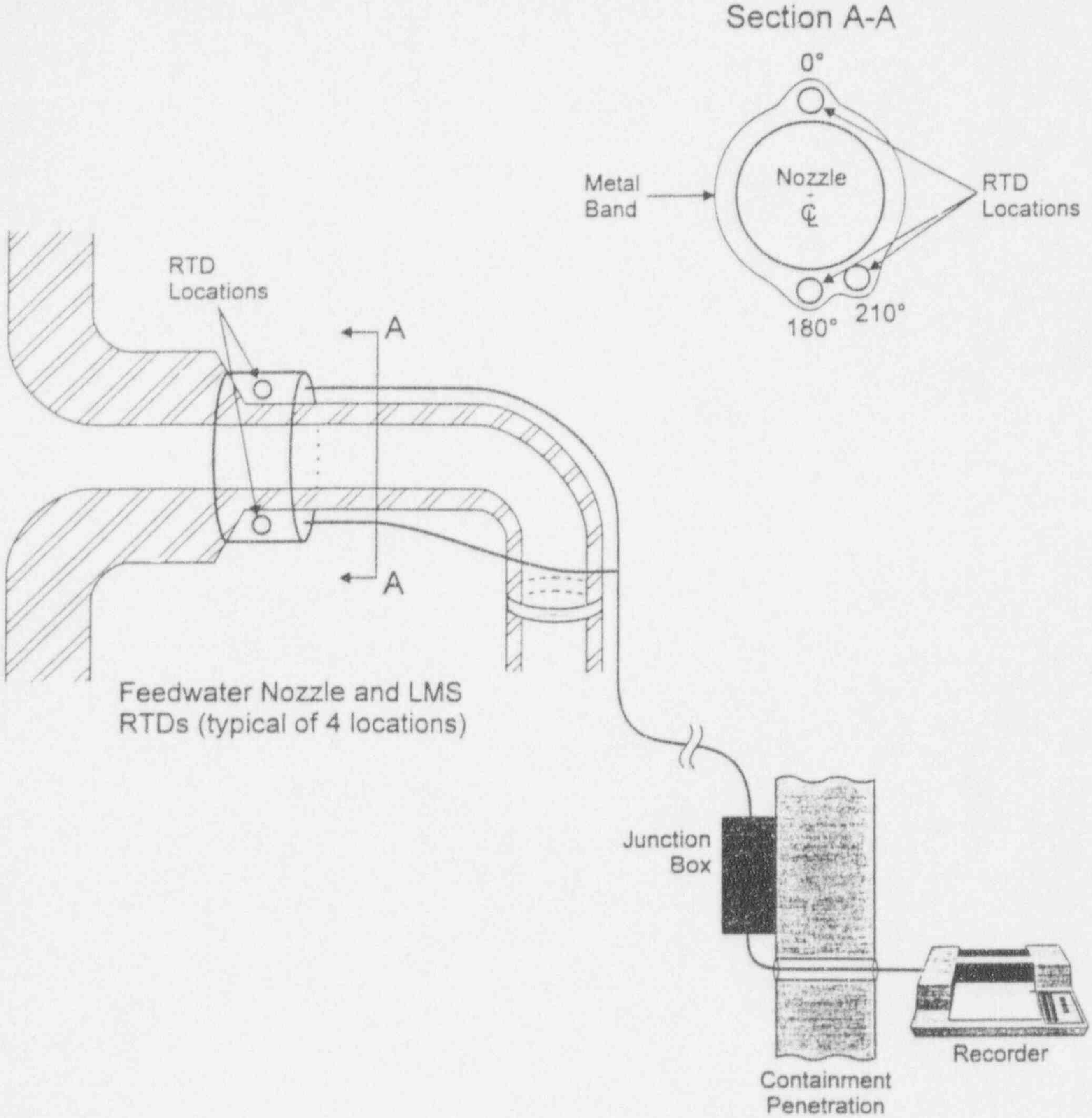


Figure 1 - Feedwater Nozzle Examination Zones



Feedwater Leakage Monitoring System: Schematic Diagram of Components

FIGURE 2

123 Main Street
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Dear Sir:

The attachment to this letter describes changes to the Authority's commitments concerning the NUREG-0619 inspection program performed for the reactor vessel feedwater (FW) nozzles at the James A. FitzPatrick Nuclear Power Plant. The changes involve: (1) the utilization of a Leakage Monitoring System to detect FW sparger seal leakage, (2) performance of a VT examination of the FW spargers and accessible portions of the FW nozzles during the next refueling outage, and (3) the elimination of the routine liquid penetrant test (PT) of all four FW nozzles during the next and subsequent refueling outages. An external ultrasonic examination of the FW nozzles every third refueling cycle will continue as previously approved by the NRC in the referenced letter.

Eliminating the need to perform a PT examination of the FW nozzles will avoid unnecessary radiation exposure to plant personnel, and potential damage to in-vessel components, without compromising plant safety. This conclusion is based on: (1) the effectiveness of the current UT examination techniques, (2) the use of an on-going diagnostic technique for determining FW bypass leakage of the FW sparger thermal sleeve seals, (3) the absence of reportable FW nozzle indications during previous nondestructive examinations, and (4) an acceleration in the VT examination schedule. The changes conform to the goals of NUREG-0619, para. 4.3.2.4, which recognizes elimination of the PT examination based upon development and use of on-line leakage monitoring systems, and advances in UT technology.

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Acting Executive Vice President
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NUREG-0619 Inspection Program:

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1. External ultrasonic examination (UT) of all FW nozzle bore areas susceptible to fatigue cracking, every third refueling cycle.

2. Visual inspection (VT) of the FW spargers every fourth refueling cycle.

3. Liquid penetrant test (PT) of all FW nozzle bores and blend radii every ninth refueling cycle, starting with the ninth cycle following the installation of the triple thermal sleeve, double seal, FW spargers.

The triple thermal sleeve, double seal, FW spargers were installed at FitzPatrick in 1978. The ninth refueling outage, during which the PT of the FW nozzle would normally be performed, is the refueling outage scheduled to start in November 1994.

Background:

FW flow enters the reactor vessel through four nozzle penetrations, and is directed by the FW spargers to mix with the downcomer flow from the steam separators before it contacts the vessel walls. Inspections of BWR feedwater nozzles at other plants revealed cracking of the nozzle internal bore and nozzle-to-vessel blend radius regions. Analysis revealed that the source of the crack initiation was high cycle fatigue due to feedwater leaking past the sparger thermal sleeve inlet seals. The NRC issued guidelines for addressing this potential for cracking in NUREG-0619 (Reference 1). The normal full power FW inlet temperature at the FitzPatrick plant is approximately 418°F, which is significantly higher than FW inlet temperatures at many other plants. This minimizes the thermal fatigue on the nozzles due to both normal FW temperature changes and thermal sleeve bypass leakage, and minimizes the potential for FW nozzle cracking at FitzPatrick.

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Changes to the NUREG-0619 Inspection Program:

The following changes to the NUREG-0619 Inspection Program for the FW nozzles have either been implemented or are scheduled for implementation during the Reload 11/Cycle 12 refueling outage scheduled to start in November 1994.

1. A Leakage Monitoring System (LMS) has been installed on all four FW nozzles, and is currently monitoring for feedwater leakage past the sparger thermal sleeve seals.

2. The schedule for performing a VT examination of the FW spargers and accessible portions nozzle will be accelerated from the Reload 13/Cycle 14 refueling outage to the Reload 11/Cycle 12 refueling outage scheduled to start in November 1994.

3. Eliminate the routine PT examination of all four FW nozzle bores and blend radii during the ninth refueling outage following installation of the triple thermal sleeve spargers (Reload 11/Cycle 12 refueling outage), and during all subsequent refueling outages.

Reason for the Change:

Eliminating the routine PT examination of the FW nozzle, scheduled for the next refueling outage, will avoid exposing many plant workers to substantial levels of radiation. The PT examination is coupled with a replacement of the sparger thermal sleeve seals. The dose survey for the FW sparger/thermal sleeve modification in 1978 was 415 person-rem. The potential radiation exposure during a PT examination/sparger replacement task is expected to be 50 to 200 person-rem, depending on the extent of the difficulties that may be experienced during this activity.

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Technical Bases for the Change:

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1. <u>UT Examination Techniques</u>

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The Authority will continue to use state-of-the-art technology for future UT examinations that is comparable or superior to past techniques, which will comply with the requirements of Section XI, Appendix VIII of the ASME Boiler & Pressure Vessel Code, when implemented. The New York Power Authority is currently a participant in the BWR Owners Group Committee monitoring NUREG-0619 developments.

2. <u>Leakage Monitoring System</u>

NUREG-0619, para. 4.3.2.4, recognizes elimination of the PT examination based upon the development and use of on-line leakage monitoring systems. A Leakage Monitoring System (LMS), that monitors for feedwater leakage past the sparger thermal sleeve seals, was installed on all four nozzles at Fitzpatrick in the spring of 1992. Maintaining bypass leakage levels less than about 0.5 gpm assures that fatigue usage is minimized (References 1, 5, and 6). Measured leakage rates in excess of 0.5 gpm will be evaluated to determine its impact on the fatigue usage factors.

The LMS includes three local temperature sensors (RTDs) mounted on each of the four feedwater nozzles, and a data collection recorder located outside the drywell (Figure 2). The RTDs are strapped to the nozzle at a location several inches downstream of the secondary thermal sleeve seal. For a nozzle with non-leaking thermal sleeve seals, the RTD located at the top of the nozzle (0° azimuth) is expected to track the reactor temperature closely. The two RTDs located near the bottom of the nozzle (180°, 210° azimuths) are expected to read slightly lower, due to the thermal stratification in the annulus between the thermal sleeve and the FW nozzle. Leakage is reflected by decreased RTD readings on the nozzle, with the maximum effect on the bottom RTDs.

In order to calibrate the leakage monitoring system against the actual conditions in the annulus between the thermal sleeve and the FW nozzle, a finite element analyses of the nozzle configuration was performed. The analyses used the FitzPatrick FW nozzle and safe-end geometry. In the annulus region, the heat transfer coefficient was varied to reflect varying leakage rates. In this manner, RTD indications are correlated to thermal and leakage conditions in the annular region.

Currently, the RTD data from the LMS confirms acceptable bypass leakage levels for all four FW nozzles. The RTD data from the A, B, and D nozzles confirms the absence of leakage. The data from the C nozzle corresponds to a leakage rate of approximately 0.75 gpm. NUREG-0619, Appendix C, endorses the use of General Electric Company report NEDE-21821-02 (Reference 7) in support of activities related to the issue of FW nozzle cracking. Based on NEDE-21821-02, figure 4-131, a seal bypass leakage of 0.5 gpm or less produces a fatigue usage factor of approximately 0.1 over the remaining 20 years life of the plant. Leakage of 0.75 gpm produces a fatigue usage factor of approximately 0.14 over the same 20-year period. This corresponds to an annual usage factor increment of 0.002 due to leakage which the Authority does not consider significant.

The LMS data is recorded daily and evaluated at least every four months during periods of power operation to detect any degradation of the sparger thermal sleeve seals which could potentially lead to thermal fatigue related damage to the nozzles. If the trends of the LMS data suggest unacceptable seal degradation, corrective actions will be taken on a schedule to prevent any significant fatigue damage to the nozzles. The NRC will be notified, in writing, of an LMS evaluation implying unacceptable seal degradation, along with the plans and schedule for resolution. Further, the operating status of the LMS, and the measured leakage for the FW nozzles, will be reported in the Inservice Inspection Summary Report prepared in accordance with Section XI of the ASME Boiler and Pressure Vessel Code. This report is submitted following the refueling outages. A PT examination will be performed on a FW nozzle whenever its sparger is removed for refurbishment.

3. <u>Inspection Results</u>

Nondestructive examinations of the FW nozzles, in accordance with NUREG-0619, have not revealed any reportable indications to date. This incudes the UT examinations performed in 1982, 1985, and 1990; and the VT examinations performed in 1985, 1987, and 1990.

4. <u>VT Examination Schedule</u>

VT examinations of the FW spargers are required by NUREG-0619 to be performed at least once every fourth refueling outage. Since the last VT examination was performed during refueling outage Reload 9/Cycle 10 (1990), the next VT examination is required to be performed during refueling outage Reload 13/Cycle 14 (currently scheduled for January 1999). The next VT examination of the FW spargers and nozzles area, to the extent accessible, will be accelerated to the November 1994 refueling outage (Reload 11/Cycle 12) to provide additional assurance of sparger and FW nozzle integrity. This examination will be continued on a schedule of at least once every fourth refueling outage.

5. FW Nozzle Fracture Mechanics Analysis

A fracture mechanics analysis of the FitzPatrick FW nozzle concluded that stress cycling from conservative temperature and flow profiles, when added to those resulting from other crack growth phenomena, such as startup and shutdown cycles, do not result in the growth of an initial 0.25 inch crack to greater than one inch during the remaining life of the plant. The analysis (Reference 8) conservatively assumed failure of the first seal on the triple thermal sleeve sparger, and remains valid for the FitzPatrick FW nozzle. The results of this analysis were previously approved by the NRC (Reference 3).

Conclusions:

The current UT examination program for the FW nozzles, utilizes state-of-the-art inspection methods and equipment, and, along with the proposed VT examination schedule, provides an inspection program consistent with the intent of NUREG-0619. This inspection program is an acceptable alternative to the PT examination. The installation of the Leakage Monitoring System provides an on-going diagnostic technique for determining feedwater bypass leakage of the FW sparger thermal sleeve seals. In this manner, the absence of unacceptable fatigue usage due to rapid thermal cycling can be confirmed, and the need for sparger seal replacement can be assessed rather than relying on the originally estimated maintenance intervals. The higher normal FW inlet temperature minimizes the potential for thermal cycle fatigue usage even in the event of bypass leakage.

The improvements in UT technology, the utilization of a Leakage Monitoring System, and absence of any anomalies associated with the present FW nozzle configuration, supports elimination of the routine PT examination. Performance of the PT examination prescribed by NUREG-0619 presents an undue risk to plant personnel and in-vessel components, and imposes an unnecessary economic burden on the Authority, without a commensurate increase in plant safety.

References:

1. NRC NUREG-0619, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking," November 1980.

2. NRC letter, H. I. Abelson to J. C. Brons (TAC 67829), dated September 13, 1988, "Relief From Augmented Inspection of Feedwater Nozzle/Sparger."

3. NRC letter, H. I. Abelson to J. C. Brons, dated July 21, 1986, "Feedwater Nozzle Cracking in BWRs."

4. NYPA letter, J. C. Brons to NRC (JPN-88-010), dated March 25, 1988, "NUREG-0619, Feedwater Nozzle Inspections."

5. GE report NEDC-32019P (Class III), "Inspection and Monitoring of Feedwater Nozzles," dated May 1992.

6. Structural Integrity Associates Report No. SIR-94-021, Rev. No.0, dated June 1994, "Evaluation of Feedwater Bypass Leakage Monitoring System Results for J. A. FitzPatrick Nuclear Power Plant."

7. GE report NEDE-21821-02, "Boiling Water Reactor Feedwater Nozzle/Sparger Final Report," August 1979.

8. GE report NEDE-30799P, "James A. FitzPatrick Nuclear Power Station Feedwater Nozzle Fracture Mechanics Analysis to Show Compliance with NUREG-0619, December 1984.

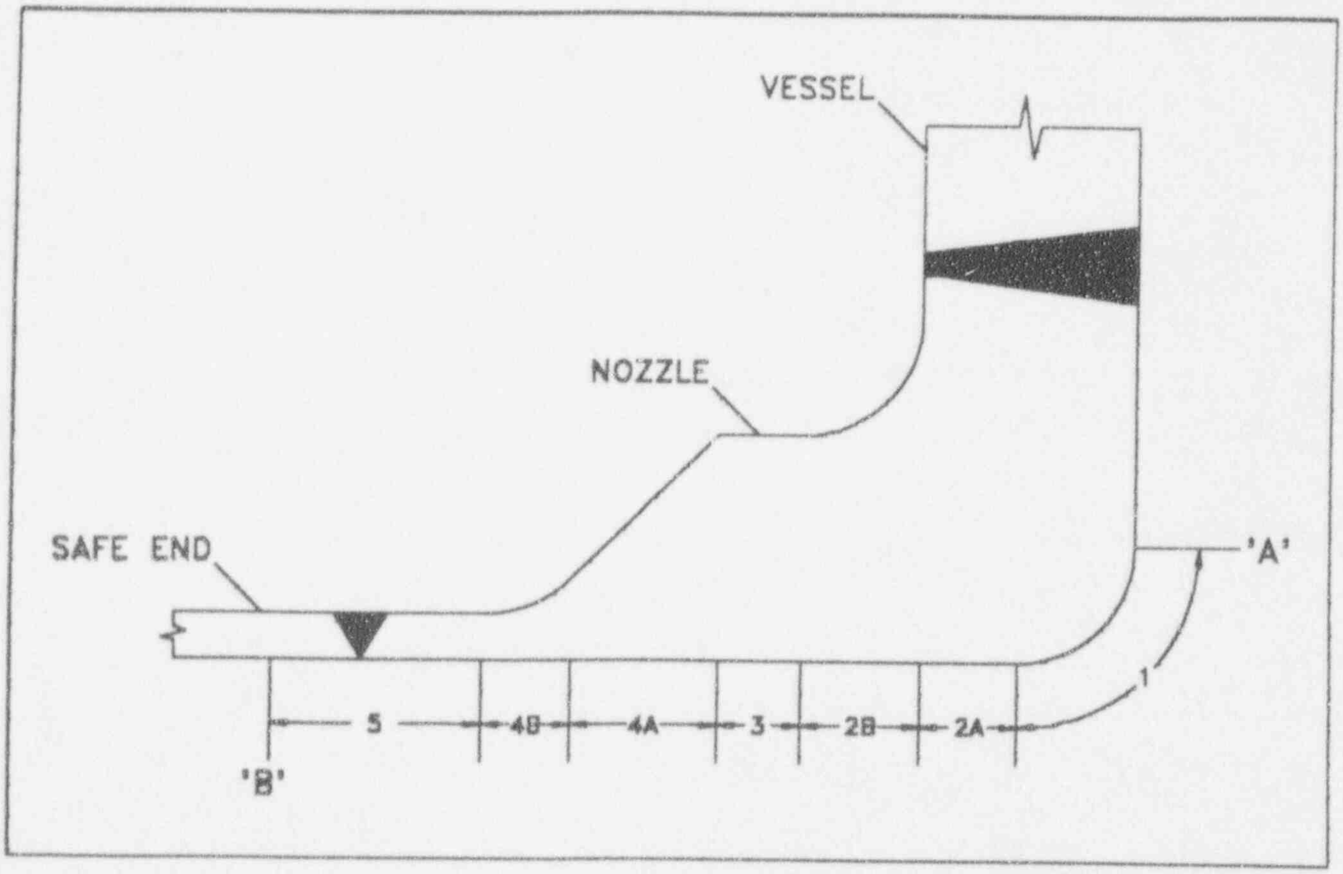
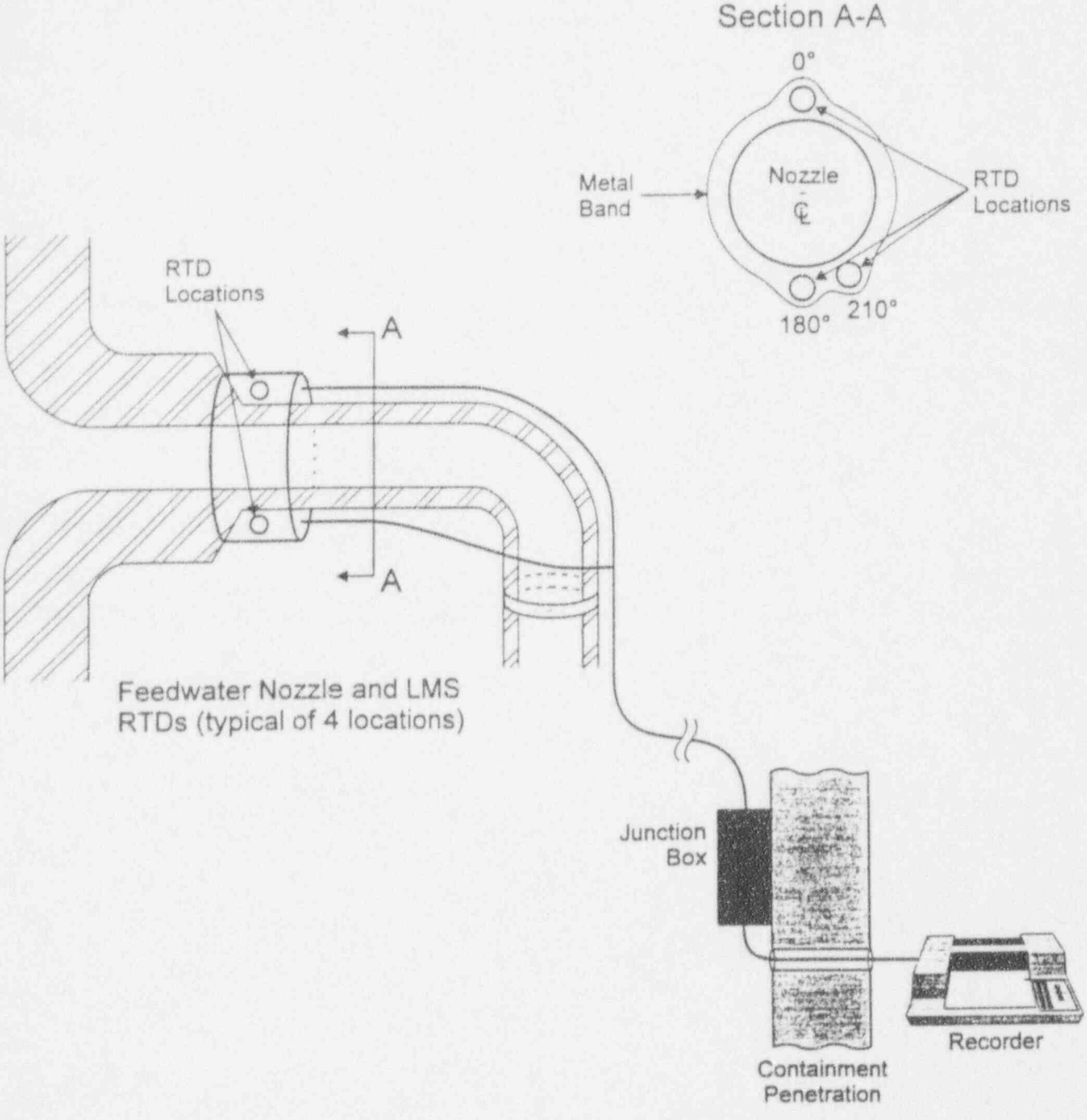


Figure 1 - Feedwater Nozzle Examination Zones



Feedwater Leakage Monitoring System: Schematic Diagram of Components

FIGURE 2