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AUTH.NAME AUTHOR AFFILIATION
LARSON,C.E. Northern States Power Co.
RECIP.NAME RECIPIENT AFFILIATION
DAVIS,A.B. Region 3, Ofc of the Director

SUBJECT: Responds to NRC Bulletin 87-001 w/info re programs for monitoring wall thickness of high-energy piping.

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Northern States Power Company

414 Nicollet Mall
Minneapolis, Minnesota 55401
Telephone (612) 330-5500

September 9, 1987

NRC Bulletin 87-01

Mr A Bert Davis
Regional Administrator - Region III
U S Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, IL 60137

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
Docket Nos. 50-282 License Nos. DPR-42
50-306 DPR-60

Response to NRC Bulletin 87-01

In response to NRC Bulletin 87-01, the following information is offered concerning programs for monitoring wall thickness of high-energy piping.

1. Piping was designed and fabricated to ANSI B31.1, 1967.

2. Scope and extent of the program:

   a. Points at which to make thickness measurements on two-phase systems were selected using the guidelines given in EPRI RP 3944, Erosion/Corrosion of Turbine Piping Systems, presented on September 5, 1984.

      Points on single-phase systems were selected using similar techniques. The information presented in April 1987 at the EPRI workshop, Erosion/Corrosion of Carbon Steel Piping, was incorporated into the selection process for single phase piping.

   b. Two approaches were used for selecting the inspection frequency:

      (1) The first method uses "percent allowable wall loss." The term "percent allowable wall loss" (%AWL) was chosen because it describes erosion/corrosion damage in a way that is easy to visualize.

      The definition of %AWL is:

      $$\%AWL = 100 \times WL / (NW - MW)$$

      where %AWL = percent allowable wall loss
      WL = actual wall loss
      NW = nominal wall thickness
      MW = code allowable minimum wall thickness

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Any area with an AWL greater than 70% requires inspection during the next refueling outage.

(2) The second method of determining inspection frequency is based on calculation of erosion/corrosion rate. The determination is made using engineering judgment and is intended to compensate for uncertainties in the inspection methods and original piping dimensions. This method of choosing inspection frequency is used to identify problem areas.

c. Ultrasonic testing is the method selected to make thickness measurements because it is well suited to the application. Measurements are taken using a digital ultrasonic instrument with A-scan presentation, such as the Nortec 131-D, or with a General Dynamics Ultra Image III (UI-III) ultrasonic imaging system.

d. Replacement and repair decisions are made by a system engineer who is responsible for the piping in a given system. Repair work should be scheduled for the next refueling outage if an area has an erosion/corrosion rate that will cause it to be below code allowable minimum wall thickness within two fuel cycles.

Engineering analysis or judgment may be used to justify scheduling replacement or repair sooner or later than two fuel cycles. The turbine crossunder piping is an example of that kind of deviation. System engineers responsible for the crossunder piping recognize the generic erosion/corrosion problems and therefore schedule repair work during each refueling outage.

3. Factors in the selection of inspection points:

a. Piping material.

b. Piping configuration. Information presented at the 1984 EPRI workshop, Erosion/Corrosion of Turbine Piping Systems, was used as a guideline.

c. The pH of the water.

d. System temperature.

e. Fluid bulk velocity was a major factor in selecting inspection points.

f. Oxygen content.

4. Inspection chronology and results:

   a. The Prairie Island thickness survey program was begun in 1983 and was originally intended for measuring the wall thickness of turbine piping systems. The program now covers the following areas:

      (1) Turbine crossunder piping
      (2) High pressure turbine extraction piping
      (3) Heater drain tank pump discharge piping (added after receiving INPO SER 23-85 describing the Trojan incident)
      (4) Feedwater pump suction piping (added after the Surry incident)
      (5) Feedwater pump discharge piping (added after INPO SER 23-85)
      (6) Cooling water piping (added in 1985)

   b. Piping listed in 4a above is inspected using instruments such as the General Dynamics UI-III, the Nortec 131-D, or the Panametrics Epoch. Reference thickness was taken from a carbon steel step wedge or from a Rompas block. Locations examined are included in the attached thickness survey material. Sketches of piping and paint stick markings on piping are the principal means for locating inspection points at subsequent inspections.

   c. The attached material contains most of the information available on the Prairie Island Thickness Survey. It includes isometric drawings, data sheets and final reports. The only material missing from this submittal is inspection data from the UI-III that is stored on floppy disks. That data cannot be displayed without a UI-III or a special software package from the manufacturer. However, data transcribed from the UI-III to data sheets in the normal manner is included.

      No areas have been identified as unacceptable. However, two areas, area 3.4 or isometric diagram PITS-3A and area 4.4 of isometric diagram PITS-4A, have been brought to the attention of the system engineers as areas that may soon need replacement. Area 3.4 is at 77% AWL and area 4.4 is at 61% AWL.

      The turbine crossunder piping is undergoing a visual inspection and repair program. That piping system is highly susceptible to erosion/corrosion damage and is visually inspected and weld repaired during each refueling outage. The damage that occurs during one fuel cycle is minor, but the philosophy is that several small repairs are better than one large-scale repair or replacement.

   d. The thickness survey has found no areas that are at or below design nominal wall thickness.

5. As described in 4a above, the thickness survey program was begun with steam piping and was expanded as further information was gained. The NUMARC Technical Subcommittee Working Group on Piping Erosion/Corrosion has made recommendations on inspection programs for high energy single phase piping. The program is currently being reviewed to determine which of the NUMARC recommendations should be incorporated.

C E Larson
Vice President, Nuclear Generation

Attachments

c: ~~NRR Project Manager, NRC~~
Resident Inspector, NRC
Document Control Desk, NRC (w/attachments)
G Charnoff

UNITED STATES NUCLEAR REGULATORY COMMISSION

NORTHERN STATES POWER COMPANY

PRAIRIE ISLAND NUCLEAR GENERATING PLANT

Docket No. 50-282
Docket No. 50-306

RESPONSE TO NRC BULLETIN 87-01

Northern States Power Company, a Minnesota corporation, by this letter dated September 9, 1987 hereby submits information required by NRC Bulletin 87-01 for the Prairie Island Nuclear Generating Plant.

This letter contains no restricted or other defense information.

NORTHERN STATES POWER COMPANY

By C E Larson
C E Larson
Vice President, Nuclear Generation

On this 9th day of September, 1987 before me a notary public in and for said County, personally appeared C E Larson, Vice President, Nuclear Generation, and being first duly sworn acknowledged that he is authorized to execute this document on behalf of Northern States Power Company, that he knows the contents thereof and that to the best of his knowledge, information and belief, the statements made in it are true and that it is not interposed for delay.

Judy L. Klapperick

JUDY L KLAPPERICK
NOTARY PUBLIC—MINNESOTA
ANOKA COUNTY
My Commission Expires Sept. 29, 1991