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SUBJECT: Application for amends to Licenses NPF-10 & NPF-15,  
 clarifying requirements for determining content of inservice  
 insp tube sample by deleting tubes in batwing area based on  
 performance of corrective action program. Fee paid.

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January 26, 1988

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

Gentlemen:

Subject: Docket Nos. 50-361 and 50-362  
San Onofre Nuclear Generating Station  
Units 2 and 3

In our letter dated April 5, 1985 the Southern California Edison Company (SCE) documented the existence of and the corrective action for steam generator tube wear caused by vibration of an internal diagonal support ("batwing wear"). The corrective action program includes a full 100 percent eddy current inspection of all tubes falling within the "batwing wear" area during every refueling outage and the preventive plugging of tubes.

The Technical Specifications require that at least 50 percent of the tubes selected for the routine inservice inspection shall be located in those areas where experience has indicated potential problems. In the case of San Onofre Units 2 and 3 this would necessitate, for a 3 percent random sample, more than half of the sample be located in critical areas (the "batwing wear" area). This reduces the size of the first random sample of tubes throughout the generator to less than 1.5 percent. Additionally, since the "batwing wear" area includes tubes which are subject to the known wear mechanism, the sample base may be unnecessarily increased beyond the initial 3 percent. Thus, the current Technical Specifications, when applied as written, would effectively reduce the extent of the random sample outside the wear area. The net effect of the proposed change is to provide for a more significant random sample by increasing the initial sample base outside of the "batwing wear" area while simultaneously precluding unnecessary expansion of the overall sample beyond 3 percent.

The purpose of this letter is to request approval of the enclosed proposed Technical Specification change package. The proposed change would clarify the requirements for determining the content of the inservice inspection tube sample by deleting the tubes in the "batwing wear" area based on performance of the above mentioned corrective action program to address that phenomenon.

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January 26, 1988

A check in the amount of \$150 is enclosed in accordance with the requirements of 10 CFR 50.172. A formal request for approval of PCN-240 will be included in our next amendment application. Approval of the proposed change prior to the Unit 3, Cycle 4 refueling outage in April 1988 is requested to prevent unnecessary SCE expenditures.

Please do not hesitate to call if you have questions or require additional information regarding your review of this proposed change.

Very truly yours,



Enclosures

cc: H. Rood, NRR Senior Project Manager, San Onofre Units 2 and 3  
J. B. Martin, Regional Administrator, NRC Region V  
F. R. Huey, NRC Senior Resident Inspector, San Onofre Units 1, 2 and 3

DESCRIPTION AND SAFETY ANALYSIS  
OF PROPOSED CHANGE NPF-10/15-240

This is a request to revise Technical Specification 3/4.4.4, "Steam Generators."

Existing Specifications:

Unit 2: See Attachment A  
Unit 3: See Attachment B

Proposed Specifications:

Unit 2: See Attachment C  
Unit 3: See Attachment D

Description:

The proposed change would revise Technical Specification 3/4.4.4, "Steam Generators." The surveillance requirements for inspection of the steam generator tubes ensure that the structural integrity of this portion of the RCS will be maintained. The program for inservice inspection of steam generator tubes maintains surveillance of the condition of the tubes in the event that there is evidence of mechanical damage or progressive degradation due to design, manufacturing errors, or inservice conditions that lead to corrosion. In SCE's letter dated April 5, 1985, SCE documented the existence of and the corrective action for steam generator tube wear caused by vibration of an internal diagonal support ("batwing wear"). The corrective action program includes a full 100 percent eddy current inspection of all tubes falling within the "batwing wear" area during every refueling outage and the preventative plugging of tubes.

The Technical Specifications currently require that at least 50% of the tubes selected for the routine inservice inspection shall be located in those areas where experience has indicated potential problems. This would require, for a 3% random sample, more than half of the sample be located in the "batwing wear" area which reduces the size of the first random sample throughout the generator to be less than 1.5%. Additionally, since the "batwing wear" area contains tubes which are subject to the known wear mechanism, the sample base may be increased beyond the initial 3%. However, any additional tube inspection would focus exclusively on the problem areas. Thus, although the tubes experiencing "batwing wear" have been enveloped by the aforementioned program, the current Technical Specifications, when applied as written, would effectively reduce the extent of the random sample outside the wear area and cause unnecessary expansion of the steam generator tube inspection sample base into the wear area for each inservice inspection.

The proposed change would revise the Technical Specification surveillance requirements to require a special "batwing wear" area inspection and remove this area from the general tube sample selection. This increases the random tube selection outside this well-defined area and provides for a better inspection program. In addition, because the wear phenomenon in the "batwing wear" area is well understood, the results would not be included in the inspection results classification. In summary, the proposed change will revise the Technical Specification surveillance requirements to exclude tubes from the "batwing wear" area from the first tube inspection sample base.

## Safety Analysis

### San Onofre Units 2 and 3 Steam Generator Design

San Onofre Units 2 and 3 have essentially identical, mirror imaged, steam generator installations. Each unit has two Combustion Engineering (C-E) designed Model 3410 steam generators.

Each steam generator contains 9350 mill annealed inconel 600 tubes arrayed in a triangular pitch U bundle. These tubes are supported along their vertical lengths by seven full diameter eggcrate supports and three partial diameter eggcrate supports (see Figure 1). The bend and horizontal lengths of the tubes are supported by diagonal ("batwing") straps, which cross the tubes just below the start of the bend, and as many as seven vertical support straps, depending on the horizontal length of the tube (see Figure 2). The vertical straps are connected in the out-of-plane dimension by horizontal straps. A stay cylinder is installed at the central portion of the tubesheet to permit reduction of tubesheet thickness. The region above the stay cylinder cannot be tubed, and forms a hollow cavity at the center of the tube bundle.

### Operation and Inspection History

Unit 2 completed three cycles of operation in September 1987. Unit 3 is scheduled to complete three cycles of operation in April 1988.

The first inservice inspection of a C-E Model 3410 steam generator was performed at San Onofre Unit 2. This inspection provided indications of tube wear at "batwing" intersections for several tubes adjacent to the stay cylinder cavity in both steam generators. As documented in SCE's letter to NRC dated April 5, 1985, appropriate tube plugging and tube staking was performed. Subsequently, at Unit 3, an opportunity for inspection of this same region occurred in the middle of the first cycle of operation. This inspection confirmed that similar tube wear was occurring at both Units 2 and 3.

The ongoing, conservative tube plugging in this wear region has helped ensure a complete lack of tube leakage due to this wear phenomenon.

### Modeling

The San Onofre Unit 2 and 3 steam generators were modeled using two phase flow tests, fatigue tests, and vibration tests to predict the extent of tubes affected by the "batwing" vibration. Results of these tests were used to develop a computer model to predict the extent and rate of wear for affected tubes.

Modeling work performed by C-E defined the problem to be wear, in a limited region of the tube bundle, resulting from out-of-plane vibration of the "batwing" supports. High velocity two phase flow up the untubed stay cylinder cavity imparts a force on the "batwing" supports, resulting in out-of-plane motion of the "batwing" against the tube, causing tube wear. The modeling work predicted that the wear phenomenon would be restricted to a small number of tubes, adjacent to the stay cylinder cavity, and would be self-limiting due

to the angle of contact of the "batwing" on the tube and reduction of "batwing" vibration deeper within the tube bundle. The C-E results were used as an input to determinations of the extent of the plugging patterns utilized.

Similar "batwing" wear has been found during inservice inspection of other Model 3410 steam generators. Field results continue to support the laboratory modeling prediction that wear progression at "batwing" support/tubing intersections would affect a limited number of tubes contained within a well defined area in the steam generator.

The proposed change discussed above shall be deemed to involve a significant hazards consideration if there is a positive finding in any of the following areas:

1. Will operation of the facility in accordance with this proposed change involve a significant increase in the probability or consequences of any accident previously evaluated?

Response: No

The "batwing wear" area of the steam generator tube bundle is subjected to a 100 percent eddy current inspection every refueling outage and tubes identified as having been subjected to the wear mechanism are preventatively plugged in accordance with conservative criteria. Tubes outside the "batwing wear" area continue to be inspected in accordance with the current Technical Specification requirements. The net effect of the change is to provide for a more significant random sample by increasing the initial sample base outside the "batwing wear" area from 1.5% to 3% while simultaneously precluding unnecessary expansion of the overall sample beyond 3%. Therefore, operation of the facility in accordance with the proposed change does not affect the probability or consequences of an accident previously evaluated.

2. Will operation of the facility in accordance with this proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No

The proposed change does not alter the configuration of the plant or its operation. Therefore, the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Will operation of the facility in accordance with this proposed change involve a significant reduction in a margin of safety?

Response: No

The margin of safety involved in steam generator tube inspection depends on the accuracy and completeness of the examination. The wear mechanism is well defined and well within the capability of inspection techniques to effectively monitor. Using the predictive models and analysis, the area of "batwing wear" is identified and will continuously be inspected. The current Technical specification surveillance requirements will be applied elsewhere in the steam generator to ensure tube integrity is appropriately monitored. Therefore, the proposed change does not reduce the effectiveness of the steam generator tube inservice inspection program nor does it involve a reduction in a margin of safety.

#### Safety and Significant Hazards Determination

Based on the above Safety Analysis, it is concluded that: (1) the proposed change does not constitute a significant hazards consideration as defined by 10 CFR 50.92; (2) there is reasonable assurance that the health and safety of the public will not be endangered by the proposed change; and (3) this action will not result in a condition which significantly alters the impact of the station on the environment as described in the NRC Final Environmental Statement.

BRD:9207F

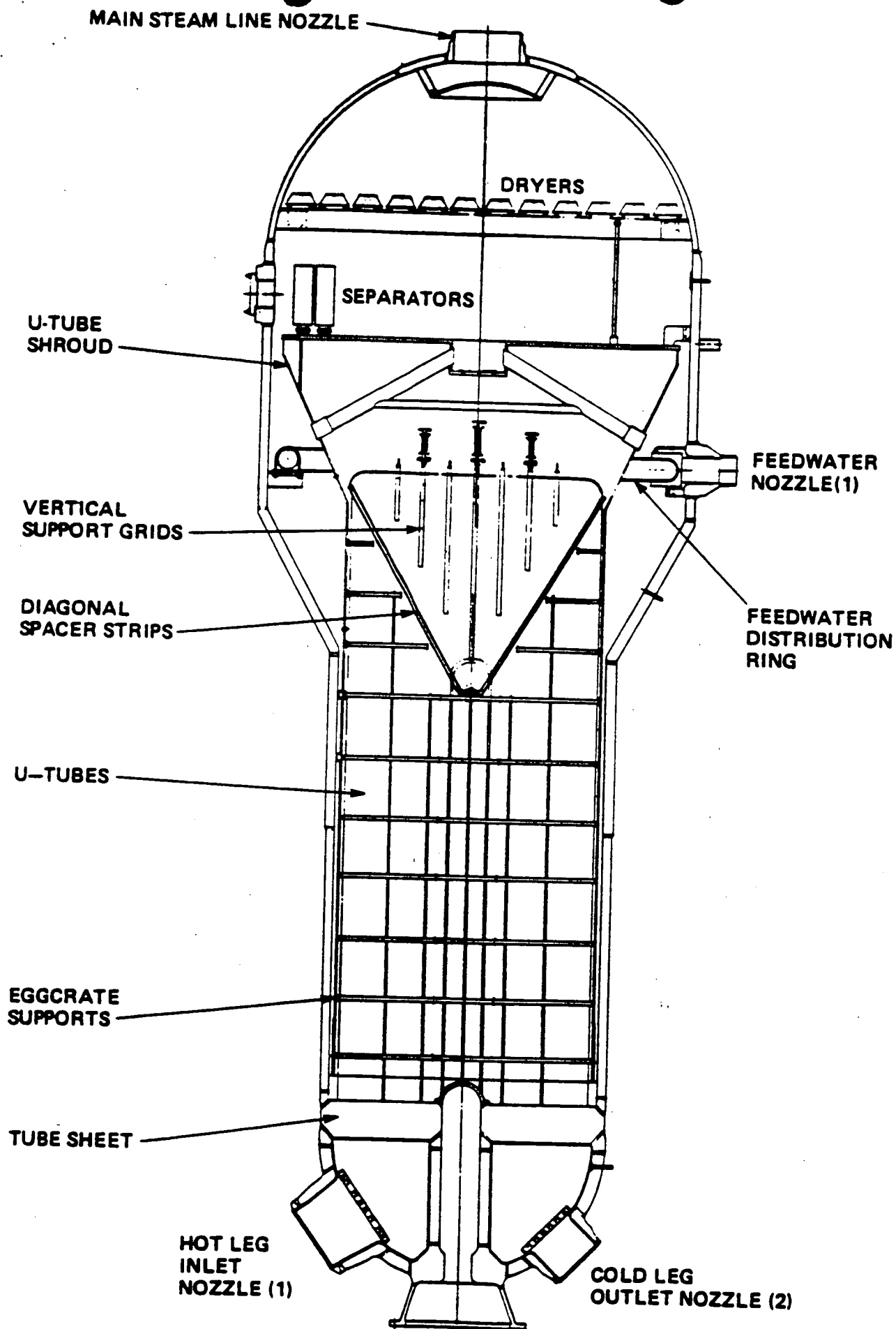


FIGURE 1 SONGS-2 STEAM GENERATOR ARRANGEMENT



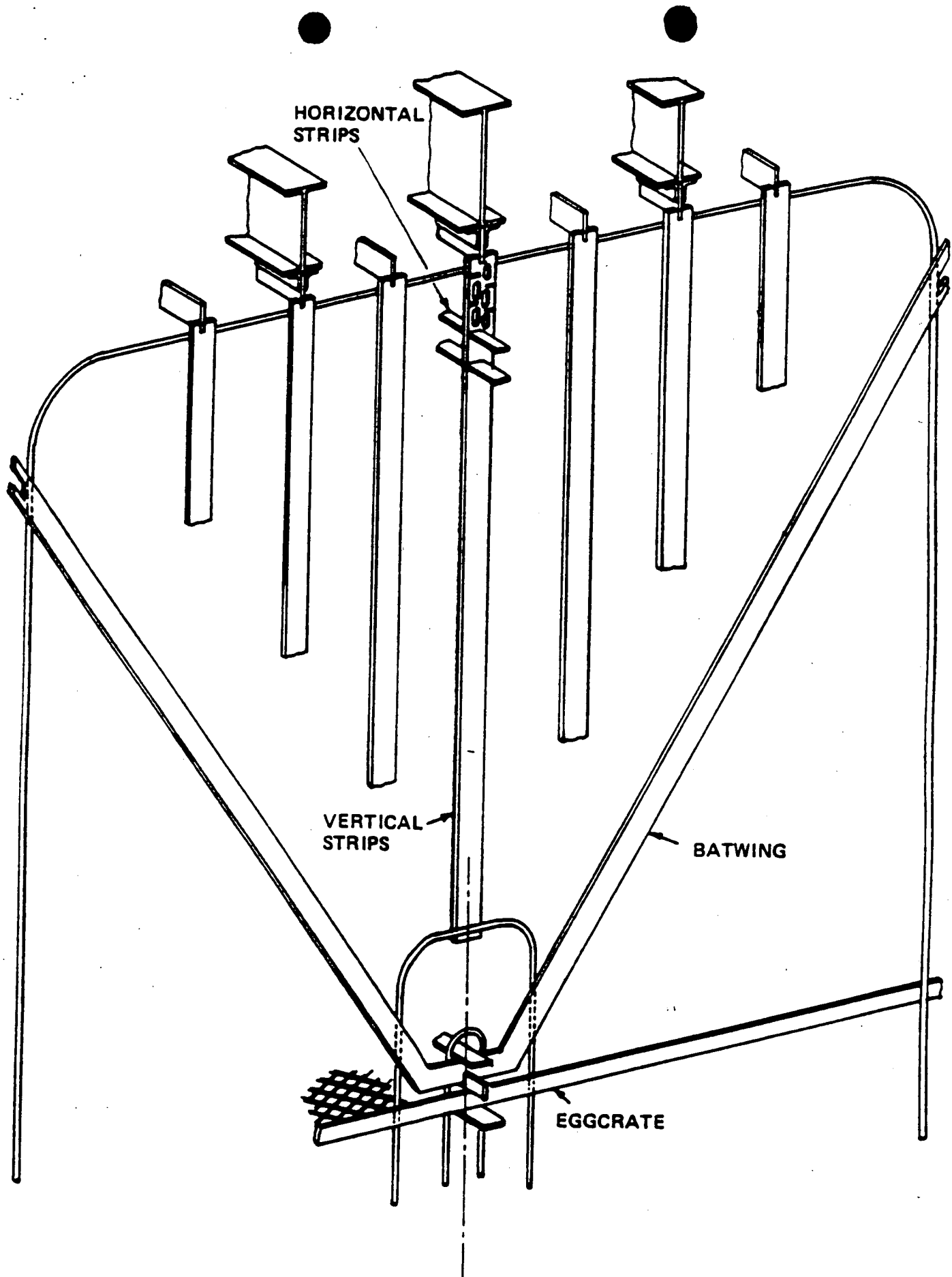


FIGURE 2  
SONGS-2 STEAM GENERATOR BEND REGION TUBE SUPPORTS

NPF-10/15-240

ATTACHMENT "A"

EXISTING UNIT 2 TECHNICAL SPECIFICATION