GENERAL ELECTRIC

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NUCLEAR ENERGY
DIVISION

BWR PROJECTS DEPARTMENT

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January 28, 1974

Mr. Voss A. Moore
Assistant Director for
Boiling Water Reactors
Office of Regulation
U.S. Atomic Energy Commission
Washington D.C. 20545

Dear Mr. Moore:

General Electric has conducted a study of feedwater spargers to determine why cracks appeared in the spargers at the Millstone Nuclear Power Station. Our investigation has included inspections of feedwater spargers at operating plants, instrumentation of the Millstone spargers, and cold flow testing at the G.E. Sparger Test Facility in San Jose. Inspection of spargers in ten operating plants has been completed. The only plant with confirmed defects is at Millstone.

Tests performed at the G.E. sparger test facility show that there is a relationship between thermal sleeve/nozzle leakage and sparger vibration. For the cold flow sparger tests, the vessel nozzle inside diameter at the thermal sleeve fit was increased in increments for the performance of leakage tests and corresponding full flow tests. These tests yielded the following results:

1. For a given sparger flow, the leakage is directly proportional to the average radial gap between the nozzle and thermal sleeve. (See Figure 1)

2. For a flow of 4500 gpm, the sparger is susceptible to self-excitation or leakage flow induced instability if the average radial gap is greater than .011-inches. (Figure 2 shows a feedwater sparger installation indicating the radial gap of concern.)

3. A line defining the predicted unstable region is also shown in Figure 1 for the particular sparger tested.

These results were obtained by testing with no preload on the sparger and the retaining pins at the ends of the sparger arms were essentially loose except for the reacting force against the hydraulic flow. The only variable introduced was the change in the average radial gap between the nozzle and thermal sleeve (i.e. leakage area varied).

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Based on this investigation, G.E. is recommending to BWR owners that the following action be taken regarding feedwater spargers:

Operating Plants - Perform inservice inspections during refueling outages to determine the conditions of spargers.

Near Operating Plants - By expanding the feedwater sparger thermal sleeve, the radial gap between the nozzle and thermal sleeve can be reduced to a point where instability will not occur. The feedwater sparger will be removed and expanded, as necessary, to give the proper radial gap to eliminate flow induced vibrations.

Future Plants - For those plants where vessel and thermal sleeve fabrication and installation schedules allow, the thermal sleeve will be welded to the nozzle safe end. The thermal sleeve design is similar to the advanced welded design for use on BWR/6. No change to BWR/6 is required.

General Electric believes the problem has been isolated and that the foregoing programs will eliminate the feedwater sparger problems in BWRs. A schedule for the suggested inspection and modification is being developed with the BWR owners.

General Electric would like to invite the AEC Staff to come to San Jose to review the sparger test facility and review the data collected. However, if the Staff would rather have the data presented to them in Bethesda, General Electric will be happy to make arrangements for such a presentation.

If there are any questions, comments, or the desire for additional information, please contact me or Mr. Gail C. Ross, Manager, Project Licensing Unit III.

Sincerely,

John A. Hinds, Manager
Safety and Licensing

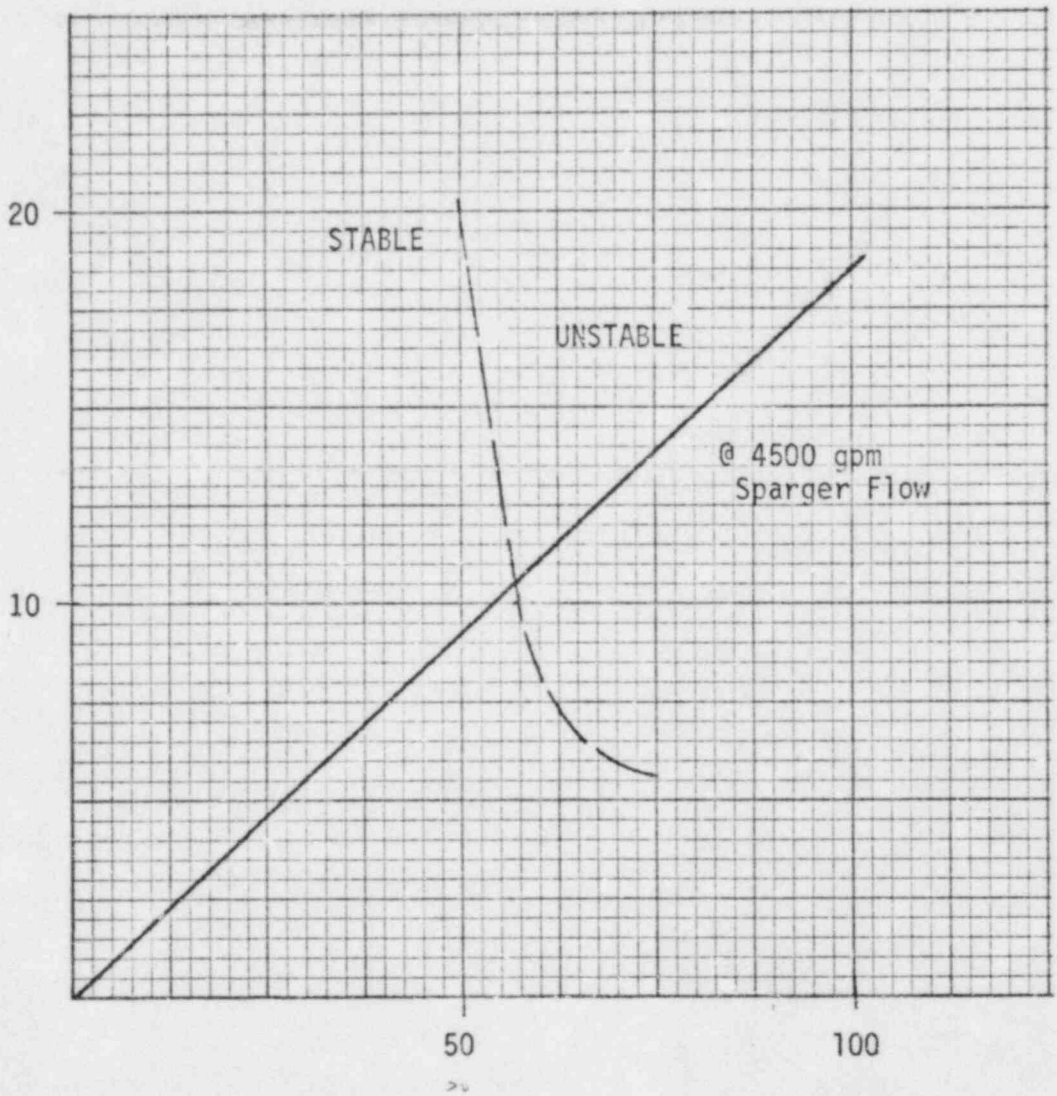
JAH:jeh

Attachments: Figure 1. Leakage Flow and Predicted Stable and Instable Regions in a Feedwater Sparger
Figure 2. Feedwater Sparger Installation

cc: A. Giambusso
J.M. Hendrie
J. Stolz
D. Eisenhut

LEAKAGE FLOW AND STABLE AND UNSTABLE

REGIONS IN A FEEDWATER SPARGER INSTALLATION



AVERAGE RADIAL GAP, MILS

LEAKAGE FLOW , gpm

FIGURE 1

FEEDWATER SPARGER INSTALLATION

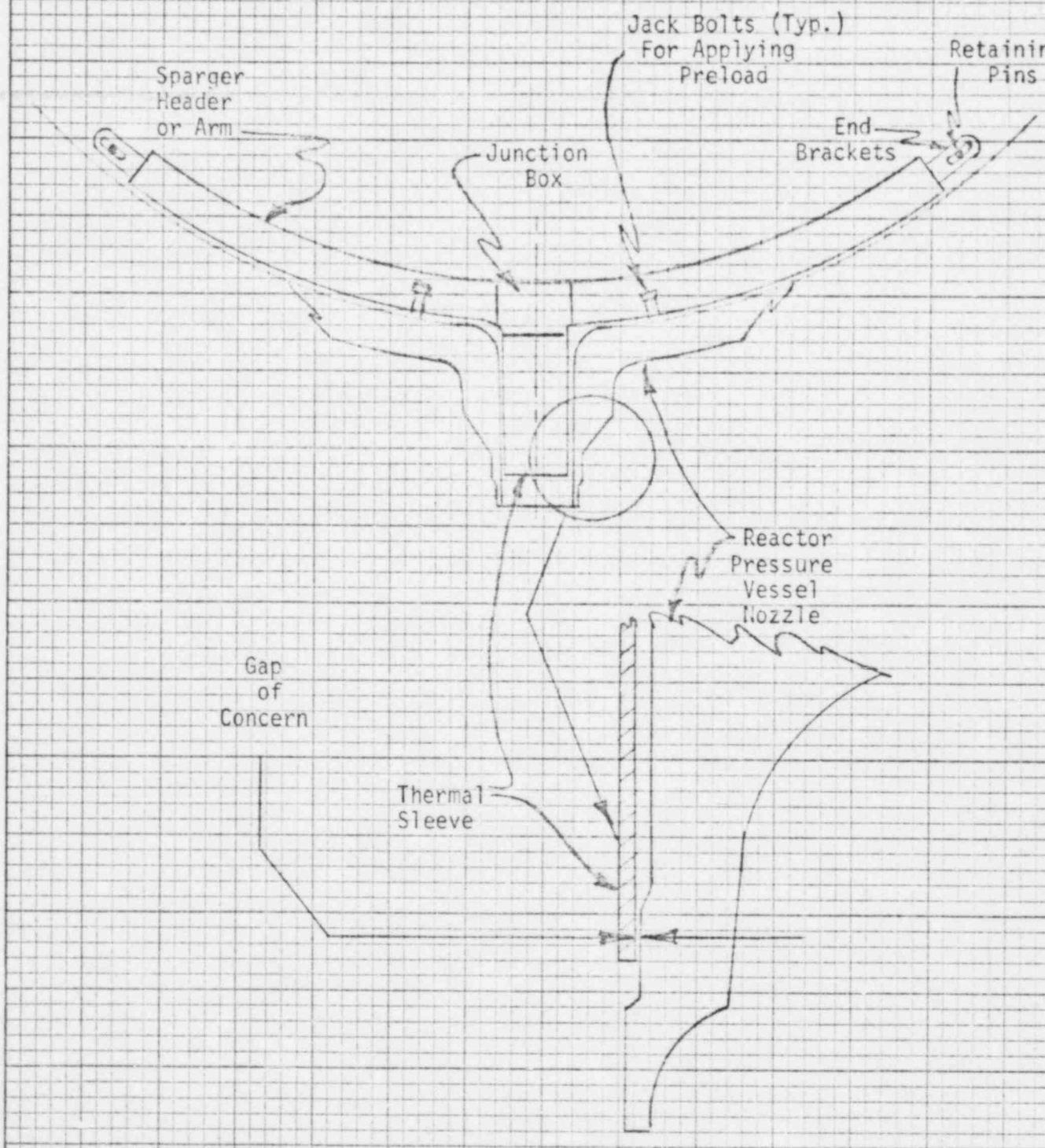


FIGURE 2