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RECIP.NAME RECIPIENT AFFILIATION
ZWOLINSKI,J.A. Operating Reactors Branch 5

SUBJECT: Submits update of improvements in steam generator tubesheet sleeve eddy current insp. techniques since iitial sleeve installation in 1983,Removal of restriction limiting number of tubesheet sleeves that can be installed requested.

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NOTES:NRR/DL/SEP 1cy. 05000244
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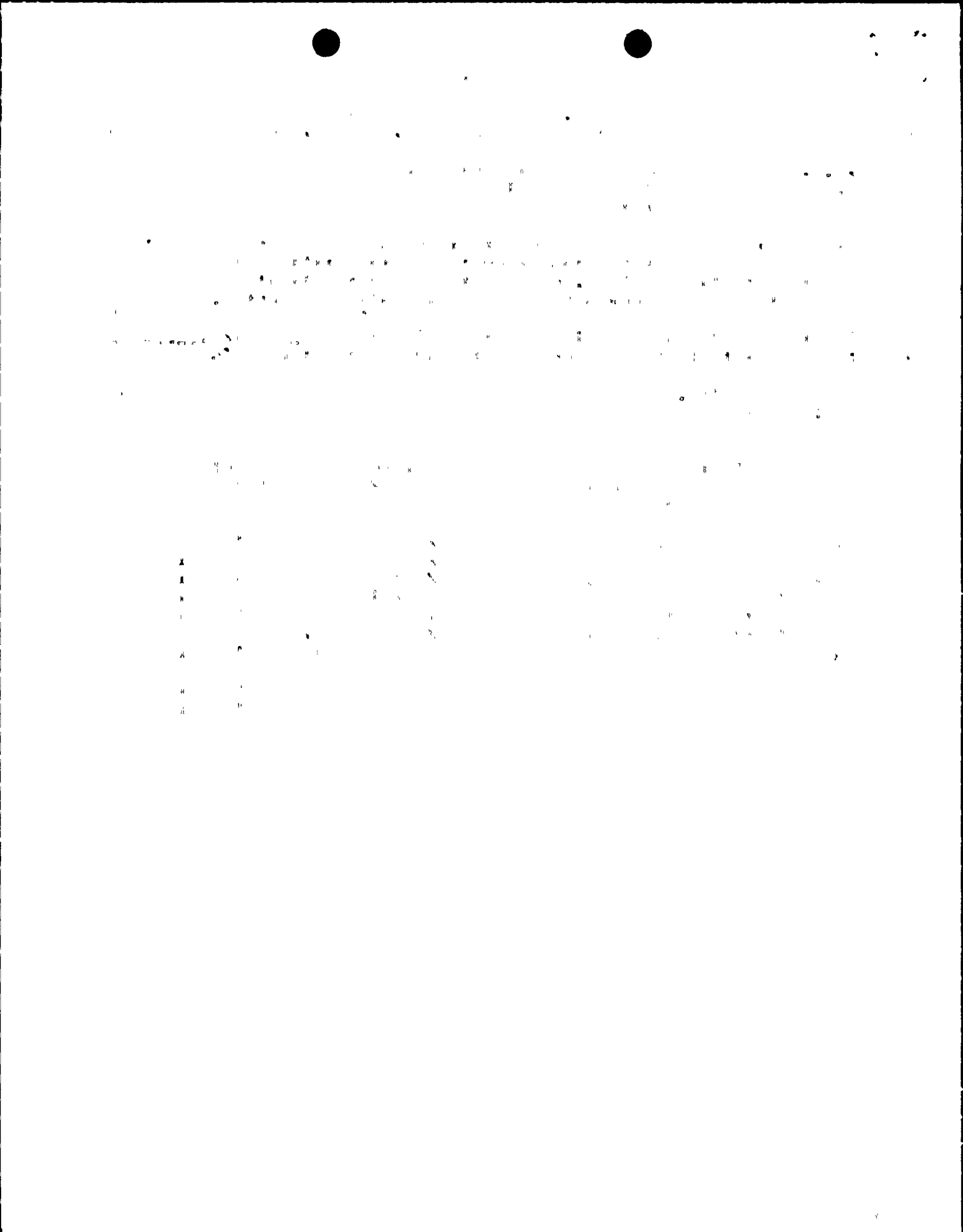

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October 4, 1985

Director of Nuclear Reactor Regulation
Attention: Mr. John A. Zwolinski, Chief
Operating Reactors Branch No.5
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Steam Generator Tubesheet Sleeves
R.E. Ginna Nuclear Power Plant
Docket No. 50-244

Dear Mr. Zwolinski:

The installation of tubesheet sleeves was approved by the Nuclear Regulatory Commission (NRC) through their Safety Evaluation Report (SER) transmitted to Rochester Gas and Electric (RG&E) by letter dated June 13, 1983. This SER limited the number of tubesheet sleeves that could be installed in 1983 to not more than 30 and also prevented the installation of additional tubesheet sleeves after the Spring 1983 outage until the effectiveness of inspection techniques could be demonstrated by RG&E. During the 1983 outage, four tubesheet sleeves were installed in the A Steam Generator and twenty-four sleeves were installed in the B Steam Generator. During the 1984 outage, nine more tubesheet sleeves were installed in the B Steam Generator, as allowed by your SER dated May 9, 1984.

Most recently, during the 1985 Outage, two tubsheet sleeves were installed in the A Steam Generator with fifty-six being installed in the B Steam Generator, as allowed by your SER dated April 2, 1985. Presently, there are eighty-eight tubesheet sleeves installed in the B Steam Generator with six installed in the A Steam Generator.

Over the last three years, the technical evaluation and development of nondestructive examination methods for the purpose of optimizing inspectability of tubesheet sleeves/tube integrity has continued. Based upon work performed during the 1984 outage, parent tube flaws located 0.75 inches or greater above the sleeve are capable of being detected with the annular differential magnetic bias eddy current probe. In 1985, improvements for reducing the area above the tubesheet sleeve where an inspection technique had been limited was accomplished by utilizing a standard annular differential coil probe delivered from the cold leg of the steam generator. This increases the area of acceptable inspection to 0.5 inches above the sleeve end. Defects are marginally detectable at 0.25 inches above the sleeve end. Improvements in detecting parent tube flaws in the free span region behind the sleeve have been made by increased gain and probe impedance optimization with the Zetec MIZ-18 Multifrequency Eddy Current System. This has improved the sensitivity by a factor of two to three, enabling standard ASME flaw detection. However, parent tube flaws located from the sleeve end through the expansion transition are still not detectable with eddy current technology.

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DATE 10-04-85
TO Mr. John A. Zwolinski

Since 1984, research and development (R&D) efforts have been undertaken and in several cases completed in the following areas where an advancement in the inspection technology could be achieved:

A. Improved the Zetec MIZ-18 Multifrequency Eddy Current System, improving gain by developing a modification to the system to improve gain.

B. Improved annular differential eddy current probes.

C. Design a reliable multi-array pancake coil probe for use above the sleeve.

D. Improved cross-wound coil probes, with optimized magnetic bias by Eddy Current Technology Incorporated.

E. Improved 3-D Eddy Current Coil Probes, with optimized magnetic bias by Eddy Current Technology Incorporated.

F. Improve the low frequency eddy current instrumentation to increase the depth of penetration of the eddy current fields for inspecting above the explosive weld but below the sleeve end.

Although improvements have been made in the eddy current inspection techniques, there are still some areas of the tubesheet sleeve/tube combination where the ability to detect and size defects is limited. These areas are at the weld transitions and at the upper end of the sleeve. Use of several of the above improvements will allow 20% thru wall defects to be seen as shown on Attachments 1 and 2. Larger defects can be seen at some intermediate locations. A comparison of the current inspection capability with that available in Spring 1984 is shown on Attachment 3.

In addition to the improvements which have already been completed, further activity will continue consistent with our overall philosophy of continuing efforts to improve inspection capabilities. In order to improve the inspection for parent tube flaws located from the sleeve end through the expansion transition, further R&D efforts are on-going in the following areas:

A. Electromagnetic Acoustic Transducers (EMAT's) developed for the inspection of the parent tube above the sleeve and down to and including the expansion area of the explosive weld.

B. Rotating Eddy Current probe for inspection of the sleeve from the sleeve end through the transition zone and expansion area of the explosive weld.

The EMAT Development Program is under joint sponsorship of RG&E and the Steam Generator Owners Group. Based upon design calculations the EMAT technology should allow for the detection of circumferential cracks approximately 0.2 - 0.4 inches above the explosive weld interface. This would provide coverage of the parent tube from above the sleeve end down through the expansion transition zone of the tube. The present schedule for the EMAT development program calls for a field deployable system by February 15, 1986. However, this schedule is very tight and may slip if unforseen problems arise over the next few months.

The rotating eddy current probe development program has been under sponsorship of Consolidated Edison and final development work has been proposed for sponsorship by the Empire State Electric Energy Research Company (ESEERCO). This technology should, intuitively, allow for more sensitivity to sleeve defects and possibly tube defects in the area from just below the sleeve end down through the transition zones of the expansion area. Final ESEERCO sponsorship should be approved in October. The rotating eddy current probe is also expected to be available in February and may be used to resolve any unknown signals from the standard bobbin coil examination of the sleeves.

The ability to detect flaws in the steam generator tubing in the region from the top of the upper weld to the secondary face of the tubesheet has certain limitations as described above and documented in Attachment 3. Therefore, an assesment has been performed based upon the possibility that an undetected defect exists in the parent tube and results in complete severance of a tube co-incident with the differential pressure that would exist following a main steam line break. This assesment takes into account the design of the tubesheet sleeve (Attachment 4), which minimizes the impact of such an incident on plant safety, by the position of the presently, uninspectable expansion transition and sleeve end relative to the top of the tubesheet. Attachment 5 is a plot of primary to secondary leakage rates for a full tube severance (360° around circumference 0.20 inch gap separation) versus position relative to the tubesheet sleeve.

There are three zones of interest in Attachment 5:

Zone 1: Above the secondary face of the tubesheet.

Installation of a tubesheet sleeve does not adversely affect the ability to inspect the tube in this region. However it is informative to compare the leakage of approximately 850 GPM resulting from a tube severance in this region to the leakage in other zones where the sleeve reduces inspection sensitivity.

Zone 2: From the top of the sleeve to the secondary face of the tubesheet.

Leakage due to a severance of a tube drops dramatically in this region as a result of the limiting flow area between the tube and the tubesheet. In evaluating the influence of the tubesheet sleeve on the inspectability of the tube in this area, a severance was assumed at 1.25 inches from the top of the tubesheet which is the worst case position where the parent tube becomes uninspectable. The worst case leakage calculated during a steam line break is 23 GPM (A on Attachment 5) or a factor of 3 less than the ability of the plant to provide high pressure make up. This was documented in RG&E's letter of April 23, 1984. Also a circumferential separation is an unlikely failure mode. Incomplete severance is a more likely tube failure mode and results in minor leakage.

Zone 3: From the top of the sleeve to the top of the weld.

> Leakage again drops for a tube severance in this region due to the added flow restriction of the sleeve to tube annulus. Calculated leakage rates, assuming no expansion of the sleeve in this region are from 4 to 10 GPM. Actually, the explosive weld causes expansion which would reduce the expected leakage to less than 1 GPM. This is well below the 60 GPM high pressure make up capability for the primary system.

From the above discussion, the influence of the tubesheet sleeve on the ability to inspect the tube will not have a significant impact on public health and safety. In Zones 1, 2 and 3 above, the tube is inspectable except for very limited areas. Where inspection is limited, a significant margin exists before plant safety systems are challenged even in the worst postulated break case. Also, since tubesheet sleeves were first installed in the Spring of 1983, developments in NDE have improved the inspectability of the sleeve and no degradation has been detected or leakage evidenced.

Based on our current inspection capabilities, due to the continuing success in improving inspectability of the sleeve/tube combination, and due to the design which avoids challenging the plant's safety systems in the worst postulated case, RG&E requests removal of the restriction of the number of tubesheet sleees which can be installed in the Ginna steam generators.

Additionally, seven tube pull analyses have shown that the area of the explosive weld and above the weld have minimal intergranular attack with less than 3% involvement. The corrosion test results for the sleeve/tube explosive weld area were totally free from any form of primary side stress corrosion cracking. Excellent secondary side water chemistry and a crevice flushing program have provided for the continuing integrity of the parent tube from the expansion transition to the top of the tubesheet. Tubes with tubesheet sleeves are inspected every outage. The consequences of the rupture of an undetected flaw are minor and therefore the limitations in tubesheet sleeve installation should be deleted.

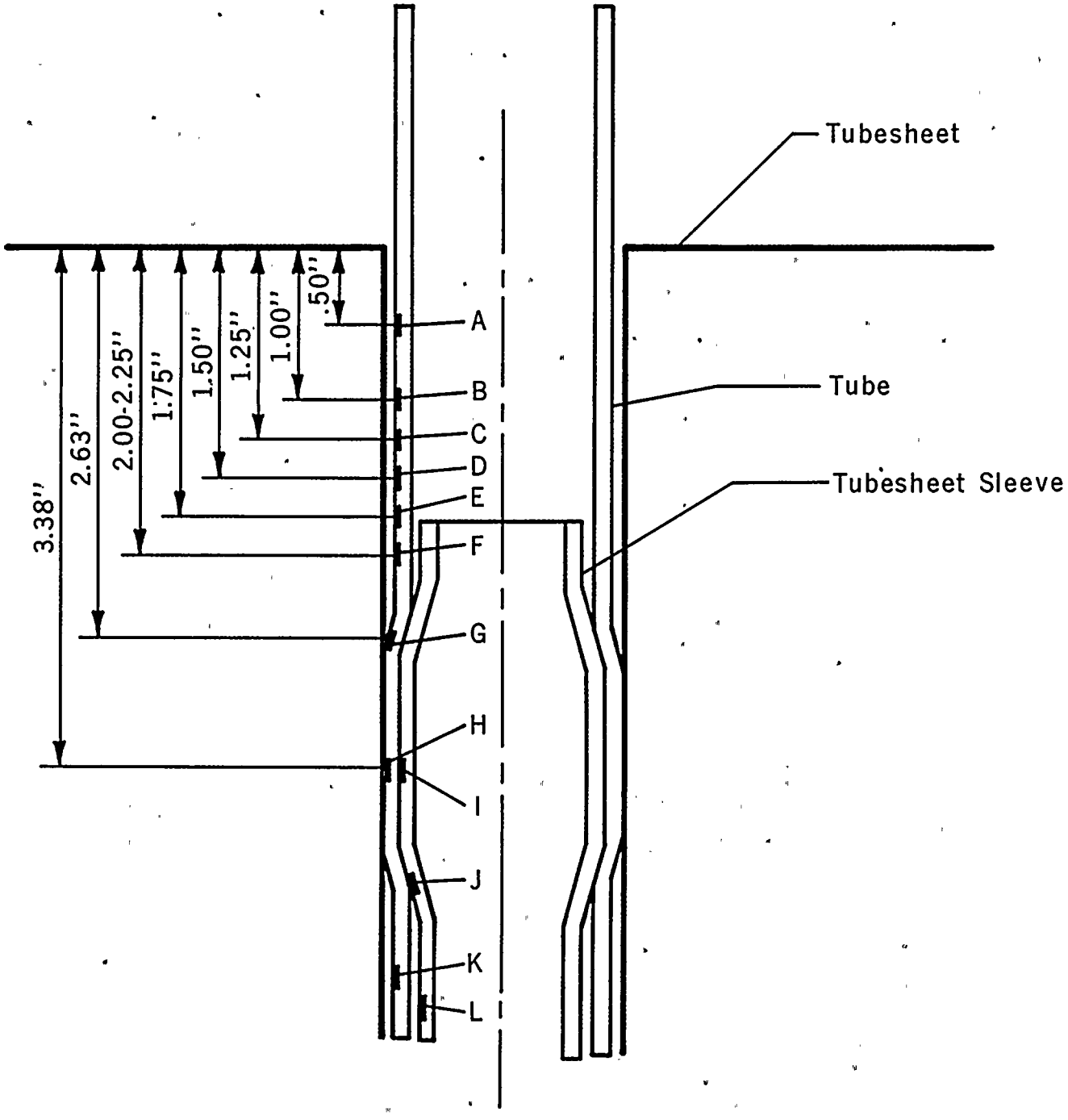
Very Truly Yours,

Roger W. Kober

Roger W. Kober
Vice President
Electric and Steam Production

Attachments

ATTACHMENT 1
TUBE/SLEEVE EDDY CURRENT INSPECTION CAPABILITY FOR ASME FLAWS

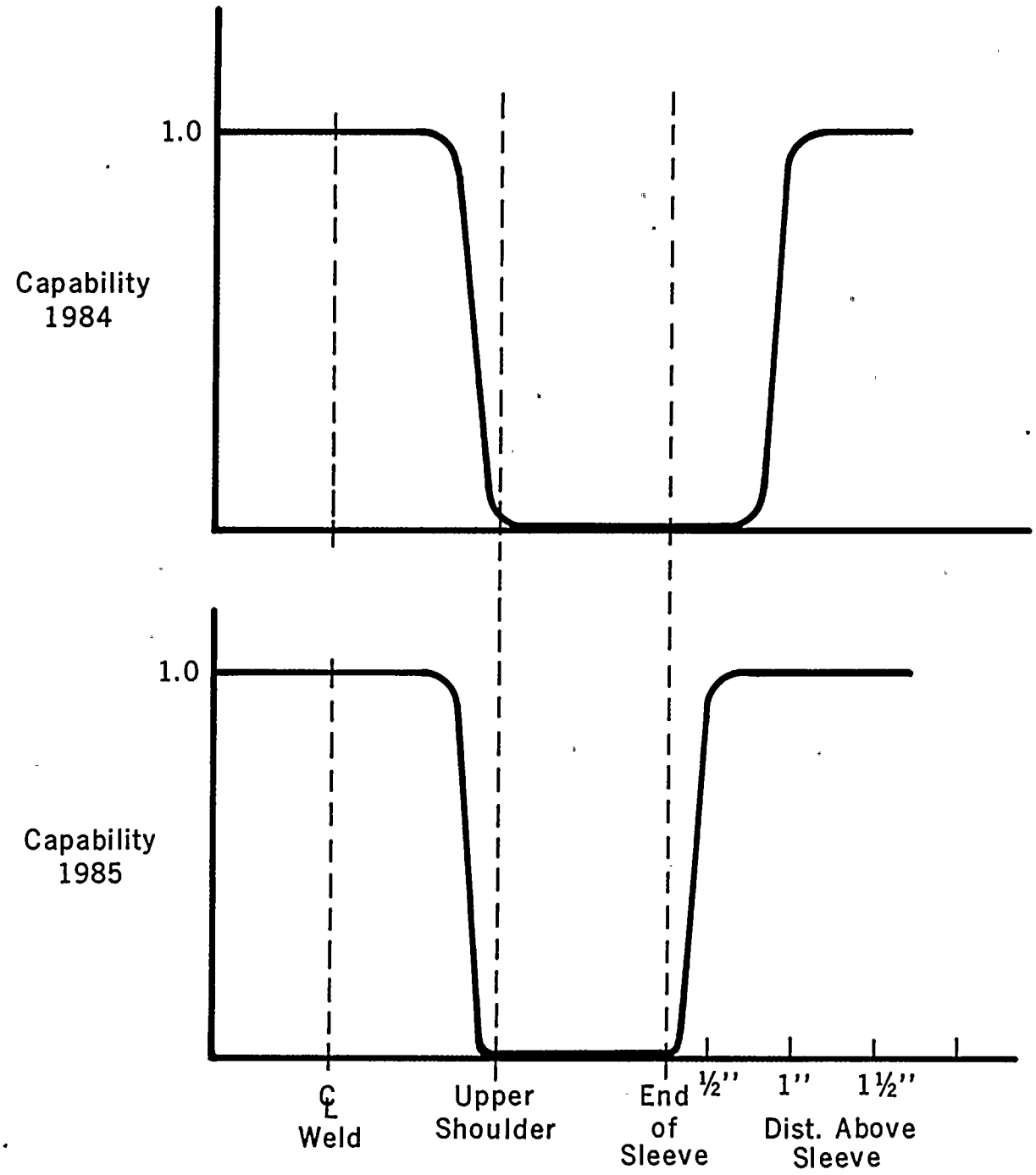


ATTACHMENT 2

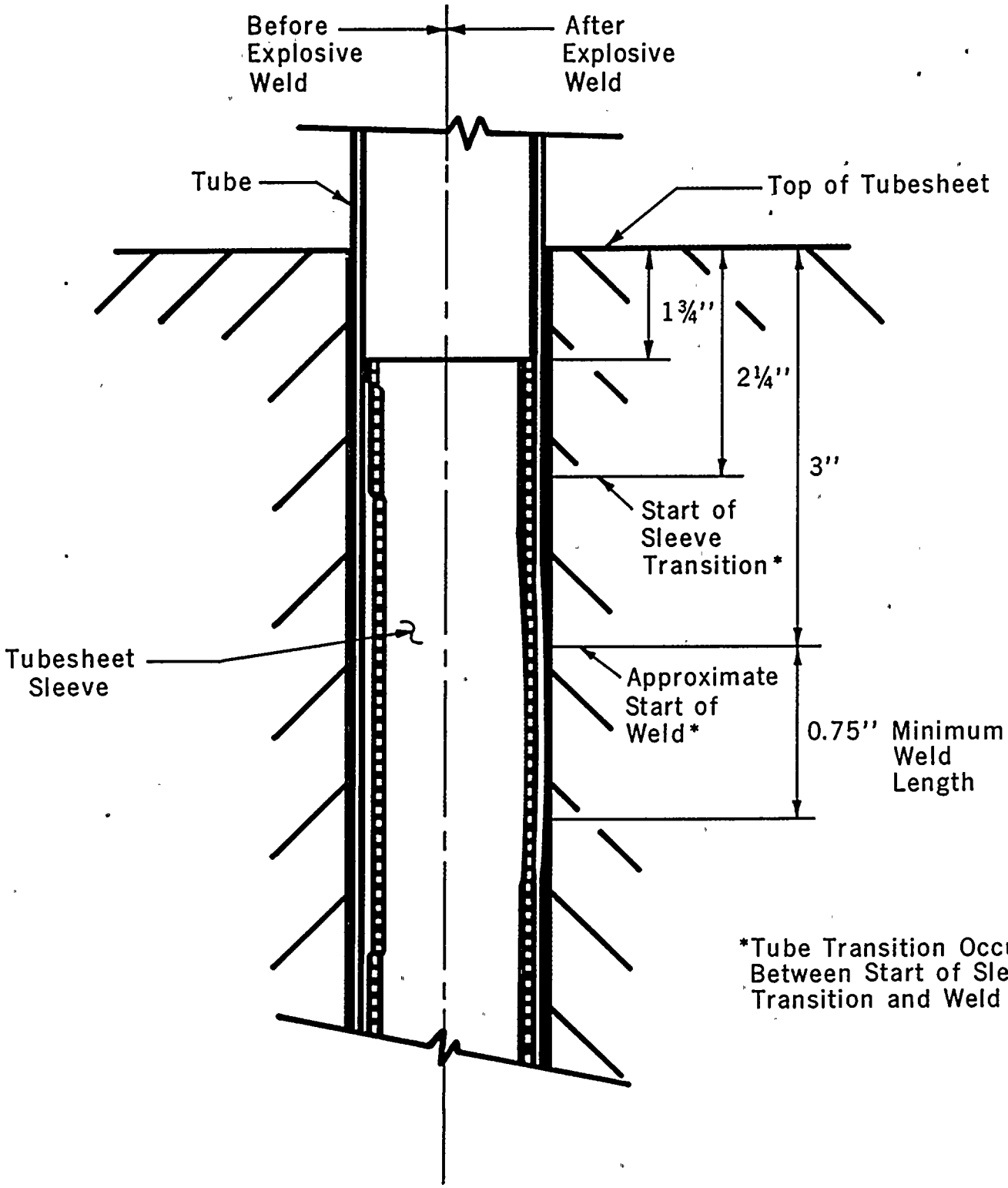
Tube/Sleeve Eddy Current Inspection Capability

Designation (See attachment 1)	Distance From Top of Tubesheet	Flaw Detection Capability	ASME Flaw Sizing Capability
A	0.50	Yes	20%
B	1.00	Yes	20%
C	1.25	Yes	20%
D	1.50	Marginal	None
E	1.75	None	None
F	2.00 - 2.25	Marginal	None
G	2.63	None	None
H	3.38	Yes	40%
I	3.38	Yes	40%
J	—	Yes	20%
K	—	Yes	20%
L	—	Yes	20%

ATTACHMENT 3
PROBABILITY OF DETECTING ASME FLAWS IN TUBE



ATTACHMENT 4
TUBESHEET SLEEVE
UPPER END



ATTACHMENT 5
PRIMARY TO SECONDARY LEAKAGE
FOR FULL TUBE SEVERANCE