

ROTTERDAM DRYDOCK REACTOR VESSEL
CRDM WELD RADIOGRAPHY

November, 1981

Westinghouse Electric Corporation

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- B. A 1/32" groove (.032") machined in the I.D. of the inconel portion of the tube is clearly discernable in the radiograph of that area.
- C. A 1/16" (.063") diameter hole in the stainless steel portion of the tube is clearly discernible through a density area of 4.52 H&D in one film.

This information verifies that the technique (and interpretable film resulting from its use) is sufficiently sensitive to detect any flaw size of concern to the design. This is consistent with results of the RDM film review wherein porosity sizes of approximately 1/64" (.016") diameter were detected in some instances.

3. Welds for which the radiographs were not interpretable on three non-operating plants were radiographed again in the field by Westinghouse. The results of these new radiographs are acceptable and are included in Attachment 1.
4. The radiographic technique utilized by other reactor vessel manufacturers for these welds was reviewed. The techniques utilized by other fabricators are different from that used by RDM and comparable problems were not present.

These actions support the conclusion that no significant defect is present in the welds under consideration. This is based on;

1. The radiographic technique used by the fabricator has been shown by mock-up to provide adequate sensitivity levels, even with some variation from code parameters.

2. No rejectable defects are discernible in reshot film and original film found to be interpretable. This is a total of 721 welds of 723 welds reviewed. The remaining 7 films were deemed not interpretable based on film densities.

Of the seven CRDM housing films which were deemed not to be interpretable, two housings are installed in North Anna Unit 1 and five are installed in North Anna Unit 2. These two units are operating plants and cannot be re-radiographed. Westinghouse has concluded that safe operation of these units can continue without additional testing based on the following.

- 1) The results of the very extensive radiographic review reported herein demonstrate that the manufacturing processes used by RDM provide a sound weld which is free of significant defects.
- 2) Other non-destructive tests performed during fabrication and pre-service inspection revealed no unacceptable indications.
- 3) A fracture mechanics evaluation of this weld indicates that a very large flaw would be necessary to cause failure of the weld. A through-wall circumferential flaw extending over 20 percent of the circumference will remain stable under the worst case loading, as would a three inch through-wall axial flaw, or a 360 degree inside surface crack extending 30 percent through the wall.
- 4) Based on previous evaluations of these materials in other applications, the leak before break mechanism would apply.
- 5) The as-built wall thickness of this weld is in excess of the minimum ASME Code requirement.
- 6) The two component hydrotests, the plant cold hydrotest, and plant operation to date have been acceptable.

In summary, the radiography performed on the CROM adapter welds on reactor vessels fabricated by RDM does not meet all of the requirements of the ASME Code, however adequate assurance exists that the welds are sound and that safe operation of the plants can continue.

STATUS RDM CROM FILM REVIEW (CONTINUED)

North Anna #2

Five films exhibit densities such that proper evaluation cannot be performed, identified as;

EAM-101 (08) EAM-104 (04)
EAM-102 (09) EAM-132 (030)
EAM-103* (06)

Remaining films exhibit no significant indications.

Surry #2

All films exhibit no significant indications.

Ringhals #2

All films exhibit no significant indications.