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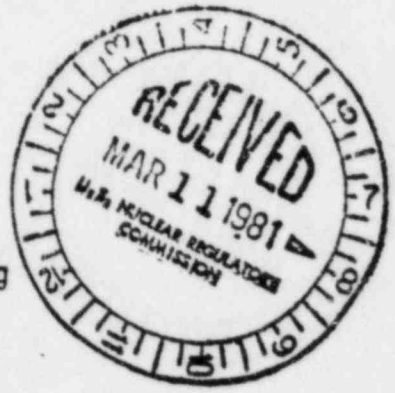

Docket Nos. 50-329 & 500330

MEMORANDUM FOR: F. Miraglia, Acting Chief, Licensing Branch #3, Division of Licensing

FROM: S. Pawlicki, Branch Chief, Materials Engineering Branch, Division of Engineering

SUBJECT: MIDLAND VESSEL HOLDDOWN MODIFICATIONS

References:

1. Note to Bosnak, Pawlicki, Butler and Schauer from F. Miraglia "Review Schedule for Midland Vessel Holddown Modification" dated December 23, 1980.

2. Teledyne Engineering Services Technical Report TR3887-1 Rev. 1 "Investigation of Preservice Failure of Midland RPV Anchor Studs" dated May 15, 1980.

3. Teledyne Engineering Services Technical Report TR3887-2 Rev. 1, "Acceptability for Service of Midland RPV Anchor Studs" dated May 20, 1980.

4. Teledyne Engineering Services Technical Report TR3887-1, Addendum 1 "Investigation of Preservice Failure of Midland RPV Anchor Studs" dated June 6, 1980.

Plant Name: Midland 1 & 2
Supplier: B&W
Docket Numbers: 50-329 and 50-330
Licensing Stage: OL
Responsible Branch & Project Manager: LB#3, D. Hood
Reviewer: C. D. Sellers
Technical Review Branch Involved: Materials Engineering Branch
Description of Task: Review of Midland Vessel Holddown Modifications
Review Status: Complete

Summary

Reference 1 provided a package of materials for a revised design concept for the reactor vessel support modification resulting from the preservice failure of holddown studs in the vessel support skirt of Midland Plant, Unit 1. This design concept included detensioning of the studs to rather low preload and incorporating upper lateral supports to restrict most overturning moments in order to permit the very low stud preload.

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References 2, 3 and 4 described the metallurgical analysis, stress analysis, and fracture mechanics analysis of the failed studs and presented solutions to the problems.

It is the MTEB staff position that the use of the high strength studs in Midland Unit 1 is satisfactory at the reduced preload. Other staff organizations must review and accept the auxiliary upper lateral support structure which permits the use of such low preloads.

The Unit 2 studs were not as grossly under tempered as were those of Unit 1 (although some exceeded the maximum hardness specified) and it was proposed to detension to the originally specified preload and not add the upper lateral supports.

It is the MTEB staff position that a small likelihood of failure of some of the Unit 2 studs exists during the life of the plant and that the addition of the upper lateral supports of this time would preclude a much more difficult modification of the contaminated plant later in its lifetime.

Discussion

Briefly summarized, the Midland I vessel holddown problem is as follows: Three studs (of 96) were found to have failed. These studs hold the reactor vessel skirt to the concrete base. It was found that the studs were of higher strength than anticipated and that they had been preloaded to a higher stress (92Ksi) than had been anticipated (75Ksi). This unfortunate combination of high strength and high load had caused failure in stress corrosion.. It was proposed that the remaining studs be used after detensioning to a very low (8Ksi) preload. The very low preload could be used if auxiliary structure were added around the top of the vessel to limit lateral movement.

The reactor vessel holddown studs of Midland 2 were found to be closer to the specified hardness levels and if the preload were as specified, the studs might perform in service as desired. The lift required to perform the reduction in preload should serve as a proof test of sorts, which would probably fail any of those bolts which might have developed cracks whilst stressed at the 92Ksi. This is particularly applicable to those studs which had achieved a higher hardness during manufacture. The hardness level of some of the Unit 2 bolts is such that failure in stress corrosion would probably not occur in pure water or humid air. However, data are available to indicate possible failure of material of this strength level in salt water. Salt water data might be more applicable for winterpoured concrete. Therefore, failure of a few of the studs in Unit 2 may be anticipated but a further detensioning is not indicated because so few studs were in the high hardness range. (A total of 19 exceeded RC 38 of which four were greater than RC 40 and all of them were only RC 41.) However, if the upper lateral support fix were incorporated into the Midland 2 plant there would be no possible reason for concern about bolt failures.

Conclusions and Recommendations

1. The detensioned Unit 1 studs will be adequate with the incorporation of the upper lateral support fix and will be at sufficiently low state of stress that no further stress corrosion failures are anticipated.

2. Although the detensioned bolts of Unit 2 are less likely to exhibit stress corrosion failures, if failures do occur the fix would probably be the addition of upper lateral supports. Because these can be installed much more conveniently prior to start-up, when there will be no radiation exposure problems, we recommend that the lateral supports be added at this time.

S. Pawlicki, Branch Chief
Materials Engineering Branch
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cc: R. Vollmer
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