

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION  
BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

DOCKETED  
USNRC

In the Matter of  
METROPOLITAN EDISON COMPANY, ET AL.  
(Three Mile Island Nuclear  
Generating Station, Unit 1

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Docket 50-289  
(Steam Tube Repairs)

JOINT INTERVENORS' RESPONSE TO BOTH LICENSEE'S, STAFF'S MOTIONS  
FOR SUMMARY DISPOSITION OF JOINT INTERVENORS' CONTENTIONS,  
AND MOTION TO STAY THE HEARING

1.0 INTRODUCTION

Both the Staff and Licensee have failed to demonstrate that there is no genuine issue of material fact to be heard with respect to the Joint Intervenor's contentions. Both Licensee and the Staff have failed to address the principle thrust of the contentions. They have failed to recognize, even after discovery, that the Joint Intervenor's do not take issue with the clear fact that sulfur contamination was immediately causative of the extensive tube failures observed in the TMI-1 steam generator tubes; or that the kinetic expansion process is acceptable as a method to re-seal the tubes in the tube plates; or that the sulfur removal program is, in itself, acceptable. The Joint Intervenor's simply argue that the steam generator tubes have experienced a substantial operational history which can reasonably be expected to enhance intergranular attack (IGA, hereafter) and susceptibility to cracking under conditions attendant to resumed plant operation. In this context, neither the Staff nor Licensee has so much as attempted to describe metallurgical, morphological and chemical changes which have occurred within the bulk tube material over the life of TMI-1. Neither have they justified an averment that, under

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the influence of the range of temperature, galvanic, chemical and stress conditions likely to be encountered in operation, these changes will not enhance IGA and the susceptibility of the tubes to cracking.

## 2.0 ARGUMENTS

### 2.1 General

We would first note some conclusions from the Ginna study (EPRI NP-2877, Feb. 1982, Pg.4-11):

Inconell Alloy 600 tubing, originally in the "mill annealed" condition, appears to undergo changes in its microstructure when in PWR service for greater than 10,000 hrs...

Impurity elements such as N, S, P or B may be diffusing to the grain boundaries during service and may lead to preferential IGA when exposed to aggressive chemicals...

Hydrogen embrittlement...might occur through the interaction of hydrogen and a segregated impurity element such as sulfur in the alloy grain boundaries...

Furthermore, the tubing is galvanically coupled to the tube sheet which would probably act as a cathodic polarizer.

Neither Licensee nor the Staff considered these effects.

We would further note that Hydrogen was added routinely to Unit 1 during operation and may not be excluded in future operation.

Babcock & Wilcox OTSG Corrosion Test Program - Final Report (May 9, 1983) also states that among "other factors that may have contributed to the extent of intergranular attack" was "metal-lurgical conditioning of the tubing during approximately 5 years of plant operation at 605° F".

The EPRI and B&W conclusions, as well as the industry experience of an increasing rate of tube failures strongly suggest that we are grappling with a generic issue of great significance. Licensee's statement that "... (After) approximately one-hundred CTGS operating

years of experience at TMI-1 and other plants...no corrosion occurs" (Giacobbe Affidavit, pg.22 at 61) does not mitigate this observation. It is akin to concluding that if 1000 persons smoked two packs of cigarettes a day for a year and no lung cancers developed (after 1000 person years of smoking two packs a day), cigarette smoking is demonstrated to not be harmful to ones health. We are dealing with a problem where "length of exposure" is a dominant, real factor.

## 2.2 Contention 1(2)

Contention 1(2) states, in essence, that "active forms of sulfur can be regenerated" during plant operation. Discussions regarding reinitiation of cracking during cleaning are not relevant. Rather, Licensee and the Staff clearly acknowledge the possibility of reinitiation of sulfur induced stress cracking during operation by their reliance on "lead" tests. We contend, as do they, that reinitiation is possible. However, we hold that simple reliance on lead tests is an inadequate control procedure. We also contend that Licensee's effort to define potential mechanisms for reinitiation have been inadequate.

It is suggested that copper may function akin to a synergist (EPRI NP-2877, Pg4-9, 4-3, S-2). Further, one or more of a host of system contaminants, including sulfur, may drive the electrochemical potential of the alloy into a corrosion susceptible region (EPRI NP-2877, Pg.4-6-8).

Licensee states that "The peroxide cleaning process was to remove the sulfides most likely to dissolve from the tube surfaces, so that active, harmful forms of sulfur will not be generated and cause reinitiation of the cracking mechanism." (Giacobbe Affidavit Pg. 113 at 191) This is an absurdity. Only 50-60% of the sulfur

was removed. Reinitiation is to be controlled by lithium addition. But Ph. can range from 4.6 to 8.5, allowing  $S^{-2}$  to be generated.

### 2.3 Contention 1(3)

Contention 1(3) states, in essence, that "morphological changes" anywhere along the tube length "could reasonably be presumed to be precursors of IGSCC." IGA islands were cited as obvious examples. Licensee, after arguing that IGA "cannot be considered a precursor of IGSCC (Pg. 58,59), capitulates in the next paragraph (Pg. 59) with the statement, "Although IGA is not strictly a precursor of IGSCC..." and proceeds to fall back on its ultimate argument, "because Licensee has taken adequate measures to insure that corrosive levels of contaminants will not be present, IGA will not propagate into IGSCC."

The Staff's argument is essentially the same. Both go on to cite the absence of laboratory failures at IGA sites as the foundation for asserting that the IGA islands will not mature to IGSCC. It is noteworthy, however, that the Staff felt compelled to place reliance on the lead tests, which have not yet, presumably, demonstrated progression to a failure mode.

The fact of the matter is that "metallurgical conditioning of the tubing" has occurred which even Babcock & Wilcox believes "may have contributed to the extent of intergranular attack". (B&W Final Report, supra.) To hold that these changes in microstructure will not be of a continuing nature defies reason. The fact that to this day the functional scope of knowledge surrounding this phenomenon can be summarized by the speculation, "may have contributed", firmly establishes the tenuous ground

upon which Licensee and the Staff stand.

#### 2.4 Contention 1(5)

Contention 1(5) addresses the simple fact that substances other than active forms of sulfur, acting singly or in concert with others, might be expected to cause future significant failure scenarios. We simply contend that the enormous gap of knowledge concerning the actual role played by various suspect substances be defined before the aged tubes at TMI-1 be given a clean bill of health.

Clearly, Licensee acknowledged lack of understanding of even the sulfur-induced cracking:

- "It was apparent that we were primarily dealing with an intergranular stress assisted failure mechanism.  
(Giocobbe, Pg. 3(7)). Licensee discusses no secondary mechanisms.
- Whereas Licensee asserts that "stress assisted cracking always produces cracks perpendicular to the tensile stress", the cracking was found to be "almost exclusively circumferential". (Giocobbe, Pg. 7(19)). Can Licensee explain these anomalies?
- "...sulfur, perhaps coupled with chloride, were possible causative agents (Giocobbe, Pg. 9(24)). The Ginna report (EPRI NP-2877) suggests "a link between enhanced chlorine levels on IGA crack surfaces and extensive IGA..." (Pg.4-5).

Beyond this, a reading of the several studies of tube cracking at other plants, provided in discovery by Licensee, demonstrates clearly that enormous gaps in knowledge concerning SCC resistance still exist. Clearly, an adequate understanding of potential failure mechanisms is of increasing importance when tubes which

have both "aged" and suffered severe chemical attack are to remain in service. Following are a few of the questions raised in other studies which we assert cannot be overlooked at TMI-1:

- . "Electrochemical potential plays an important role in the SCC resistance of alloy 600...the change from intergranular to transgranular SCC at cathodic potentials...need to be clarified, especially the role of hydrogen on failure mode." (EPRI NP-2114-SR, Pg. S-2).
- . "Future research to explain SCC failures of alloy 600 should concentrate on grain boundaries...examining the influence of minor elements and microstructural aspects... (and)...the effect of cyclic stresses superimposed on residual stresses...."(Id., Pg.S-4).
- . "Copper...is a possible polarizing agent which could alter corrosive response." (EPRI NP-2877, Pg. 4-3).
- . "Sporadic traces of copper may be associated with severe IGA cracking." (Id., Pg. S-2).
- ;. "The tubing is galvanically coupled to the tubesheet which would probably act as a galvanic polarizer. (Id., Pg. 4-12).
- . "Relatively large grain sizes appeared to contribute to severe IGA...(EPRI NP-3070-LD,Abstract).
- . "We conducted tests with different heats of the alloy, but the most susceptible material tested was a tube removed from one of the (TMI) Unit No. 1 steam generators. If this tube is representative..." (ORNL/TM 8544, Abstract).

### 3.0 Conclusions

#### 3.1 Regarding Summary Disposition

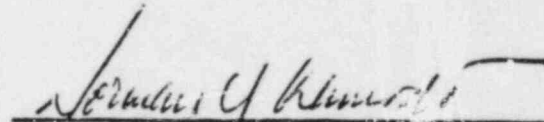
Both Licensee and the Staff have failed, with regard to all the Joint Intervenors' contentions, to demonstrate that there is no genuine issue to be heard.

#### 3.2 Regarding Future Action

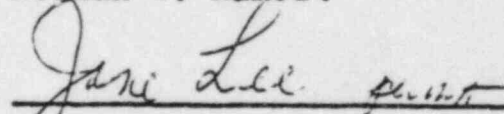
In light of the obvious lack of understanding of many parameters which influence intergranular attack on the steam generator tubes at TMI-1, and the general nature of the issue, we would urge the Staff to coordinate an industry effort to resolve the most pertinent questions raised by industry investigators. This should be a prerequisite to any proceeding judging adequacy of the TMI-1 OTSG's. We, therefore, motion the Board as follows:

To stay the Steam Generator Repairs proceeding until an industry concensus can be developed regarding the likelihood of the recurrence of intergranular cracking of the steam generator tubes at TMI-1.

Respectfully submitted,



Norman O. Hamodt



Jane Lee

March 19, 1984

(Note: All underlining was added to quotations to provide emphasis.)

This is to certify that the document JOINT INTERVENORS' RESPONSE TO BOTH LICENSEE'S, STAFF'S MOTIONS FOR SUMMARY DISPOSITION OF JOINT INTERVENORS' CONTENTIONS AND MOTION TO STAY THE HEARING was served by deposit in U. S. Mail, First Class on March 20, 1984 on the following Service List.

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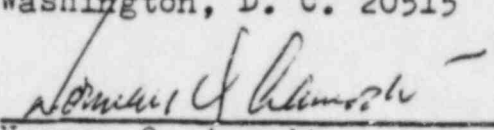
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March 20, 1984