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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Appeal Board

In the Matter of)	
)	
METROPOLITAN EDISON COMPANY)	Docket No. 50-289 OLA
)	
(Three Mile Island Nuclear)	(Steam Generator Repair)
Station, Unit No. 1))	

BRIEF ON APPEAL FROM INITIAL DECISION

IN TMI-1 STEAM GENERATOR REPAIR OLA AND IN SUPPORT OF

MOTION TO REOPEN THE RECORD

ON THE BASIS OF NEW INFORMATION

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For Three Mile Island Alert

Dated: December 10, 1984

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I. INTRODUCTION

On 15 July 1983, an Atomic Safety and Licensing Board was established to, among other things, rule on contentions to be admitted and to preside over a hearing to consider the safety of the TMI-1 steam generators as repaired using the kinetic expansion process.

During the proceeding the Board denied TMIA an effective opportunity to prepare and present its case. The Board artificially and improperly narrowed the scope of the hearing, thereby denying a full hearing on important safety issues. The new information which has come to light since the close of the hearing demonstrates the importance of the issues and the necessity for a full hearing.

A. BACKGROUND

1. Description of the Steam Generators.

In November 1981, primary to secondary leaks were discovered in both TMI-a once through steam generators (OTSG). Upon investigation it was discovered that a majority of the tubes in both steam generators had suffered circumferential cracking.

TMI-1 has two vertical straight tube and shell once through steam generators. Each OTSG contains 15,531 Inconel-600 tubes, 56 feet 2-3/8 inches in length, rolled and seal-welded into 24 inch thick carbon steel tube sheets at the top and bottom of OTSGs.

The plant was shut down in February 1979, for refueling and has remained in a cold shut down condition since the TMI-2 accident at the direction of the NRC, pending the outcome of restart hearings. During August and September 1981, hot functional tests were performed at TMI-1. There was no indication of leakage from the OTSGs at that time and it was not until November 1981 during pressurization for additional tests that the

primary to secondary leaks were detected in the steam generators. This leakage was caused by intergranular stress assisted cracking of the steam generator tubes. Eddy current testing (ECT) revealed that 95% of the damage occurred within the top seven inches of the upper tub sheet (UTS).

2. Description of the Repair Process.

The existing technical specifications for TMI-1 allowed only for plugging as a method of steam generator tube repair, but because of the extent of the damage, plugging was not a viable method of repair. The Licensee did not consider replacing the damaged steam generators but, instead, attempted to repair them by kinetically expanding the tubes within the tube sheet to provide a new seal below where the defects were detected. This was done by detonating an explosive cord encased in a polyethelene insert which had been placed in the tube. The resulting explosive energy was transmitted to the tube wall by the polyethelene insert, pressing the tube against the tube sheet. The tubes were expanded from the top of the UTS down either 17 or 22 inches depending on the elevation of the lowest ECT indication within the UTS. This was to provide a 6 inch or greater ECT indication-free expanded length between the lowest elevation ECT indication and the bottom of the expansion to serve as the new pressure boundary.

About 5% of the damage to the steam generator tubes occurred in the lower elevation of the UTS or in the free span of the tubes. These tubes were not amenable to the kinetic expansion repair method and were subsequently plugged. All of the tubes in both steam generators which had not been previously plugged, were kinetically expanded regardless of whether or not they were later to be plugged.

3. Procedural History.

On 9 May 1983, Licensee submitted to the NRC an application for an amendment to its operating license, requesting that it be allowed to revise the

technical specifications to recognize steam generator repair techniques other than plugging and that the Commission approve the proposed kinetic expansion repair method used at the facility.

On 31 May 1983, the NRC published a notice in the Federal Register captioned "Issuance of Amendment to Facility Operating License and Proposed No Significant Hazards Consideration Determination and Opportunity for Hearing."

On 21 September 1983, TMIA filed "Supplement To Petition For Leave To Intervene." During a special prehearing conference held on 17 October 1983, the Board heard oral argument on the admissibility of the proposed contentions and by its Order of 29 November 1983, admitted:

1. Neither Licensee nor the NRC Staff have demonstrated that the kinetic expansion steam generator tube repair technique, combined with selective tube plugging, provides reasonable assurance that the operation of TMI-1 with the as-repaired steam generator can be conducted without endangering the health and safety of the public for the following reasons:

1.a. Post repair and plant performance testing and analysis including the techniques used, empirical information collected, and data evaluation, and proposed license conditions are inadequate to provide sufficient assurance that tube ruptures, including but not limited to those which could result upon restart, a turbine trip at maximum power, thermal shock from inadvertent actuation of emergency feedwater at high power or following rapid cooldown after a LOCA, will be detected in time and prevented to avoid endangering the health and safety of the public through release of radiation into the environment beyond permissible limits.

1.b. Because of the enormous number of tubes in both steam generators which have undergone this repair process, (1) the possibility of a simultaneous rupture in each steam generator, which would force the operator to accomplish cooldown and depressurization using at least one faulted steam generator, resulting in release of radiation into the environment beyond permissible levels, "isn't an incredible event," (see, September 19, 1982 memorandum from Paul Shewmon, then Chairman of the ACRS), (2) and could lead to a sequence of events not encompassed by emergency procedures, (3) and in the course of a LOCA, such a scenario could create essentially uncoolable conditions.

1.c. The type of plug used, the number of tubes requiring plugging, and choice of tubes to be plugged, including failure by

Licensee to plug 66 degraded tubes, supported a conclusion that plan operation with the as-repaired steam generator can not be conducted without endangering the health and safety of the public, considering among other things interference which plugged tubes will have in the plant's ability to respond to transients and accidents.¹

1.d. Neither the "Report of Third Party Review of Three Mile Island, Unit 1, Steam Generator Repair" nor the Staff's Safety Evaluation Report (NUREG-1019) are credible documents in their evaluation of the kinetic expansion repair technique, including leak tightness and load carrying capabilities, and thus can not be used as a basis for conclusion that the repairs insure safe plant operation, because of the reports' inherent inconsistencies, their failure to provide data or calculations to support their evaluations, assumptions, and conclusions, and the fact that those individuals participating in the Licensee and NRC reviews lack proper qualification to render an expert opinion on this issue, as evidenced for example by the fact that their basis assumptions and conclusions rest improperly on linear fracture mechanics theory as opposed to non-linear theory, axial symmetric stress analysis which would not be applicable to all cracks, failure to analyze crack resistance on the basis of toughness as opposed to hardness which has no relation to crack resistance, and failure to differentiate in their analysis between the effects of thermal stress on small versus large cracks.

2. Neither Licensee nor the NRC staff has demonstrated that the corrosion which damaged the steam generator and other RCS components and systems, will not reinitiate during plant operation and rapidly progress, attacking either the steam generator or elsewhere in the primary pressure boundary, thus providing no reasonable assurance that the operation of TMI-1 with the as-repaired steam generator can be conducted without endangering the health and safety of the public, for the following reasons:

2.a. There is no assurance that the causative agent or the source of initiation or the conditions under which initiation originally occurred, have been properly identified, thus undermining any conclusion that the causative agent has been removed from the system, and undermining the reliability of any proposed clean-up process, procedures meant to eliminate the corrosive environment, or the reliability of the Licensee and staff stress analysis as to when corrosion could reoccur.

2.b.1. The Staff's own consultant on this issue, R. L. Dillon, believes that the risk associated with cleaning, i.e., that a relatively large inventory of sulfur compounds will be put into solution, are greater than simply "living with a large S inventory in the system." supporting a conclusion that the only two possibilities being considered by the Licensee and Staff pose substantial risk that corrosion will reinitiate.

¹ During the special prehearing conference, TMIA explained that it was concerned that the kinetic expansion process had reduced the tubes capability to retain plugs such that the plugs would give a good seal.

2.b.2. Even if the proposed cleaning process presented no risks, there is no assurance that the proposed process can remove more than 50-80% of the contamination, thus there can be no assurance that the contamination which would be left after the process is complete will not cause reinitiation.

2.c. Neither the "Report of Third Party Review of Three Mile Island, Unit 1, Steam Generator Repair" nor the Staff's Safety Evaluation Report (NUREG-1019) are credible documents in their evaluation of the causative agent, clean up, or procedures to prevent contaminant reintroduction, and thus can not be used as a basis for conclusion that the repairs insure safe plant operation, because of the reports' inherent inconsistencies, because the basic assumptions and conclusions therein rest improperly on axial symmetric stress analysis which would not be applicable to all cracks, because of the failure to analyze crack resistance on the basis of toughness as opposed to hardness which has no relation to crack resistance, and because the failure to differentiate in their analysis between the effects of thermal stress on small versus large cracks.

Discovery was initiated immediately and 31 January was set as the date for completion of discovery.

On 30 December 1983, TMIA served on Licensee its "First Set of Interrogatives and Request for Production of Documents." In its response Licensee stated that because TMIA's document request involved the production of a large number of documents, Licensee would establish a document room located in the vicinity of the TMI Visitors Center and would provide copies of documents at a cost of 10 cents a page. Licensee further stated that documents containing information which Licensee considered proprietary would be made available pursuant to applicable proprietary agreement and protective order. On 25 January 1984, TMIA filed "TMIA's Request for Production of Documents and Order to Compel Discovery." Licensee opposed TMIA's motion and requested the Board grant a Protective Order. In its 2 March 1984 Ruling the Board granted Licensee's motion for Protective Order. On 1 May 1984, the Board denied TMIA's Request for Reconsideration of Protective Order.

On 25 January 1984, TMIA filed "TMIA Motion for Appointment of Special Panel." The Board denied the motion in its 24 February 1984 Order.

Motions for summary disposition of contentions were filed by Licensee and staff on 24 February 1984. TMIA filed its response in opposition to those motions on 3 April 1984. On 1 June 1984 the Board issued its Rulings on Motions for Summary Disposition which eliminated the majority of TMIA's contentions. The following are the issues which survived summary disposition and which subsequently became issues at the hearing:

Issue 1.a. Reliability of Leak Rate Measurements.

1.b. Frequency of Eddy Current Tests.

1.c. Power Ascension Limitations.

1.d. Long-Term Corrosion Tests.

Issue 2. Inadvertent Initiation of Emergency Feed Water.

Issue 3. Hardness Tests on Repaired Tubes.

Issue 4. Industry Experience with Kinetic Expansion.

Contention 1.b. The Increased Probability of Simultaneous Tube Rupture in Both Steam Generators Resulting from the Kinetic Expansion Repair.

The hearing opened on 16 July 1984 and closed 18 July 1984. On 31 October 1984, the Board issued its Initial Decision concluding that an amendment to the operating license which revises the technical specifications to recognize the kinetic expansion repair method should be issued.

II. IMPROPER BOARD RULINGS DURING DISCOVERY: The Board improperly imposed a Protective Order which effectively precluded TMIA from gaining proper discovery; furthermore, the Board failed to grant TMIA requested relief which would have enabled TMIA to prepare an effective case.

A. The Rulings of the Board during the discovery phase of the proceeding precluded a full and fair consideration of safety significant issues.

1. The Protective Order.

In its 25 January 1984 Motion for Order to Compel Discovery, TMIA predicted that without full access to relevant documents it would be unable to litigate the major issues in the case. TMIA pointed out to the Board that Licensee's proposed "Proprietary Agreement" would intimidate TMIA members and would hinder TMIA's ability to do adequate research. Furthermore, Licensee had provided no justification for limiting discovery by means of a Protective Order.

TMIA's prior experience with a protective order during the "Reopened Hearing on Cheating" was an additional factor in TMIA's decision not to become party to a Proprietary Agreement.

On 2 March 1984 the Board denied TMIA's Motion to Compel and granted a Protective Order. On 3 April 1984, TMIA requested that the Board reconsider its Protective Order, stating that the documents to which TMIA sought access were relevant to issues in contention, that Licensee had not denied this fact and that Licensee had not shown cause why the documents should be protected. In addition, TMIA requested the Board to review the documents for which proprietary privilege was claimed to determine the validity of that claim. The Board denied TMIA's request for reconsideration and did not review the documents which Licensee claimed were proprietary.

2. Request for an Expert Panel.

TMIA on 25 January 1984 filed a Motion for Appointment of Special Panel, explaining that because of the expedited pace of the discovery schedule, the location of the documents, TMIA's lack of expertise in the technical issues being considered, the prohibitive cost of document

reproduction and because the Protective Order effectively limited discovery, without such assistance, TMIA would be forced to enter the hearings with a fatally flawed case. TMIA proposed that each of the four parties appoint an expert representative, who would be signatories to the "proprietary agreement." TMIA further proposed that each expert representative would examine the documents and submit a report to the Board. The parties would then have an opportunity to comment on the recommendation of their appointed expert and based on the reports and comments, the Board would make a decision. The Board denied TMIA's motion on 24 February 1984.

III. Summary Disposition: The Board erred in granting Licensee and Staff's motions for summary disposition on contentions relative to the safety of the repaired tubes.

1. TMIA Contention 1.c.

Contention 1.c expressed a concern that the kinetic expansion process had weakened the steam generator tubes and that they would not be capable of retaining plugs.

In support of its contention, TMIA cited the concerns of Licensee's Third Party Review Group, expressed in the Third Party Report (TPR), that the tubes had been weakened. TMIA further pointed to 23 plugs which leaked after testing, as additional evidence that tubes which had been kinetically expanded and then plugged, had a higher risk of plug failure. The Board's dismissal of this fact as "a quibbling make-weight argument presented in an effort to secure a hearing upon an obviously insubstantial issue," was arbitrary and capricious.

In light of new information that 280 plugs out of 1,006 plugged tubes in the "A" steam generator, which were recently tested, have failed and that many of these plugs have come out of the tubes, clearly

demonstrates that contention 1.c was a substantial safety issue. See TMIA Motion to Reopen the Record on the Basis of New Information, Att. 3.

TMIA Contentions 2.a, 2.b.1 and 2.b.2.

- a. The corrosive contaminant and the failure mechanism had not been adequately identified.
- b. The cleaning process utilized by Licensee itself posed a risk of initiating additional corrosion.
- c. There existed a potential for the 20-50% sulfur remaining trapped in the oxide film after cleaning to reinitiate corrosion.

Licensee stated that sulfur possibly coupled with chloride was the suspected corrodant. See Licensee's Motion for Summary Disposition, (Giacobbe at 9 and 26). (Emphasis added.) They argued that the necessary precautions had been taken to eliminate contaminants from the RCS. Licensee pointed out that the sodium thiosulfate tank (thought to be the primary source of the contaminant) had been physically removed and that stringent administrative controls on chemical additions to the RCS had been put in place.

Despite these precautions sulfur and chloride levels unaccountably began to increase in both the primary and secondary sides of the steam generators in October of 1983. See Att. 1. Licensee was unable to determine the cause of the increased levels of sulfur and chloride and they continued at least until 17 January 1984. Atts. 1,2,4,5.

In its Motion for Summary Disposition, Licensee stated that "two independent laboratories, Battelle Columbus and Babcock & Wilcox" had examined the evidence" and "provided a description of the failure scenario which they believed was responsible for the damage observed, based on the facts uncovered." See Licensee's Motion for Summary Disposition, Giacobbe

¶9. (Emphasis added.) However, Staff consultant Digby McDonald stated his belief that a volatile polysulfur must be present in the system. See SER, McDonald at 20-21. The Staff argued that since McDonald's comments were raised in the context of a "cleaning" recommendation, they were irrelevant in the context of contention 2.a. Clearly McDonald's concern that other sulfur species might be responsible for the corrosion was relevant to contention 2.a, and in light of the concerns expressed by the Staff's consultant, the Board improperly failed to consider these facts in its decision.

Contention 2.b.1

Contention 2.b.1 alleged that concerns raised by Staff consultant Dillon regarding the risk of further corrosion from the cleaning process had not been resolved.

Dillon was concerned that the cleaning process itself might put a large inventory of sulfur into solution. Licensee claimed that the cleaning process posed no danger. In his statement supporting Licensee's Motion for Summary Disposition, Giacobbe stated "Amonium hydroxide was selected as the reagent for use in raising the pH to avoid the possibility of hideout and future corrosion that a solid alkali might introduce." Giacobbe ¶82. Apparently, the amonium hydroxide was intended in part to dislodge sulfur from the oxide layer, and put that sulfur into solution so it would eventually be removed from the system. This was precisely the issue which was the basis for Dillon's concern, and in fact when sulfur levels in the stream generator were increasing in October 1983, Licensee thought that the increase was caused by the amonium hydroxide. See Att. 1. Licensee claimed that Dillon's concerns were mooted by successful hot functional testing and subsequent low leakage, proving that the cleaning process had been successful. However, the 27 November 1984 letter from R. F. Wilson to

counsel for Licensee indicates that cracking has reinitiated and Dillon's theory concerning the cleaning process cannot be ruled out as the cause.

Contention 2.b.2.

TMIA alleged that a potential existed for reinitiation of corrosion from the 20-50% sulfur remaining trapped in the oxide layer after cleaning.

Licensee relied on its assertion that the corrodant had been identified in order to reassure the Board that the sulfur specie present in the steam generators was innocuous, and that the control procedures Licensee had put in place would minimize the conversion of the sulfur to an aggressive form. Licensee further asserted that the "long-term corrosion test" provided additional assurance that reinitiation would not occur.

Although Licensee did not make the Board aware of the problems with increasing levels of sulfur and chlorides, and of Licensee's concern over those levels, (see Atts. 1,2,4,5, TMIA raised genuine material facts, and the Board's dismissal of TMIA's contentions was in error.

IV. IMPROPER RULINGS DURING THE HEARING: During the hearing the Board refused TMIA's request that it be allowed to question witnesses regarding safety significant information which came to the attention of the parties during the hearing.

In June and July 1984, Licensee submitted 3 PNO's which described problems of loose and missing plugs in the TMI-1 steam generators. On the first day of the hearing, TMIA requested that it be allowed to question Licensee witnesses about the loose and missing plugs. TMIA pointed out to the Board that contention 1.c had in fact addressed the plug retention capability of the kinetically expanded tubes. Tr. 204-208 (Bradford).

The Board stated that the issue had been dealt with on summary disposition and that during licensing and amendment hearings there was

always information that became available which could be construed as relevant to issues being litigated. The Board also stated that if they were to allow all of this material in, hearings would last indefinitely, and noted that the Board had a responsibility to guard against broadening the scope of the hearing. The Board denied TMIA's request and suggested that TMIA's representative could question Licensee and Staff during the recess. Tr. 208-209 (Wolfe).

Clearly, the question of whether the plugs will be retained within the tubes is an important one, made more important by the fact that 280 plugs in steam generator "A" have since failed. See Att. 3. The Board's decision not to allow TMIA an opportunity to explore the new information was improper. Furthermore, having Licensee and Staff respond to questions off the record is not an acceptable substitute for the creation of a record.

The Board Improperly Expunged Material from the Record: The Board expunged material from the record without determining that such action was justified.

TMIA gathered the information which formed the basis for a line of questioning from documents made available to TMIA by Licensee, designed to demonstrate that tubes underwent multiple detonations and that the hardening effect was cumulative. These documents were characterized by Licensee as being non-proprietary. This information was provided to TMIA in December 1983, 6 months prior to the hearing. Although Licensee had on two occasions retrieved documents which it had supplied to TMIA, in order to excise materials it claimed as proprietary, Licensee made no attempt to remove the so-called proprietary information, nor even to caution TMIA concerning use of that information.

It was not until the second day of hearing, while TMIA was laying the ground work for a line of questioning intended to show that multiple detonations in the tubes would cause an increased amount of hardness in the tubes, that Licensee belatedly decided that this information was proprietary. Tr. 447. (Churchill)

In an off-the-record bench conference Licensee requested an in-camera session in order to receive the information. TMIA maintained its position, stating that it had a right to full public hearings, that it had continually objected to Licensee's claim of proprietary privilege and would not agree to an in-camera session. TMIA further pointed out that given its lack of expertise in the issues being litigated, it was clear that the information which was the basis for the line of questions, was garnered from the documents provided to TMIA by Licensee.

TMIA had established with an earlier witness the fact that each detonation had a hardening effect on the tubes, and that this effect was cumulative. The responses which TMIA expected to elicit with the line of questioning, of which the expunged material was a part, would have demonstrated that the kinetic expansion process causes greater hardening of the tubes than the mechanical rolling process.

IV. THE BOARD'S INITIAL DECISION: The Board issued its Initial Decision on 31 October 1984.

The decision was favorable to the Licensee. Since the close of the record several items of new information have come to light which have significant safety relevance, and would have resulted in a different outcome.

Summary Conclusion.

The Board's ruling during the discovery phase of the hearing and on Summary Disposition Motions effectively eliminated all of the contentions which would have examined the actual safety of the repaired tubes. Those issues which survived and were litigated, are for the most part only important when the repaired tubes fail.

For example, issues 1.a, 1.b and 1.c are not issues designed to get at the facts concerning reliability of the repaired tubes, but instead anticipate failure. Resolution of these issues could not possibly test the adequacy of the kinetic expansion repair process since all of these issues went to the adequacy of systems which would signal or monitor ruptured or leaking tubes.

Issue 1.d is likewise inadequate. Having failed to identify conclusively the corrosive specie which caused the damage and the exact sequence of the contamination, the long-term corrosion test cannot possibly be an accurate predictor of future corrosion.

On Issue 4 we heard evidence from Licensee's witness, Dr. Pai, that there had been virtually no industry experience with the kinetic expansion process used as a repair method for steam generators in a nuclear power plant in the United States. See Tr. 399-406 (Pai).

In order to predict the probability of simultaneous tube rupture in both TMI-1 steam generators, it is necessary to first determine the reliability of the repair method itself. As stated earlier, TMIA was effectively precluded from making such a determination as a result of the improper rulings of the Board during discovery and summary disposition.

The Board's Initial Decision should be overturned.

Respectfully submitted,

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