UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)	
)	
METROPOLITAN EDISON COMPANY, ET AL.)	Docket No. 50-289
)	(Restart Remand on
(Three Mile Island Nuclear Station,)	Management)
Unit No. 1)	

AFFIDAVIT OF CONRAD E. McCRACKEN
AND STANLEY KIRSLIS IN
SUPPORT OF SUMMARY DISPOSITION OF JOINT
INTERVENORS' CONTENTION 2

We, CONRAD E. McCRACKEN and STANLEY KIRSLIS, being duly sworn, do depose and state:

1. We are employed by the Nuclear Regulatory Commission in the Division of Engineering, Office of Nuclear Reactor Regulation. Our professional qualifications are set forth in our affidavits submitted in support of the Staff's motion for summary disposition of TMIA Contentions 1.a. and 2.a., and are incorporated herewith. We certify that we have personal knowledge of the matters set forth herein, and that the statements made are true and correct to the best of our knowledge.

2. Joint Intervenors' Contention 2 states as follows:

> There is no assurance that the steam generator tube repair program can assure the integrity of the tubes and their joints under the environmental conditions attendant to operation. TMI-1 shall not be permitted to restart before such assurance is provided. The following elements of the repair program are deficient:
>
> Active forms of sulfur can be generated from presumably benign sulfur remaining on the tubes after cleaning.

3. As basis for this contention, Joint Intervenors cite to two statements, the first by a staff consultant and the second by the third party review:

- Attachment 3 to SER, pg. 6, 3rd para., "If it has not been shown that SCC does occur in low temperature solutions, neither has it been shown that it does not."

- Third Party Review, May 16, 1983, pg. 5, last sentence, 2nd para., "...There was (and is) no quantitative measure of the potential for reactivation."

4. Both of these bases statements are taken from sections of the respective reports which are considering the potential for reactivation during the cleaning (desulfurization) process. As such, they cannot provide basis for Joint Intervenors' Contention 2, which pertains to sulfur remaining on the tubes after cleaning.

5. Both Attachment 3 and the TPR of May 16, 1983 conclude that the sulfur residual remaining on system surfaces is inactive or superficial and that continued operation is acceptable without performing a cleaning process. Therefore, while the Staff agrees that "active forms of sulfur can be generated from presumably benign sulfur remaining on the tubes after cleaning," both NUREG-1019 and the TPR explain that it is unnecessary to completely remove the sulfur because the low levels of sulfur in solution remaining after the cleaning do not have a significant corrosive effect, and that any sulfur remaining on tube surfaces after cleaning will be released so slowly that there will be more than ample time to prevent buildup of corrosive sulfur concentrations.

6. Attachment No. 3 to NUREG-1019 is a document by Staff consultant R. L. Dillon. It states, on page 6, at paragraph 3: "Convincing argument that any special measures need to be taken to remove superficial sulfur is more difficult". (Emphasis Added). On page 14, paragraph 2, it is explained: "I believe TMI-1 restart is appropriate. This view is confined to consideration of corrosion related factors. The likelihood of reactivation of IGSCC based on some manipulation of the sulfur inventory now fixed in or on corrosion product surfaces is small. Release of sulfur to solution from the corrosion product is slow, amounting to days or weeks even for the cleaning process. The metastable species that appear capable of initiating or sustaining cracking reactions are rapidly oxidized to relatively inert species, with the result that they can only be present in the most minute quantities (ppb's or less as a guess) -- a very different situation from the transient condition where 3-5 ppm of dissolved sulfide was suddenly oxidized during the crack initiating event.

The repetition of the sulfur contamination incident is precluded physically and administratively."

7. In Attachment No. 6 to NUREG-1019 is the Third Party Review, dated May 16, 1983 at page 5, it is stated:

> "The Review Group previously considered both the necessity or benefits of sulfur removal and the capability of the proposed peroxide flushing process for accomplishing sulfur removal. At that time we concluded that sulfur removal was not essential for return of the plant to power. All available information indicated that the corrosion had stopped and that sulfur residues following completion of the repair would be comparable to other plants. The primary benefit of sulfur removal was intangible; the potential for reactivation of the corrosion from these surface residues would be reduced in proportion to the degree of effectiveness of removal. However, there was (and is) no quantitative measure of the potential for reactivation. (Emphasis Added).

8. At page 6, Attachment 6 continues:

> The Review Group continues to believe, however, that sulfur removal is not essential for safe operation of the plant, and that the costs and residual risks in uncertainty over peroxide flushing outweigh any benefit. We believe that the corrosion process is presently passive and will remain passive with good chemistry control even though sulfur residues will be available. We note that tests show 20-50% of the sulfur will not be removed by the process, so that sulfur residues will still be available after the flush. This process will be costly in time, chemical, ion exchange resins, radioactive waste generation and man-Rems. In any complicated process, upsets can occur which could result in exposure of system materials to conditions not enveloped by testing. Finally, there is much about the reactions between peroxides and system materials which is not understood, so that (in spite of testing) there remains a risk that the process could be detrimental. (Emphasis Added).
>
> We therefore believe that peroxide flushing to remove sulfur is not essential to plant safety nor is peroxide flushing expected to have an adverse effect on plant safety. (Emphasis Added).

9. Therefore, contrary to Joint Intervenors' claim that technical basis for their Contention 2 is provided by their referenced statements, the opposite is true when the statements are put in proper context. The conclusion of both reports is that the likelihood of converting surface sulfur to a corrosive soluble form during reactor operation is so low that the peroxide cleaning procedure is of questionable benefit.

10. The information contained in sections III and IV of Topical Report 008, Rev. 3 and Sections 3.5, 3.6 and 3.7 of NUREG-1019 and NUREG-1019, Supplement No. 1 demonstrates that Joint Intervenors Contention 2 is without technical basis. As explained therein, the vast majority of sulfur contamination was removed by flushing and purifying of the reator coolant and associated systems during 1982. Subsequent to cleanup of sulfur from the bulk fluids, it was determined that a sulfur residual existed within the oxide surfaces of the reactor coolant system.

No evidence existed that the sulfur residual in the oxide surfaces was causing re-initiation of corrosion. However, a concern existed that the residual sulfur, present in the oxide film might, under some undefined conditions, reinitiate corrosion.

11. On this basis, the Licensee initated an extensive corrosion test program which incor ated actual tubing specimens from TMI-1 OTSG's. Tests were conducted, and are in progress, using as-removed tubing samples before and after cleaning by the peroxide process. Chemistry conditions duplicate those listed on Page 31 in NUREG-1019. Chemistry conditions are maintained at the maximum limits to simulate worst case conditions, including 0.1 ppm sulfate. None of these tests have shown reinitiation of corrosion, with up to 300 days exposure as of December 1983. NUREG-1019, Supplement 1, p. 17, docketed Licensee letter dated January 31, 1984.

12. Despite the positive test results, which show no reinitiation of corrosion from oxide-trapped sulfur compounds, the decision was made to clean the reactor coolant system. The decision, in part, reflected Mr. Dillon's concerns because if the potential, even though remote, existed for re-initation of corrosion, then it was better from a public health and safety point of view to have it initiated during a cleaning process with the reactor shutdown. Additionally, Staff consultant Dr. McDonald at page 25 of Attachment No. 4 to NUREG-1019 concluded that cleaning was necessary. Therefore, in consideration of public health and safety cleaning was the conservative approach. Although the cleaning process only removed 50 to 80% of the oxide-trapped sulfur, it was conservative measure and, in conjunction with all of the other steps

taken, provides additional assurance that corrosion will not reinitiate. A synopsis of these steps is provided in Section 3.7 of NUREG-1019, Supplement No. 1.

13. The fact that the sulfate concentration in the peroxide cleaning solution reached a plateau at 0.4 ppm and stopped increasing indicates that the remaining surface sulfur was trapped in the oxide film and would be very slowly released to the coolant under reactor operating conditions. This was borne out by the very low sulfate concentrations observed during the hot functional tests. This is additional evidence that the remaining surface sulfur will not be converted to a corrosive soluble species.

14. As stated in Sections 3.5 and 3.7 of NUREG-1019 and Supplement 1, during and subsequent to the cleaning process no evidence of corrosion reinitiation has been detected in the plant. This is verified by the steam generator hot functional tests during which full temperature and pressure conditions were maintained for approximately a month with no evidence of corrosion reinitiation. Therefore, a technical basis has not been provided by Joint Intervenors in support of Contention 2.

Conrad E. McCracken

Conrad E. McCracken

Stanley Kirslis

Stanley Kirslis

Subscribed and sworn to before
me this 24th day of February, 1984.

Ruth S. Becker

Notary Public

My commission expires: 7/1/86