STATE OF ILLINOIS)
) SS.
COUNTY OF C O O K)

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

IN THE MATTER OF	)	
	)	
COMMONWEALTH EDISON COMPANY	)	Docket Nos. 50-295
	)	50-304
(Zion Station Units 1 and 2)	)	
	)	
Proposed Amendments to Increase Spent Fuel Storage Capacity (43 F.R. 30938)	)	

AFFIDAVIT OF ROGER STAEHLE

I, ROGER STAEHLE, of lawful age, being first duly sworn, upon my oath certify that the statements contained in the attached pages and accompanying exhibits are true and correct to the best of my knowledge and belief.

Roger Staehle

SUBSCRIBED AND SWORN TO
before me this 22nd day
of January, 1980.

Notary Public

My commission expires 10/2-, 19 8-.

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In the Board's most recent order, it raised a question relating to whether or not the water in the pool would be a "stagnant, oxygenated, borated water system," as defined by the NRC staff on page 3 of I. E. Bulletin #79-17, Revision 1, dated 29th October 1979. It also raised the question of whether the water inside the proposed vented fuel storage tubes would be "stagnant, oxygenated, borated water system", and, if so, what would be the effect on the fuel storage tubes and racks.

The water in the Zion fuel pool is circulated at a rate of approximately one complete volume every five hours. Further the heat from the stored spent fuel creates convective flow. Thus, there is enough circulation in the overall system to assure mixing and chemical homogeneity. Thus the pool, in general, would not have the same stagnant conditions present in the Three Mile Island piping where cracking was sustained.

Despite this general pattern of recirculation, it should be noted that there could be stagnant areas in the fuel racks. First, the region between the boral and the stainless steel sheaths of the fuel storage tubes will be stagnant. Further, there could also be localized stagnant conditions in any crevices which might exist between adjoining parts of the racks. I understand that Mr. Tramm is investigating this possibility with the architect-engineers at NSC.

While the concept of a stagnant area has been associated with the Three Mile Island cracking, the means by which the stagnant conditions contributed to cracking is not clear. A stagnant region can exert its effect most probably by one of three routes. Either the oxygen concentration has been changed in such a way as to accelerate cracking, or the pH has been changed to accelerate cracking, or contaminants are present, such as fluoride or chloride. There is not enough information about the Three Mile Island experience to conclusively establish which of these three explanations is most reasonable.

Nevertheless, enough is known about intergranular stress corrosion cracking of stainless steel to come to conclusions about the Zion racks. In order for stress corrosion cracking to occur, three conditions must be present: an aggressive environment, a condition of sensitization susceptible to stress corrosion cracking, and high stresses. If we accept the idea that the stagnant condition, for whatever reason, can be an aggressive environment, this does not mean that cracking will occur. It is only necessary for one of the three factors in cracking to be non-operative or "zero" to prevent cracking. Thus, if any of the environmental, metallurgical, or stress factors is not present, then cracking will not occur.

It was shown clearly in the tests of Clarke that the potential for IGSCC to occur via the route of sensitization

does not exist. His test was particularly useful because he conducted precisely this same test using the Three Mile Island material and compared directly the material which had cracked with that which had not cracked. The Zion material which was tested fell well within the range of results from the EPR test on TMI material which indicated the absence of cracking. Further, and in support of the EPR test, the carbon concentrations of the materials used in the Zion racks are low and would not be so easy to sensitize as a higher carbon material. It is noteworthy in the Three Mile Island case that the regions which did not exhibit cracking contained carbon concentrations similar to the Zion racks, whereas the regions which cracked in the TMI material contained carbon concentrations substantially higher.

So long as the sensitization is not significant and can be taken as a zero, then any stresses present will play no role except if they become high enough to cause overload failure in the absence of any corrosion. As I stated in my previous affidavit the stresses normally experienced by the racks are expected to be low anyway.

To conclude the point raised by the issue of "stagnant" environment, it appears that the absence of significant susceptibility of the material itself, i.e., a low EPR test rating and its vindication by comparison with the Three Mile Island case, is adequate to assure the absence of cracking.

An additional item mentioned in the affidavit of Weeks stated that the stainless steel containing the aluminum-clad boral plates would be less susceptible to attack because of the galvanic protection afforded by the aluminum. This is a reasonable argument here. Because the solution is conducting, the effect of the aluminum in this case is to lower the electrochemical potential of the stainless steel. Further protection is provided by the fact that some of the oxygen present in the water inside the tube walls would combine with the aluminum to make aluminum oxide or aluminum hydroxide, and thus would be lost to the environment, thereby lowering the oxidizing conditions which would have the same effect as lowering the electrochemical potential. Thus, a lowered oxygen concentration and galvanic protection both have the beneficial effect of preventing cracking.