UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of COMMONWEALTH EDISON CO. (Zion Station, Units 1 and 2	)))))	Docket Nos. 50-295 50-304 Proposed Amendment to Facility Operating License No. DPR-39 and DPR-48 to permit storage pool modification

AFFIDAVIT OF JOHN R. WEEKS

I, John R. Weeks, being duly sworn, do state as follows: I am employed by the Brookhaven National Laboratory, Department of Nuclear Energy, as Leader of the Corrosion Science Group. The statment of my professional qualifications is attached to this affidavit.

This affidavit addresses the concerns of the Atomic Safety and Licensing Board in their order of September 14, 1979. The extent to which Type 304 stainless steel will be present in the Zion Spent Fuel Pool has been described by the licensee in the affidavit of Tom Tramm. Further, the licensee has provided through the affidavit of Roger Staehle on page 6 that the carbon content of the Type 304 stainless steel in the Zion spent fuel rack tubes is low, ranging from .03 to .04% by weight. Further, Dr. Staehle indicates that the carbon content of the base material and joining bars is somewhat higher but still below .06% by weight. The tendency for an intergranular stress corrosion of sensitized stainless steel to occur in high purity water or boric acid solutions increases with the carbon concentration of the steel. The heat of material at Three Mile Island Unit 1 (where the low temperature stress

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corrosion cracking occurred) contained approximately .07 weight % carbon, which is higher than that in any of the documented materials at the Zion Fuel Pool.

In the stagnant water within the vented tubes of the proposed fuel storage racks, the stainless steel will be in physical contact with the aluminum cladding on the Boral plates. Because aluminum is electropositive with respect to stainless steel and the boric acid environment is electrically conducting, this Boral cladding will provide electrochemical (galvanic) protection to the stainless steel, thereby reducing the probobility of stress corrosion cracking on the stainless steel tubing in the creviced, stagnant area.

Recent research at Brookhaven National Laboratory shows that intergranular stress corrosion cracking of sensitized stainless steel can occur at temperatures as low as room temperature provided there is sufficient sensitization and that the material is strained at a rather specific strain rate. Stresses high enough to produce such a strain rate are unlikely to develop in the Zion Spent Fuel Pool, although they may exist in a highly local manner as a result of residual stresses from the welding process. In my opinion, while we cannot rule out, based on past experience and the experience of Three Mile Island, that stress corrosion cracking may occur somewhere in the spent fuel system at Zion, it is highly unlikely to occur in a widespread fashion, and if it does occur, it would result in small cracks and pin-hole leaks which would not significantly degrade the structural integrity of the fuel storage racks, the fuel pool liner, or the spent fuel pool piping systems. In all these cases, the systems are under low pressure so that the development of a rapidly propagating crack appears to me to be remote.

Stress corrosion cracking of a spent fuel pool liner of Type 304 stainless steel has not developed in any operating spent fuel pool in the United States, to the best of my knowledge. Welded stainless steel liners are used in spent fuel pools containing boric acid at all PWR's in the U.S. (except Yankee-Rowe), where they have been in service for periods greater than 12 years. It thus seems unlikely that massive stress corrosion cracking of the type that would seriously harm the integrity of the spent fuel pool liner will develop in Zion.

I concur with Dr. Staehle that the fuel pool water should be routinely monitored for chloride and fluoride ions and that it would be desirable to place into the spent fuel pool test coupons of stainless steels, preferably containing welds, and made from some of the same heats of steel that are used in the spent fuel storage pool components. These coupons should be periodically removed from the pool and examined by the licensee.

In addition to the experience at Three Mile Island, intergranular stress corrosion cracking of sensitized stainless steel has also occurred at temperatures below 140^{0}F in the primary piping of the High Flux Beam Reactor at Brookhaven National Laboratory. In this instance, the material was a weld neck flange containing approximately 0.059% carbon, was heavily sensitized, and heavily stressed as a result of bolt tightening stresses, although pressure stresses are low. I learned while working as a member of the NRC pipe crack study group that in cases where intergranular stress corrosion cracking has developed at higher temperatures in boiling water reactors, this cracking has almost exclusively been limited to materials that contained greater than .05% carbon by weight. In the absence of detailed information on the carbon analyses of all Type 304 stainless steel heats used in the Zion Spent Fuel Pool components and racks, however, it is impossible to conclude that intergranular stress corrosion will not occur. It is, however, my opinion that should it occur it will be localized and not have a significant effect on the spent fuel storage pool components. Should it occur in the liner or in the heat exchanger piping, it would be detected by trace leakage into the spent fuel pool leak collection system or by the presence of boric acid crystals on the external surface of the piping long before it would have progressed to the point at which the liner or piping would be seriously weakened. The low values of P_a determined by Mr. Clarke on selected welds in the spent fuel storage pool racks are an encouraging indication that stress corrosion will be unlikely on these components.

The above statements are true and accurate to the best of my knowledge.

John R. Weeks

Subscribed and sworn to before me
this 6th day of December, 1979.

Elizabeth Ann Tipton
Notary Public

My Commission expires: July 1, 1982

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PROFESSIONAL QUALIFICATIONS 6/79

OF

JOHN R. WEEKS

I am currently a metallurgist at Brookhaven National Laboratory, (BNL), where I have been employed since 1953. My present title is Leader, Corrosion Science Group, in the Department of Nuclear Energy. My current responsibilities include experimental investigations on the mechanisms of stress corrosion cracking and pitting corrosion of stainless steels and Inconel, and providing technical assistance to the U.S. Nuclear Regulatory Commission (NRC) in the area of corrosion and coolant chemistry in light water reactors. I am a participating consultant on the NRC Pipe Crack Study Group. I also am Chairman of the BNL Reactor and Critical Experiments Safety Committee, and represent the Department of Nuclear Energy on the BNL Council.

Since joining Brookhaven I have performed and supervised research on materials behavior in both liquid metal and water cooled reactors. From 1970 to 1972 I headed Brookhaven's program on liquid sodium technology. I have been materials advisor to the Reactor Division at BNL since 1959. I was keynote lecturer in 1966 at the International Atomic Energy Agency Symposium on Alkali Metal Coolants, and served in 1967-1969 as a U.S. delegate at the US-UK information exchanges on corrosion of reactor materials. I was a consultant to Aerojet General on the SNAP-8 project.

I was an adjunct associate professor of materials science at SUNY - Stony Brook in 1962-1963, and am currently an adjunct professor of Metallurgy and Nuclear Engineering at the Polytechnic Institute of New York. From 1972 to 1974 I was on assignment to the U.S. Atomic Energy Commission as a senior metallurgist in the Materials Engineering Branch, Directorate of Licensing. In 1974-1975, I served on the AEC (later NRC) Task Force investigating the causes of the stress corrosion problems in BWR piping.

My academic qualifications include a Met. E. degree from the Colorado School of Mines in 1949, a M.S. in 1950, and a Ph.D. in 1953 in Metallurgy from the University of Utah. I am a member of the American Society for Metals, for which I have been Chairman of the Long Island chapter, the Metallurgical Society of AIME, for which I have served as Chairman of the Nuclear Metallurgy Committee, and the American Nuclear Society. I am the author or co-author of approximately sixty-five publications in the areas of my research, and have prepared testimony or affidavits and testified before several Atomic Safety and Licensing Boards, and one Atomic Safety and Licensing Appeal Board, in U. S. Nuclear Regulatory Commission proceedings.