UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING APPEAL BOARD

In the Matter of	)	
	)	
WISCONSIN ELECTRIC POWER COMPANY	)	Docket No. 50-266-OLA2
	)	
(Point Beach Nuclear Plant, Unit 1)	)	

AFFIDAVIT OF HERBERT F. CONRAD

I, Herbert F. Conrad, being duly sworn, depose and state:

1. I am presently a Senior Materials Engineer in the Inservice Inspection Section of the Materials Engineering Branch, Division of Engineering in the Office of Nuclear Reactor Regulation.

2. The purpose of this statement is to respond to the request of the Atomic Safety and Licensing Appeal Board ("Board") in its Memorandum and Order of July 8, 1983 that the Staff provide it with an assessment of the efficacy of the Applicant's use of eddy current techniques for the early detection, sizing and repair of steam generator tube defects with respect to assuring the integrity of the primary coolant boundary. This was to be with specific reference to the detection of degradation in the transition region of fully expanded tubes where the change in tube diameter reduces the sensitivity of the eddy current testing technique.

3. The Staff has reviewed the Applicant's discussion of eddy current techniques used to inspect the tube sheet transition region. What the Applicant has described is essentially the current state of the art eddy current inspection technology available. The method of comparison of current test data with preoperational baseline "signature" data has been successful in other plants in detecting the presence of flaws at the site of geometric discontinuities and has been accepted by the Staff as the standard screening inspection technique. The Staff is fully aware of the limitations inherent in this method, especially in the sizing of defects when eddy current indications are found and the standard technique is unable to determine the exact size of the indications. When this occurs the Staff expects the use of more specialized probes, coils and signal processing equipment to investigate and size any such indications of degradation before the Staff will approve of the adequacy of a steam generator tube inspection program prior to return to power. Because of the fundamental limitations of any available inspection technique, the Staff takes this into consideration in its establishment of the plant Technical Specification plugging limit and primary to secondary leakage rate limit.

4. The Board is correct in presuming that such concerns regarding eddy current testing have been addressed whenever the Staff has reviewed steam generator tube inspection results from the several operating plants that have the fully expanded steam generator tube design and that such concerns have been resolved before such plants have been

permitted to operate. The Staff does not rely on eddy current testing as the sole method of preventing unacceptable consequences of steam generator tube degradation.

5. Although eddy current testing has proven to be a generally reliable technique for the purposes of monitoring tube integrity, as substantiated by operating experience, some difficulty is experienced in detecting and quantifying small flaws in the vicinity of geometric discontinuities.

   Experience in other plants has shown that where serious flaws have gone undetected, the usual consequence is a small leak of manageable size. Of over 200 leaks reported to the Staff, only four have involved ruptures. None of the rupture occurrences resulted in unacceptable offsite radiological consequences and all have been within the design basis limits for the specific plants. (NUREG-0886, "Steam Generator Tube Experience", pp. 32-41; Point Beach (Sleeving Hearing), November 18, 1983, Tr. at 1828)

6. Plugging limits for degraded tubes are based on the minimum remaining wall thickness of tubing which is required to maintain acceptable structural margins against a tube rupture over a full range of normal and accident conditions.

The Point Beach 40% plugging limit includes a margin for eddy current testing uncertainty as well as a margin for degradation between inspections. For Point Beach the tube wall could theoretically sustain greater than 55% degradation and resist rupture under normal and accident loads. Actual tube burst tests have indicated even a greater margin to failure exists even in a tube with a 360°, 55% through wall defect. (NUREG/CR-0718, "Steam Generator Tube Integrity Program")

7. The restrictive leakage rate limits in the plant technical specification provide assurance that the unit will be shut down in a timely manner for appropriate corrective action. The limits on allowable primary to secondary leakage are intended to assure that a tube leaking at a rate equal to or less than the limit will retain adequate integrity against rupture. Experience has shown that leakage events provide a timely indication of the existence of new degradation phenomena, or of known degradation developing at an unanticipated rate. Thus, licensing action or remedial measures may then be taken to provide added assurance of tube integrity and to prevent unacceptable degradation.

8. With respect to a postulated tube rupture at the site of the tube expansion transition at the tube sheet due to an undetected degradation process, the narrow annulus region between the tube and the tube sheet in the vicinity of the transition would limit the tube leakage which could result from a circumferential crack at the tube sheet, thereby making it of less concern than a similar postulated guillotine rupture above the tube sheet which

is within the design basis for this plant. For this reason and those stated above, the Staff finds the current state of the art eddy current test techniques acceptable.

I certify that the foregoing is true and correct to the best of my knowledge and belief.

Herbert F. Conrad

Herbert F. Conrad

Subscribed and sworn to before
me this 29th day of July, 1983

Edythe L. Becker

Notary Public

My Commission expires: 7/1/86

U.S. NUCLEAR REGULATORY COMMISSION
HERBERT F. CONRAD
PROFESSIONAL QUALIFICATIONS

My present position is Senior Materials Engineer, Material Engineering Branch, Office of Nuclear Reactor Regulation. In this capacity I am responsible for technical safety review and evaluation of materials used in the construction of nuclear power plant components. Specifically, the responsibilities include evaluation of materials application, heat treatment, fabrication, inspection and corrosion control. I am a former member of the American Society of Mechanical Engineers Nuclear Code Committee Subgroup on Fabrication and Examination (Section III).

I hold a MS in Metallurgy (1959) and a BS in Mechanical Engineering (1957) from the Massachusetts Institute of Technology. I am registered by the State of California as a Professional Engineer in Mechanical Engineering and in Metallurgical Engineering with more than 24 years of professional experience. I am a member of the American Society for Metals (ASM). I have several publications in metallurgy, the most recent is a contribution to the ASM Metals Handbook, Volume 10, Failure Analysis (ASM, 1975).

I have been with the Nuclear Regulatory Commission since February 1973, two years of which were as a loan employee on detail from the University of California. From September 1971, to December 1974, I was employed by the Lawrence Livermore Laboratory of the University of California as a Metallurgist. Prior to my assignment to Washington, I was responsible for the metallurgical and fracture mechanics aspects of the Laboratory's Nevada underground nuclear test emplacement program. In that capacity,

I developed a "fracture-safe" components program to insure against the possibility of catastrophic failure of critical structures through the practical application of fracture mechanics and metallurgical principles.

From November 1970, to September 1971, I was with the consulting engineering firm, Drachma, Incorporated as a staff member and acting general manager. I performed engineering services and metallurgical failure analysis. I provided expert witness testimony in courts of law, qaulified as a mechanical engineer and as a metallurgist.

From June 1969, to November 1970, I was a Senior Physicist with the Physics International Company. I was a program manger for experimental/ analytical projects in the area of radiation effects upon materials.

From 1959 to 1969, I was a staff metallurgist with the Lawrence Livermore Laboratory. I was assistant to the Chief Metallurgist for the design, construction and operational testing of the Pluto Nuclear Reactors (Tory IIA and Tory IIC). My responsibilities involved working with engineering and physics groups on materials selection, inspection, testing and failure analysis. I was the principal investigator on research into materials radiation effects, materials mechanical deformation and high temperature alloy development programs.