UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	Docket Nos. 50-443 OL-01
PUBLIC SERVICE COMPANY OF	)	50-444 OL-01
NEW HAMPSHIRE, et al.	)	On-site Emergency Planning
	)	and Safety Issues
(Seabrook Station, Units 1 and 2	)	

AFFIDAVIT OF HERBERT F. CONRAD

I, Herbert F. Conrad, being first duly sworn, hereby affirm that the responses to the questions set forth herein are correct to the best of my knowledge and belief:

Q1: Mr. Conrad, by whom and in what capacity are you employed?

A1: I am employed by the United States Nuclear Regulatory Commission. 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. Specially, my responsibilities include the evaluation of materials application, heat treatment, fabrication, inspection and corrosion control.

Q2: Have you prepared a statement of your professional qualification?

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A2: Yes, a statement of my professional qualifications is attached as an exhibit to this affidavit.

Q3: Mr. Conrad, what is the purpose of your affidavit?

A3: My affidavit addresses the question whether NECNP's Contention I.V raises issues which must be resolved prior to the reauthorization of low power operations at the Seabrook facility.

Q4: Mr. Conrad, NECNP Contention I.V states:

> The Applicants have not demonstrated that they have met CDC 14, 15, 31, and 32 insofar and to the extent that those CDC require a program of in-service inspection of steam generator tubes.

Does Applicants' inservice inspection program of steam generator tubes meet applicable regulatory requirements?

A4: Yes it does. The Staff's position on this issue is reflected in the following sections of NUREG-0896, the Safety Evaluation Report (SER) related to the operation of the Seabrook Station. That SER states in pertinent part:

> 5.4.2.2 Steam Generator Tube Inservice Inspection
> 5.4.2.2.1 Compliance with the Standard Review Plans Seabrook Units 1 and 2 were reviewed in accordance with SRP 5.4.2.2 (NUREG-0800). However, the staff review will continue until the plant Technical Specifications governing steam generator tube examinations are completed and are in conformance with the applicable standard Technical Specification.
>
> 5.4.2.2.2 Evaluation of the Inspection Program

> GDC 32 requires, in part, that RCPB components be designed to permit periodic inspection and testing of important areas and features to assess their structural and leaktight integrity. The design of all pressure-retaining parts of the steam generators at Seabrook Units 1 and 2 has been optionally upgraded to meet the ASME Code requirements for ASME Code Class 1 components. Provisions also have been made to permit Inservice Inspection of the Class 1 and 2 components, including individual steam generator tubes. The applicant has committed to following the recommendations of [Regulatory Guide] 1.83, Revision 1, "Inservice Inspection of Pressurized Water Reactor Steam Generator Tubes," and NUREG-0452, Standard Technical Specifications for Westinghouse Pressurized Water Reactors," and to complying with the requirements of ASME Code Section XI with respect to the Inspection methods to be used. The staff finds this commitment acceptable.
>
> 5.4.2.2.3 Conclusions
>
> Conformance with RG 1.83, NUREG-0452, and the Inspection requirements of ASME Code Section XI constitutes an acceptable basis for meeting, in part, the requirements of GDC 32.

Q5: Mr. Conrad, please explain the bases for the Staff's position that compliance with Regulatory Guide 1.83 constitutes an acceptable basis for meeting the requirements of GDC 32.

A5: As stated in Regulatory Guide 1.83, conformance with the provisions of the Regulatory Guide is a method acceptable to the NRC Staff for implementing General Design Criteria 14, 15, 31, and 32. Conformance to Regulatory Guide 1.83 reduces the probability and consequences of steam generator tube failures through periodic inservice inspection for early detection of defects and deterioration. Part A and B of Regulatory Guide 1.83 fully describe the bases for the Staff's position.

Q6: Mr. Conrad, the Ginna plant experienced a steam generator tube rupture despite its licensee's commitment to Regulatory Guide 1.83. What assurance does the Staff have that a similar rupture will not occur at Seabrook?

A6: As described in NUREG-0909, "NRC Report on the January 25, 1982 Steam Generator Tube Rupture at R.E. Ginna Nuclear Power Plant" (April 1982), the Ginna tube rupture event was caused by the presence of a foreign object. According to the December 22, 1987 Affidavit of Gregory A. Kann, the Seabrook Station's secondary side steam generator internals were inspected following hot functional testing, assessable areas of the lower tube sheet were inspected, with a miniature camera, and the separator area and related components were inspected. All debris located was removed and material and equipment inventory control was maintained to prevent the introduction of foreign objects into the steam generator. In addition, a loose parts monitoring system is employed to detect loose parts during plant operation. In my opinion, these provisions provide reasonable assurance that a rupture caused by a loose part, similar to that experienced at Ginna, will not occur at Seabrook.

Q7: Similarly, Mr. Conrad, what assurance does the Staff have that a rupture similar to the one that occurred at the North Anna plant will not occur at Seabrook?

A7: The Seabrook plant is not considered to be susceptible to the fluid flow induced vibration fatigue failure mechanism that caused the North Anna steam generator tube rupture because it does not have carbon steel top support plates with drilled holes. As stated in section 5.4.2.1 of NUREG-0896, the Seabrook SER:

Steam Generator Materials:

> The tube support will be manufactured from ferritic stainless steel material, which has been shown in laboratory tests to be corrosion resistant to the operating environment. The tube support plates will be designed and manufactured with broached rather than drilled holes. The broached-hole design promotes high-velocity flow along the tube, sweeping impurities away from the support plates locations.

The Staff's present understanding of the failure mechanism at North Anna is that the stresses in the steam generator tubes will not be high enough to cause a fatigue crack failure without the clamping action of the corrosion product buildup in the annalus between a drilled hole in the top support plate and the tube caused by the "denting" process. This is prevented from happening in the Seabrook steam generators in three ways:

1. Highly corrosion-resistant ferritic stainless steel is used instead of suscentible carbon steel for the tube support plate material, thus preventing the formation of the iron oxide corrosion product.

2. An improved support plate design is used. The quatrefoil tube support plate hole design features four lobes and tube support lands. The lands support the tubing and the lobes provide a path for water to flow adjacent to the tube. The quatrefoil design directs the flow along the tubes in a way that minimizes steam formation and chemical concentration at tube-to-tube support plate intersections. The quatrefoil support plate results in higher average velocities adjacent to the tubes than the original lower assembly support plates, which feature circulation flow holes between tube holes.

The quatrefoil support plate minimizes sludge deposition. The combination of high velocities in the support plate region and corrosion resistant material should minimize the potential for tube corrosion in the vicinity of the support plates.

3. As stated in NUREG-0896 Supplement No. 5, Safety Evaluation Report related to the operation of Seabrook Station Units 1 and 2, Section 10.3.4, the Seabrook Technical Specifications will contain [Section 6.7.4c] a requirement to implement a secondary water chemistry monitoring and control program that conforms with NUREG-0800, Standard Review Plan, Section 5.4.2.1. The implementation of a water chemistry program conforming to these guidelines will minimize the possibility of an enviroment in the steam generator that will promote corrosion processes.

Q8: Mr. Conrad, please describe the role of the Seabrook inservice inspection program of steam generator tubes, if any, in operating the Seabrook Station at five percent (5%) rated power.

A8: The Seabrook Station Technical Specifications require that the first inservice inspection be performed six months after full power operations begin but within 24 months of initial criticality. Operation of the Seabrook Station at five percent of rated power would not change this requirement in any way. Nor would low power operations make steam generator tubes inspections more difficult to perform or prevent augmented inspections. With respect to assurance of steam generator tube integrity during operation at 5 percent of rated power, the Technical Specification requires that the full length of each tube in each of the four steam generators be eddy current inspected from the point of entry on the hot leg side completely around the U-bend to the top support of the cold leg. This examination provides additional assurance of steam generator

tube integrity for the initial period of operation until the first inservice inspection, and establishes a baseline condition of the tubing against which future inservice inspections can be compared. In Section 5.2.4.3 the Seabrook SER, the Staff concluded that Applicants' preservice inspection program was acceptable.

Q9: Is there any factor which would lead to lesser chance of steam generator tube failure or degradation at 5 percent power than at 100 percent power?

A9: Yes. The reduced fluid flow at 5 percent power is such a factor. If we consider the Ginna type of occurrence of a loose part in the steam generator, the reduced rate of fluid flow at 5 percent power would greatly reduce the driving force that could be caused by such a postulated loose part and thus reduce the likelihood of steam generator tube failure from such a cause. Even if we consider a North Anna type failure, which as I have stated is virtually impossible at Seabrook, the reduced rate of fluid at 5 percent power would not cause the flow induced vibrations which caused the North Anna tube rupture.

Q10: Can the Seabrook Station be operated safely at 5 percent rated power in the absence of an adequate steam generator tube inservice inspection program?

A10: Yes. As stated in my response to the previous question, operation of Seabrook Station at 5 percent of rated power would not change or prevent augmentation (if it should be deemed desirable) of the planned steam generator tube inservice inspection program.

Q11: Mr. Conrad, does this complete yo r affidavit?

A11: Yes it does.

Herbert F. Conrad

Sworn to and subcribed befor me
this 12th day of January 1987:

Patricia J. Noonan

My Commission expires: 7/1/90

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. Specially, 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 M.S. in Metallurgy (1959) and a B.S. 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 28 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. Prior to my assignment to Washington, I was employed by the Lawrence Livermore Laboratory of the University of California as a Metallurgist.

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CERTIFICATE OF SERVICE

I hereby certify that copies of "NRC STAFF RESPONSE TO LICENSING BOARD ORDER OF NOVEMBER 27, 1987" in the above-captioned proceeding have been served on the following by deposit in the United States mail, first class, or as indicated by an asterisk, by deposit in the Nuclear Regulatory Commission's internal mail system, or as indicated by double asterisk, by hand delivery, or as indicated by triple asterisk, by express mail, this 12th day of January 1988.

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