Citizens Exhibits 18

RAS 14328

U.S. NUCLEAR REGULATORY COMMISSION
In the Matter of AmerGen Energy Co., LLC
Docket No. 50-0219-LR Official Exhibit No. Citizens Exh. 18
OFFERED by: Applicant/Licensee Intervenor NRC Staff
IDENTIFIED on 9/27/07 NA
Action Taken: ADMITTED REJECTED WITHDRAWN
Reporter/Clerk DW

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:
E. Roy Hawkens, Chair
Dr. Paul B. Abramson
Dr. Anthony J. Baratta

DOCKETED
USNRC

October 1, 2007 (10:45am)

OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

In the Matter of:	)	
AmerGen Energy Company, LLC	)	Docket No. 50-219
(License Renewal for Oyster Creek Nuclear Generating Station)	)	

AFFIDAVIT OF JON R. CAVALLO

City of Portsmouth)
State of New Hampshire)

Jon R. Cavallo, being duly sworn, states as follows:

INTRODUCTION

1. This Affidavit is submitted to support AmerGen Energy Company, LLC's Motion for Summary Disposition on the contention filed by environmental and citizen groups ("Citizens") opposed to the renewal of the Oyster Creek Nuclear Generating Station operating license, and admitted by the Licensing Board on October 10, 2006. Citizens' contention as admitted by the Licensing Board is: "AmerGen's scheduled [ultrasonic testing ("UT")] monitoring frequency in the sand bed region is insufficient to maintain an adequate safety margin." The purpose of my Affidavit is provide

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information regarding the multi-layer epoxy coating used on the exterior of the Oyster Creek drywell shell in the sand bed region, in order to address Citizens' contention.

2. It is my expert opinion that Citizens' allegations have no technical merit because they are based on a misunderstanding of the nature of the epoxy coating, and of the inspections performed on that coating.

EDUCATION AND EXPERIENCE

3. I am Vice President of Corrosion Control Consultants & Labs, Inc., and in this capacity I provide corrosion mitigation professional engineering services in surface preparation, protective coatings and linings. I have held this position since 1998. I am also Vice-Chairman of Sponge-Jet, Inc., located in Portsmouth, New Hampshire, a company I helped found which designs and manufactures state-of-the-art surface preparation and decontamination systems.

4. I served as Editor of Electric Power Research Institute (EPRI) Report 1003120 (formerly TR-109937), Revision 1, "Guideline on Nuclear Safety-Related Coatings." I also teach and assisted developing the EPRI protective coatings course. I am also the Principal Investigator of EPRI Report 1009750, "Analysis of Pressurized Water Reactor Unqualified Original Equipment Manufacturer Coatings," (Final Report, March 2005).

5. I have worked on coatings and corrosion control at nuclear power facilities for over 35 years. Specifically:

   - From 1971 to 1983, I was employed by Stone & Webster Engineering Corporation in both the Boston and Denver offices. During this period, I specified coating systems for a number of new nuclear generating facilities as

well as performed coating system failure analysis and attendant repair plans for operating nuclear generating facilities.

- After leaving Stone & Webster, I worked with Metalweld, Inc. until 1986 as its Northeastern United States regional manager. I was the project manager for all of the protective coatings work for the Seabrook Nuclear Plant.
- From 1986 to 1991, I was a Senior Associate in the consulting engineering firm of S.G. Pinney & Associates, Inc. During my employment with the firm, I performed protective coating and lining work at a number of nuclear generating facilities. I was the Professional Engineer assigned to all underwater protective lining work conducted by the firm.
- From 1991 to 1998, I was an independent professional engineer performing corrosion engineering consulting services.
- From 1998 to the present, I have worked in my current capacity as Vice President of Corrosion Control Consultants & Labs, Inc.

6. I received my B.S. degree in Engineering Technology, *cum laude*, from Northeastern University in Boston, Massachusetts, in 1979. I have completed a variety of engineering and engineering management study programs, including U.S. Naval Nuclear Power Training, the University of Colorado (engineering project management), and NACE International (corrosion prevention in oil and gas production). I am a Registered Professional Engineer in six states, President of the Maine Society of Professional Engineers, and an SSPC-Society for Protective Coatings certified Protective Coating Specialist.

7. I am active on a number of national technical societies including SSPC, NACE and ASTM. I have served as Chairman of the Northern New England Chapter of SSPC from 1991 to 1998, Chairman of the New England Chapter of SSPC from 2000 to the present, and was a member of the SSPC National Strategic Planning Committee. I was elected Chairman of ASTM Committee D-33 (Protective Coating and Lining Work for Power Generation Facilities) for the period 2004 through 2008. I have also served as Chairman of the Industry Coating Phenomena Identification and Ranking Table (PIRT) Panel reviewing the work of Savannah River Technical Center on the USNRC Containment Coatings Research Project (Generic Safety Issue -191).
8. Based on my review of the relevant historical documentation, I am familiar with the historical corrosion of the OCNGS drywell shell, and the actions taken to control corrosion.
9. I have also reviewed the relevant portions of the OCNGS License Renewal Application ("LRA") submitted to the NRC on July 22, 2005, and the LRA supplement submitted to the NRC on December 3, 2006.
10. Finally, I testified before the Advisory Committee on Reactor Safeguards (ACRS) license renewal subcommittee on January 18, 2007, on the topic of the Oyster Creek drywell shell epoxy coating.

OPINIONS OF JON R. CAVALLO

11. Citizens have asserted that under corrosive conditions, long-term corrosion rates of more than 0.017 inches per year have been observed in the sand bed region of the Oyster Creek drywell shell. This assertion is based on public documents estimating

long term corrosion rates in the period before the application of the epoxy coating to the drywell shell.

12. The historic corrosion occurred because, among other things, the drywell shell in the sand bed region was not coated. The exterior shell is now protected by a three-layer (pre-prime and two coats) epoxy coating system. This coating system was designed for submerged applications, such as tank bottoms, so even if water was always present in the sand bed region, it would have no effect on the coated steel shell. This coating was applied in the following manner:

- Prior to application, Oyster Creek personnel created a mock-up of the sand bed region. Using the same mechanics, and with the same restricted access, personnel prepared the surface and applied to the coating to this mock-up. Through this process, Oyster Creek personnel qualified the surface preparation, coating application, and inspection techniques for use on the drywell shell.
- Following surface preparation of the drywell shell by SSPC-SP 2 hand tool cleaning that removed loose rust, loose mill scale, and loose coating, the pre-prime was applied.
- The pre-prime is a red epoxy coating that soaks and penetrates into the semi-irregular shape of the substrate metal.
- Then two coats of the whitish-gray Devran-184 epoxy were applied with a brush and roller.
- Finally, a Devmat 124S caulking was used to seal the interface between the concrete floor and the steel substrate.

13. Citizens speculate that there might be tiny holes in the epoxy coating - "pinholes" or "holidays" - which would allow water to get behind the coating, causing corrosion of the underlying drywell shell. Dr. Hausler has suggested that such holidays would be so small that they could not be detected with the naked eye during a visual inspection. By definition, a pinhole or holiday is a very localized defect in the coating that occurs during the application and cure of the coating. Thus, these localized defects could only be caused by a defect in the original application of the coating, and cannot be caused by degradation over time.

14. As would be expected, the possibility of a pinhole or holiday decreases with each layer of coating that is applied. As I noted, the epoxy protecting the exterior of the drywell shell is comprised of a three layer (a pre-prime and two coats) coating system.

15. AmerGen's protective coating monitoring program includes VT-1 visual inspections of the epoxy coating by qualified inspectors in accordance with NUREG-1801 and ASME Section 11, Subsection IWE. Under the VT-1 method, trained and qualified individuals inspect surfaces such as the drywell shell for evidence of flaking, blistering, peeling, discoloration, and other signs of degradation. The VT-1 technique is a proven method, used throughout the industry, on both boiling water reactors and pressurized water reactors. If a corrosion rate of 0.017" per year had occurred between 1992 and 2006, then it would have been readily detected by the VT-1 inspections performed during the 2006 refueling outage. Future corrosion would also be detectable in a VT-1 inspection.

16. This is because as carbon steel corrodes, the reaction between oxygen and the iron in the steel results in an iron oxide byproduct. The epoxy coating would not allow the corrosion byproducts to migrate from the site of the corrosion, so these byproducts would either accumulate as a blister at the corrosion site, or they would seep out through the postulated pinhole or holiday in the coating onto the otherwise whitish-gray epoxy coating. In either case, the corrosion byproducts would be clearly visible in a VT-1 inspection.

17. It is well accepted corrosion science that corrosion byproduct occupies a volume seven to ten times greater than the underlying corroding steel. For example, if 0.017" of steel corrodes in a year under an epoxy coating, then between 0.119" and 0.170" of byproduct would result. Four years of corrosion at that rate—the interval that AmerGen will perform UT in the sand bed region—would result in between 0.476" and 0.680" of corrosion byproduct. Thus, the amount of corrosion that Citizens postulate would, in a four-year period, generate a blister under the epoxy coating of around ½-inch thickness. Such a blister would be clearly visible to an inspector qualified to perform VT-1 inspections.

18. Therefore, a corrosion rate of 0.017" occurring in a pinhole since 1996 (the last time that strippable coating was not used during a refueling outage), would result in a 1.2" to 1.7" blister in the epoxy coating. Even if significant corrosion could occur behind a pinhole or holiday in the epoxy coating, corrosion at a rate of 0.017" per year would be visible through the VT-1 inspections performed every four years.

19. In fact, Citizens' argument that such local defects have existed since 1992 is inconsistent with their argument that the air in the sand bed region is moist and

capable of corrosion. If a moist environment and pinholes coexisted for the past 14 years (1992 to 2006), then the resulting corrosion would be easily visible during the VT-1 inspections.

20. The VT-1 inspections would also detect the corrosion products caused by much lower corrosion rates. Even a corrosion rate of 0.002 inches per year would yield corrosion products that would cause a blister of between 0.056" and 0.080" in the four year interval between inspections. Such a blister would also be visible in a VT-1 inspection performed by a qualified inspector.

21. The VT-1 Inspection is designed to be used on any type of steel or concrete surface, including textured concrete and irregular surfaces such as welds. Therefore, the techniques used in this inspection would be adequate to use on surfaces such as the Oyster Creek drywell shell.

22. Also, the eight to ten year rated lifetime discussed in Citizens' Exhibit 6 to their original contention (this exhibit is a letter submitted to the NRC in 1995 by the previous owner of Oyster Creek Nuclear Generating Station) is simply incorrect. The multilayer epoxy coating is designed to withstand a submerged environment and to last for the life of the plant, including the extended period of operation, provided that proper VT-1 inspections are conducted and necessary corrective maintenance is performed to address any discrepancies found. This type of coating is commonly used throughout the nuclear industry, and there is no such limitation in life span.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

Jon R. Cavallo
235 Heritage Avenue, Suite 2
Portsmouth, NH 03801

Subscribed and sworn before me this 26th day of March, 2007.

Notary Public

My Commission Expires: JOYCE L. GOODWIN, Notary Public
My Commission Expires January 15, 2008