RAS J-70

January 29, 2008

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
Entergy Nuclear Generation Co. and Entergy Nuclear Operations, Inc.	)	Docket No. 50-293-LR
	)	
	)	ASLBP No. 06-848-02-LR
(Pilgrim Nuclear Power Station)	)	

NRC STAFF TESTIMONY OF TERENCE L. CHAN AND ANDREA T. KEIM
CONCERNING PILGRIM WATCH CONTENTION 1

Q1. Please state your name, occupation, and by whom you are employed.

A1a. My name is Terence L. Chan (TLC). I am employed as Branch Chief of the Piping and Nondestructive Examination ("NDE") Branch within the Division of Component Integrity, Office of Nuclear Reactor Regulation ("NRR"), U.S. Nuclear Regulatory Commission ("NRC"). A statement of my prof

U.S. NUCLEAR REGULATORY COMMISSION
In the Matter of Entergy (Pilgrim Nuclear Power Station)
Docket No. 50-293-LR Official Exhibit No. 40
OFFERED by: Applicant/Licensee Intervenor
NRC Staff Other NRC Staff Exh. 2
IDENTIFIED on 4-10-08 Witness/Panel
Action Taken: ADMITTED REJECTED WITHDRAWN
Reporter/Clerk Thibault

A1b. My name is Andre

Component Integrity, NRR, NRC

hereto.

Q2. Please describe y

A2a. (TLC) As Chief of

engineers involved in the evalua

NDE issues, American Society o

activities, and inservice inspecti

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regional offices. I provide day-t

administrative and technical rev

DOCKETED
USNRC

April 15, 2008 (10:00am)

OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

Temp = SECY-027

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Q1. Please state your name, occupation, and by whom you are employed.

A1a. My name is Terence L. Chan (TLC). I am employed as Branch Chief of the Piping and Nondestructive Examination ("NDE") Branch within the Division of Component Integrity, Office of Nuclear Reactor Regulation ("NRR"), U.S. Nuclear Regulatory Commission ("NRC"). A statement of my professional qualifications is attached hereto.

A1b. My name is Andrea T. Keim (ATK). I am a Materials Engineer in the Division of Component Integrity, NRR, NRC. A statement of my professional qualifications is attached hereto.

Q2. Please describe your current responsibilities.

A2a. (TLC) As Chief of the Piping and NDE Branch since 2001, I manage eight engineers involved in the evaluation of generic and plant-specific materials degradation and NDE issues, American Society of Mechanical Engineers ("ASME") Code and standards activities, and inservice inspection ("ISI") activities. My branch is also involved in the review of certain power uprate and license renewal applications, and provides technical support to the regional offices. I provide day-to-day management of activities in my branch, which include administrative and technical review responsibilities. As part of my duties, I represent the NRC on four groups within the ASME that address materials degradation or inspection issues: Task Group on Alloy 600, Task Group on Alternate NDE, Working Group on General Requirements, and Subgroup on NDE.

A2b. (ATK) I am responsible for performing safety reviews related to nuclear power plant piping and NDEs of operating nuclear power plants, license renewal applications, and new reactor design certifications. For the past twelve years, I have reviewed plant license and license renewal applications and have been involved in updating technical review guidance documents, such as standard review plans. As a technical reviewer in the Division of Component Integrity, I have been responsible for conducting reviews involving corrosion of metals, NDEs, risk-informed ISI programs and repair/replacement activities. I represent the NRC at the ASME Section XI Code on the working group on Implementation of Risk Based Examinations.

Q3. Please explain your duties in connection with the NRC staff's ("Staff") review of the License Renewal Application ("LRA") submitted by Entergy Nuclear Generation Co. and Entergy Nuclear Operations, Inc. (collectively, "Entergy") for the renewal of the Pilgrim Nuclear Power Station ("Pilgrim").

A3. (TLC) (ATK) We were not involved in the review of Entergy's LRA.

Q4. Are you familiar with Pilgrim Watch's Contention 1, as refined by the Atomic Safety and Licensing Board ("Board")?

A4. (TLC) (ATK) Yes. Pilgrim Watch's Contention 1, as admitted reads:

> The Aging Management program proposed in the Pilgrim Application for license renewal is inadequate with regard to aging management of buried pipes and tanks that contain radioactively contaminated water, because it does not provide for monitoring wells that would detect leakage.

Contention 1 was clarified in the Board's Order dated October 17, 2007 as follows:

> Thus, the only issue remaining before this Licensing Board regarding Contention 1 is whether or not monitoring wells are necessary to assure that the buried pipes and tanks at issue will

> continue to perform their safety function during the renewal period – or, put another way, whether Pilgrim's existing AMPS have elements that provide appropriate assurance as required under relevant NRC regulations that buried pipes and tanks will not develop leaks so great as to cause those pipes and tanks to be unable to perform their intended safety functions.

Q5. What is the purpose of your testimony?

A5. (TLC) (ATK) Our testimony will address the required tests and inspections being performed under Pilgrim's current license for routine maintenance and operation of those buried pipes and tanks within the scope of the contention.

Q6. Are there buried pipes and tanks for systems within the scope of license renewal that could contain radioactive liquids?

A6. (TLC) (ATK) Yes, with respect to buried pipes, but there are no buried tanks within the scope of Contention 1. According to the testimony of James A. Davis, PhD., the buried piping in scope for Entergy's license renewal application are part of the following systems: the condensate storage ("CS") system, salt service water ("SSW") system, the standby gas service system, the fuel oil system, the station blackout diesel generator system, and the fire protection system. The only system that contains radioactive liquid by design is the CS system, which contains buried piping but no buried tanks. The SSW system is designed to contain non-radioactive cooling water. However, the SSW system cools the reactor building closed cooling water ("RBCCW") system, which cools systems that contain radioactive water. Thus, there is a small possibility that the SSW could become cross contaminated. The SSW system contains buried piping but no buried tanks.

The standby gas treatment system could contain radioactive gas following an accident, but would not contain radioactive liquid.

The only buried tank in scope for license renewal is the fuel oil diesel tank and it does not contain any radioactive liquid.

The station blackout diesel generator system and the fire protection system do not contain any radioactive liquids.

These systems are consistent with those discussed in the Applicant's testimony dated January 8, 2008.[1]

Q7. What is the intended function of the CS system?

A7. The CS system does not provide a credited safety function. It does however provide the preferred supply of water to the high pressure coolant injection ("HPCI") and reactor core isolation cooling ("RCIC") systems.

The RCIC system provides makeup water to the reactor vessel whenever the vessel is isolated. The HPCI system provides and maintains coolant inside the reactor vessel to prevent fuel clad melting in the event of a postulated small break in the reactor coolant system.

Q8. What inspection or examinations are required by current NRC regulations or Pilgrim's technical specifications for the CS system?

A8. (TLC) The CS system provides for condensate system makeup and system rejection to accommodate fluctuations in power generation demands. Although the CS tanks and associated piping provide the preferred water supply to the HPCI and RCIC systems, the CS system is not relied upon for accident mitigation. The torus water storage provides the backup emergency HPCI and RCIC systems water supply. As such, there are no inspections or examinations of the CS system required by the NRC regulations or technical specifications.

Q9. Are there any requirements that would detect leaks in the CS system buried pipes?

A9. (ATK) Yes. There are testing requirements for the RCIC and HPCI systems that would allow the licensee to identify a leakage problem in the buried piping of the CS system.

[1] Testimony of Alan Cox, Brian Sullivan, Steve Woods, and William Spatero on Pilgrim Watch Contention 1, Regarding Adequacy of Aging Management Program for Buried Pipes and Tanks and Potential Need for Monitoring Wells to Supplement Program (January 8, 2008), at 9, 13-15

The regulations at 10 C.F.R. § 50.55a(f) require plants whose construction permit was issued before January 1, 1971, such as Pilgrim's, to implement an Inservice Testing ("IST") program that meets 10 C.F.R. §§ 50.55a(f)(4)-(5) to the extent practical.

By letter dated December 6, 2002, the licensee submitted the fourth 10-year IST program plan for Pilgrim. (Staff Ex. 10). The fourth 10-year IST interval started on December 7, 2002 and ends December 7, 2012. The IST program plan was developed in accordance with the requirements of the 1995 Edition through the 1996 Addenda of the ASME Code for Operation and Maintenance of Nuclear Power Plants, except where specific alternatives to these requirements have been authorized by the NRC.

In accordance with the Pilgrim IST program and the Pilgrim technical specifications, specifically Surveillance Requirement 4.5.C. for the HPCI system and Surveillance Requirement 4.5.D. for the RCIC system (Staff Ex. 11), the HPCI system and the RCIC system are tested quarterly to verify flow rate and pump operability. (Staff Ex. 10 at 17 of 179, 18 of 179). The test for HPCI and RCIC pumps are performed by establishing a flow path with suction from and discharge to the condensate storage tank. This suction path utilizes the buried piping from the condensate storage tank to the HPCI and RCIC pump suctions as identified by the Pilgrim January 8, 2008 testimony. Entergy's Testimony at 13-14, 15) A leak large enough to prevent condensate storage tank water delivery to these pumps would cause the quarterly IST to fail and the tested pumps would be termed inoperable. This would require Pilgrim to take action pursuant to the TSs. The testing would allow the licensee to identify a leakage problem in the buried piping of the CS system.

Q10. How does Pilgrim's FSAR address the CS system?

A10. (ATK) FSAR 11.9 discusses the power generation objective of the condensate storage system at Pilgrim. (Staff Ex. 12) As discussed above, the CS system provides the preferred supply of water to the HPCI and RCIC systems. The torus water storage provides the backup emergency HPCI and RCIC systems supply. There are two 275,000 gallon CS tanks that are above ground. The tanks are made of coated carbon steel with all inlet and outlet lines, overflows, vents, and instrument lines located at the tank bottom or toward the tank center to prevent freezing problems. All systems that take suction from the condensate storage tanks are located above the HPCI and RCIC suctions to provide a 75,000 gallon reserve in each tank for these systems.

Q11. What is the intended safety function of the SSW system?

A11. (ATK) The SSW system provides a heat sink for the RBCCW system under transient and accident conditions.

Q12. What current NRC regulations address the safety of buried piping in the SSW system at Pilgrim?

A12. (ATK) On July 18, 1989, the NRC issued Generic Letter ("GL") 89-13, "Service Water System Problems Affecting Safety-Related Equipment," after operating experience and studies led the Staff to question the compliance of service water systems in the nuclear power plants of licensees and applicants with certain general design criteria ("GDC") and quality assurance requirements. (Staff Ex. 3).

As addressed in the purpose section of GL 89-13, nuclear power plant facilities or licensees and applicants must meet the minimum requirements for quality assurance in 10 C.F.R. Part 50, Appendix B, Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants. In particular, Section XI, "Test Control," requires that "a test program shall be established to assure that all testing required to demonstrate that structures, systems, and components will perform satisfactorily in service is identified and performed in accordance with written test procedures which incorporate the requirements and acceptance limits contained in applicable design documents."

Q13. Has Pilgrim established a test program as required by Appendix B?

A13. (ATK) Yes, as stated in FSAR Section 1.10. (Staff Ex. 13).

Q14. What inspection or examinations are required by NRC regulations for the SSW System?

A14a. (TLC) The regulations at 10 C.F.R. § 50.55a(g) require plants whose construction permit was issued before January 1, 1971, such as Pilgrim's, to implement an ISI program that meets 10 C.F.R. §§ 50.55a(g)(4)-(5) to the extent practical.

By letter dated June 29, 2005, the licensee submitted the fourth 10-year ISI program plan for Pilgrim. (Staff Ex. 14). The fourth 10-year ISI interval started on July 1, 2005 and ends June 30, 2015. The ISI program plan was developed in accordance with the requirements of the 1998 Edition of the ASME Boiler and Pressure Vessel Code (Code), Section XI, through the 2000 Addenda, except where specific alternatives to these requirements have been authorized by the NRC. The SSW system is included in Pilgrim's ISI Program Plan and will be examined and pressure tested in accordance with the requirements of the ASME Code, Section XI and Pilgrim's augmented ISI requirements. (*Id.* at 1-11, 1-14, 1-15). In 10 C.F.R. § 50.55a(b) the NRC has approved the use of Section XI of the ASME Code including the 1970 Edition through the 1976 Winter Addenda, and the 1977 Edition through the 2003 Addenda, subject to certain limitations and modifications stated in 10 C.F.R. § 50.55a(b)(2). Pilgrim's fourth 10-year ISI Program Plan complies with these limitations and modifications. ISI, including pressure testing, of the SSW system in accordance with ASME Code Section XI (*Id. at* 1-35), and provides reasonable assurance of structural integrity and that significant degradation will be identified in a timely manner such that safety related systems will be able to perform their safety function.

A14b. (ATK) The ISI program plan referenced routine inspection, maintenance, and test requirements for the SSW system piping and heat exchanger inspections, along with the associated acceptance criteria for consistency with GL 89-13. These inspections are separate from, but supplement, the ASME Code Section XI Class 3 ISI inspections.

Regional inspectors use Inspection Procedure ("IP") 71111.07 to verify heat sink performance. (Staff Ex.15). As stated in Pilgrim Nuclear Power Station - NRC Integrated

Inspection Report 05000293/2006002 dated May 12, 2006, "The inspector reviewed performance tests, periodic cleaning, eddy current inspections, chemical control methods, tube leak monitoring, the extent of tube plugging, potential water hammer analysis, operating procedures, [and] maintenance practices." (Staff Ex. 16 at 6). The inspector also confirmed that controls for selected components conformed to Entergy's commitments to Generic Letter 89-13, "Service Water System Problems Affecting Safety Related Equipment." The inspector did not identify any findings of significance. (*Id.*). The verifying of the heat sink performance provides assurance that the heat sink is capable of meeting its safety function.

Q15. How does Pilgrim's Final Safety Analysis Report ("FSAR") address the NRC regulations described above for the SSW system?

A15. (ATK) FSAR § 10.7 discusses the safety objective of the SSW system at Pilgrim. As discussed above, the SSW system provides a heat sink for the RBCCW system under transient and accident conditions. (1) The system is designed with sufficient redundancy so that no single active system component failure can prevent the system from achieving its safety objective. (2) The system is designed to continuously provide a supply of cooling water to the secondary side of the RBCCW heat exchangers adequate for the requirements of the RBCCW under transient and accident conditions. (Staff Ex. 17)

The SSW system consists of five vertical service water pumps located in the intake structure, and associated piping, valves, and instrumentation. The pumps discharge to a common header from which independent piping supplies each of the two cooling water loops.

Testing is performed on pumps and valves in accordance with the inservice testing program. The testing is performed per the ASME Code as required by 10 C.F.R. § 50.55a(f).

The buried portions of the 22-inch nominal diameter discharge piping from the last flange connections in the auxiliary building piping vault to the end of the discharge pipes at the seal well opening have been provided with a cured-in-place-pipe ("CIPP") lining. The 240-feet total length loop "A" lining was installed in refueling outage (RFO-14) and the 225-feet total length "B" lining was installed in RFO-13. The CIPP liner material consists of a tube composed of nonwoven polyester felt material that is saturated with either an isophthalic polyester resin and catalyst system (Loop "A") or epoxy resin and hardener system (Loop "B") with a polyurethane or polyethylene inner membrane surface. The liner has a nominal ½" installed thickness. The resulting configuration is a rigid resin composite pipe within the original pipe with no requirements for bonding between the pipes. (Staff Ex. 17 at 10.7-2a)

Q16. Will the tests and inspections described above continue to be performed during the period of extended operation?

A16. Yes. The tests and inspections discussed above are performed as part of routine maintenance and operation. Those required under the regulations and TSs, will carry forward unless changed by an amendment to the regulations or to the operating license. Those tests and inspections covered by the FSAR can be changed by the Applicant, but only as permitted under 10 C.F.R. § 50.59. Changes to the ISI and IST are governed by 10 C.F.R. § 50.55a.

Q17. How does the NRC treat unexpected leakage from systems such as the SSW and CS?

A17. (TLC) Unexpected leakage from the pressure boundary of a system, such as the piping itself, welds, and valve bodies, is considered as operational leakage, and is a current licensing basis issue. Industry experience has shown that operational leakage from typical service water systems as a result of corrosion due to the nature of service water environments does occur. Because such leakage is a clear nonconformance to the expected condition of the system, treatment of operational leakage was provided in GL 91-18, "Information to Licensees Regarding Two NRC Inspection Manual Sections on Resolution of Degraded and Nonconforming Conditions and on Operability." (Staff Ex.18). This guidance was revised in NRC Regulatory Issue Summary ("RIS") 2005-20, "Revision to Guidance Formerly Contained in NRC Generic Letter 91-18,'Information to Licensees Regarding Two NRC Inspection Manual Sections on Resolution of Degraded and Nonconforming Conditions and on Operability," dated

September 26, 2005. (Staff Ex.19). Specific guidance regarding operational leakage is provided in Appendix C, Article C.12, "Operational Leakage from Code Class 1, 2, and 3 Components," to NRC Inspection Manual Part 9900, attachment to the RIS. (*Id.* at C-9). Article C.12 provides guidance for evaluating the structural integrity of the leaking component to perform its safety function and identifies actions which may be taken to determine the operability of the component. (*Id.* at C-10). This guidance makes no distinction as to whether the component or piping is buried or exposed.

Q18. What is the Staff's conclusion regarding whether the inspections being performed under Pilgrim's current license for routine maintenance and operation of buried pipes and tanks that could potentially contain radioactive liquid are adequate to detect leaks prior to challenging the buried piping's ability to fulfill its safety function?

A18. (TLC) (ATK) The buried piping at Pilgrim that could potentially contain radioactive liquid is effectively managed by the inspections, testing, quality assurance, and corrective action programs performed under the current license. These programs provide reasonable assurance that significant leaks would be detected in a timely manner that will allow for action to be taken prior to the system being unable to perform its intended safety function.

Q19. Have you had an opportunity to review the testimony of Entergy's witnesses regarding the testing, inspections and surveillances performed on the SSW, CS, and other systems?

A19. (TLC) (ATK) We have each reviewed Entergy's testimony dated January 8, 2008.

Q20. Do you have an opinion regarding whether these tests and inspections are adequate to detect leaks before they would affect the ability of buried pipes to perform their intended safety function?

A20. (TLC) (ATK) Yes. The tests and inspections are discussed in the testimony of the Applicant's expert witnesses and include: water level indicators in the CS system tanks that are checked every four hours (Entergy's Testimony at 48), quarterly waterflow rate testing of the

HPCI and RCIC pumps and related corrective actions (*Id.* at 48-49), quarterly IST of flow rate to the HPCI and RCIC systems in accordance with the ASME code and Pilgrim TSs (*Id.* at 51), flowrate tests once after every outage and once every two years (*Id.*), and monthly flowrate test of the SSW system (*Id.* at 53). In our opinion, they provide reasonable assurance that during routine operation, leaks in the buried pipes in the CS and SSW systems will be detected before affecting the ability of the buried pipes to perform their intended function.

Q21. Does this conclude your testimony?

A21. Yes.

Terence L. Chan, PE
Statement of Professional Qualifications

CURRENT POSTION:

Branch Chief, Division of Component Integrity
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission, Rockville, MD

EDUCATION:

B. NE. Georgia Institute of Technology, 1977, Nuclear Engineering
MS Georgia Institute of Technology, 1981, Mechanical Engineering

LICENSES:

Professional Engineer (Mechanical Eng.), Washington, DC #7997 (since 1983)

SUMMARY:

Nearly 30 years of experience in nuclear, mechanical and materials engineering in the nuclear power industry. Significant experience in the following areas:

- Mechanical Engineering
- System Design
- Nondestructive Examination
- Inspection
- Licensing
- Allegations
- Quality Assurance
- Construction
- American Society of Mechanical Engineers (ASME) Code Committees

EXPERIENCE:
U.S. Nuclear Regulatory Commission, 02/09/1981 – Present

06/2001 to Present – Chief, Piping and NDE Branch, Division of Component Integrity, Office of Nuclear Reactor Regulation

- Manage the day to day technical and administrative responsibilities of a technical staff, dealing with materials degradation, welding, and inspection issues. Specific issues include reactor vessel head degradation, and cracking of dissimilar metal welds.
- Responsible for the inservice inspection requirements of piping systems and components, pressure boundary integrity issues and nondestructive examination methods and qualification requirements.
- NRC representative to ASME, Section XI
    - Task Group on Alternate NDE

- Task Group on Alloy 600
- Working Group on General Requirements
- Subgroup on Nondestructive Examination

05/2000 to 06/2001 – Senior Mechanical Engineer, Materials and Chemical Engineering Branch, Division of Engineering, Office of Nuclear Reactor Regulation

- Technical lead for ASME Code issues.
- Peer reviewer of technical safety evaluations

10/1999 to 05/2000 - Commissioner Assistant, Office of Chairman Richard A. Meserve
02/1996 to 10/1999 - Commissioner Assistant, Office of the Chairman/Office of Commissioner Greta Joy Dicus

- Reviewed and advised on technical and policy matters related to reactor issues including License Renewal, Advanced Reactors, Risk-informed Regulations, Y2K, International Exports and Technology Transfer, Budget, NRC Organization Structure, Regulatory Reform, Decommissioning, and Deregulation.

08/1990 to 02/1996 - Section Chief, Mechanical Engineering Branch, Division of Engineering, Office of Nuclear Reactor Regulation

- Manage the day to day technical and administrative responsibilities of a technical staff, dealing with inservice surveillance and testing requirements of safety-related pumps and valves.
- Responsible for piping design requirements, seismic design requirements, and effects of thermal stratification in piping systems.

04/1986 to 08/1990 - Senior Project Manager/Project Manager, Division of Reactor Projects III, IV, and V, Office of Nuclear Reactor Regulation

- Project Manager for Trojan Nuclear Plant and Surry Power Station; Senior Project Manager for Palo Verde Nuclear Generating Station. Responsible for all licensing activities related to the facilities; coordination of issues between NRC, licensee, and other State and Federal agencies; and coordination of all technical reviews.
- Lead Project Manager for generic technical issues - pipe wall thinning, thermal stratification, and reactor vessel support embrittlement.

11/1983 to 04/1986 - Reactor Construction Engineer, Reactor Construction Programs Branch, Division of Quality Assurance, Safeguards and Inspection Programs, Office of Inspection and Enforcement

- Performed Construction Appraisal Team inspections at Clinton, Seabrook, Waterford, Shearon Harris, and Millstone 3. Lead inspector responsible for all mechanical engineering related systems and components (i.e., fluid piping systems, HVAC).

02/1981 to 11/1983 - Auxiliary Systems Engineer, Auxiliary Systems Branch, Division of Systems Technology, Office of Nuclear Reactor Regulation

- Performed licensing reviews of nuclear power plant applications. Reviewed Final Safety Analysis Reports. Determined the acceptability of the design of safety-related and "balance-of-plant" systems (e.g., spent fuel pool and cooling system, fuel storage, safe shutdown in the event of fire, emergency feedwater system, HVAC, ultimate heat sink, component cooling systems).

U. S. Tennessee Valley Authority; Bellefonte Nuclear Plant - Construction Engineer (06/1978 to 02/1981)

- Construction engineer responsible for the installation and preoperational testing of safety piping systems, supports and components.

Andrea T. Keim

Statement of Professional Qualifications

CURRENT POSITION:

Materials Engineer — Division of Component Integrity, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission (NRC), Rockville, MD

EDUCATION:

Bachelor's of Engineering - Stevens Institute of Technology, Materials and Metallurgical Engineering 1990
Master's of Science - Stevens Institute of Technology, Materials Science and Engineering 1995

SUMMARY:

Over 15 years of experience in materials engineering with over 12 years of experience in the nuclear power industry. Significant experience in the following areas:

- Materials Engineering
- Corrosion and Control
- Welding and Special Repair Processes
- License Renewal
- Nondestructive testing
- Review of Next Generation Power Plant Designs
- Quality Assurance
- American Society of Mechanical Engineers (ASME) Code Committees

EXPERIENCE:

U.S. Nuclear Regulatory Commission, July 1995 - Present

September 1997 to Present – Materials Engineer, Division of Component Integrity, Office of Nuclear Reactor Regulation

- Member of the Liquid Radioactive Release Lessons Learned Task Force, providing technical expertise on regulatory requirements for systems, structures and components related to radioactive leaks

- ASME Committee member for the working group on implementation of risk-based examinations

- Performed technical reviews related to plant relief requests

- Performed technical reviews related to license amendments including license renewal reviews

July 1995 – September 1997– Reactor Engineer Intern, Office of Nuclear Reactor Regulations

- Completed extensive formal training in nuclear reactor technology t

- Performed a series of developmental assignments throughout the agency to gain a broad perspective of its role.

NOVON Products, a Division of Warner Lambert, Applications Testing Engineer, 1990–1993 1990:

- Responsible for Technical Marketing for the biodegradable polymer productions providing technical data and reports to domestic and international customers.

- Interacted between sales representatives, customers, managers and research staff to develop products and test procedures to identify appropriate materials.

Consolidated Edison, Summer Intern – Summer 1989

- Failure analysis

- Evaluation of nondestructive testing equipment

Stevens Institute of Technology, Teaching Assistant, 1990-1991

- Responsible for research, development and teaching powder metallurgy laboratory class for sophomore level students.

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PREFILED TESTIMONY OF TERENCE L. CHAN

I, Terence L. Chan, do declare under penalty of perjury that my statements in the foregoing testimony and my attached statement of professional qualifications are true and correct to the best of my knowledge and belief.

/Original Signed By/

Terence L. Chan

Executed at Rockville, Maryland
This 29th day of January, 2008.

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PREFILED TESTIMONY OF ANDREA T. KEIM

I, Andrea T. Keim, do declare under penalty of perjury that my statements in the foregoing testimony and my attached statement of professional qualifications are true and correct to the best of my knowledge and belief.

/Original Signed By/

Andrea T. Keim

Executed at Rockville, Maryland
This 29th day of January, 2008.