



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
WASHINGTON, DC 20555 - 0001

May 4, 2007

MEMORANDUM TO: O. Maynard, Chairman, Plant License Renewal Subcommittee

FROM: Maitri Banerjee, Senior Staff Engineer, ACRS **/RA/**

SUBJECT: THE MINUTES OF THE MEETING OF THE SUBCOMMITTEE ON  
PLANT LICENSE RENEWAL REGARDING PILGRIM NUCLEAR  
POWER STATION ON APRIL 4, 2007, IN ROCKVILLE, MARYLAND

A working copy of the minutes for the subject meeting is attached for your review. Please review and comment on them at your earliest convenience. If you are satisfied with these minutes please sign, date, and return the attached certification letter.

Attachments: Certification Letter  
Minutes

cc w Attachments: Pilgrim License Renewal Subcommittee Members

cc w/o Attachments: F. Gillespie  
C. Santos  
S. Duraiswami



May 5, 2007

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
MINUTES OF THE MEETING OF THE SUBCOMMITTEE ON PLANT LICENSE RENEWAL  
REGARDING PILGRIM NUCLEAR POWER STATION ON APRIL 4, 2007,  
ROCKVILLE, MARYLAND

On April 4, 2007, the ACRS Subcommittee on Plant License Renewal held a meeting regarding Pilgrim Nuclear Power Station (Pilgrim) in Room T-2B3, 11545 Rockville Pike, Rockville, Maryland. The purpose of the meeting was to discuss the Pilgrim application for license renewal and NRC staff review of it. In addition to the NRC staff, representatives from Entergy (the Pilgrim operator and the licensee) made presentations to the Committee. The meeting was convened at 10:30 a.m. and adjourned around 3:20 p.m. The meeting was open to the public. No written comments or requests to make oral statements were received from the public related to this meeting. Upon request, a telephone bridge was provided for members of the press to listen in.

## Attendees

<b>ACRS Members/Staff</b>	<b>Entergy Presenters</b>	<b>NRC Staff</b>	<b>Entergy/Other</b>
Otto Maynard (Chairman)	G. Dyckman	L. Lois	J. Thayer
Graham Wallis (Member)	A. Cox	A. Stubbs	J. McCann
William Shack (Member)	F. Mogolesko	R. Auluck	T. White
Thomas Kress (Member)	F. Ulm (MIT/Entergy)	K. Hsu	J. Costedio
J. Sam Armijo (Member)	B. Gordon (SIA/Entergy)	D. Ashley	G. Young
Said Abdel-Khalik (Member)	<b>NRC Staff</b>	Y. Chung	J. Dreyfuss
Mario Bonaca (Member)	L. Lund	R. Matthew	
J. Barton (Consultant)	M. Mitchell	S. Arora	M. Stroud
Maitri Banerjee (DFO)	R. Schaaf	B. Lehman	E. Sanchez
<b>NRC Staff Presenters</b>	K. Chang	E. Davidson	D. Lach
P. Buckberg, NRR	J. Medoff	N. Iqbal	D. Mannai
G. Meyer, RI	D. Harrison	C. Sydnor	H. Metell
J. Davis, NRR	D. Roth	J. Kim	R. Ahrabli
<b>Entergy Presenters</b>	M. Heath	E. Smith	T. Ivy
R. Smith	G. Cheruvenki	B. Rogers	M. Fallin
S. Bethay	D. Nguyen	A. Black	J. Hoffman
B. Sullivan	D. Reddy	D. Jeug	C. Marks
B. Ford	V. Rodriguez	T. Le	M. Gallagher
R. Pace	R. Subbaratnam		W. Teng
T. Griesbach	K. Howard		R. Plasse

The presentation slides and handouts used during the meeting are attached to the Office Copy of these minutes. The presentations to the Subcommittee are summarized below.

Chairman Maynard convened the meeting by introducing the ACRS members present. Mr. Maynard stated that the purpose of the meeting was to review the Pilgrim license renewal application, with particular focus on the unresolved items in the staff's draft safety evaluation. He then called upon the NRR Project Manager, Perry Buckberg, to begin the staff presentation. Mr. Buckberg introduced the NRC staff presenters and the management present, and turned over the presentation to the Pilgrim licensee.

Mr. Robert Smith, General Manager for Pilgrim Plant Operations, introduced the Pilgrim team present to the meeting to support their presentation to ACRS. Mr. Bethay, Director of Nuclear Safety Assurance at Pilgrim, started his presentation by describing the general information related to plant location, design, licensing, and upgrades made to the plant over the years. Mr. Bethay stated that the 16<sup>th</sup> refueling outage starting in a few days has been designated as a license renewal outage to install several plant modifications, upgrades and major equipment replacements. He pointed out that the Pilgrim license renewal application was prepared to address the Revision 1 of the Standard Review Plan for License Renewal and the NRC's Generic Aging Lessons Learned (GALL) report, in addition to in-house and industry lessons learned findings. He stated that the application was peer reviewed by ten utilities in addition to going through the existing Pilgrim safety and quality review processes. Out of the 40 aging management programs Entergy committed to for the period of license extension, 14 existing programs will require enhancement and 10 new programs are required to be developed. Additionally, Entergy is evaluating several cost-beneficial severe accident mitigation alternatives related upgrades for implementation.

Mr Bethay addressed the four open items in the staff's safety evaluation (SE). The first open item involved the security diesel generator and confirming proper scoping of its components in the license renewal program. Mr. Bethay stated that the Region I license renewal inspection reviewed the details and found the scoping, which included all of the security diesel components, to be acceptable.

The second open item involved the inaccessible fire barrier penetration seals, whether all such seals are included in the aging management program. As all such seals are accessible for periodic inspection at Pilgrim, the licensee believes that the open item is resolved pending NRC confirmation.

The third open item in the SE involves the containment and has several issues. The first issue was the potential for corrosion in the inaccessible area of the steel containment shell. Mr. Bethay described the diverse design features provided at Pilgrim to minimize the potential for undetected water intrusion in to the air gap between the containment steel shell and the concrete. He also presented multiple water collection and detection provisions. Entergy has taken steps to ensure these design features are maintained operational, and also verified through inspections (visual, boroscope and limited ultrasonic testing (UT)) that the containment shell is not degrading. Entergy stated that they would continue doing confirmatory UT, in addition to keeping the design provisions operable. The ACRS members asked many probing questions regarding the details of the design, inspections, and licensee's findings.

The other containment open item involved finding of water in the torus room floor. The licensee stated that they had confirmed the source of the water to be ground water coming up around

some of the torus saddle anchor bolt base plates due to hydraulic pressure, and concluded that it has no effect on the integrity of the concrete, embedded steel or anchor bolts in the torus room floor. The hydraulic pressure is caused by the higher water table (about 25 feet above the bottom of the reactor building) due to the geology of the site. The licensee presented various site construction diagrams showing the relative heights of the containment base mat and the ground water level. The licensee has committed to monitor the water, the concrete and the bolts and perform repair of the existing bolt corrosion.

Upon Chairman Maynard's questions, Mr. Bethay indicated that their assessment was based on monitoring of water in the torus room, that comes in and evaporates, and multiple engineering evaluations done over the years. Mr. Bethay showed pictures of various bays in the torus room, with some showing puddles of water, the worst being not of a depth that can be pumped out. Upon questions from the members, Mr. Bethay stated that only a few of the bays have water coming in, and that a small leaching of calcium from the concrete is seen in some of the bays. Upon Dr. Armijo's question, Mr. Bethay also stated that the collection containers from the drain lines in the sand bed region are periodically inspected, and always found dry, hence the containment refueling water drains can not be the source of the torus room water. A chemical analysis of the water also proves it not to be from the refueling pool.

Professor Ulm from MIT was contracted by the licensee to perform an analysis of the base mat concrete condition and cause of the water intrusion. Prof. Ulm stated that uneven heat distribution during construction of the reactor building base mat, when the outer donut structure (torus room base mat) was poured in various sections before the thicker inner core, resulted in stress concentration at the construction joints and ensuing cracks in concrete. He stated the membrane placed under the base mat had failed also. Hence, according to the licensee's analysis, ground water is finding its way through vertical construction joints and localized cracks in concrete and reaching the surface ultimately near the torus saddle support mounting bolts where the concrete is cored out by 2 to 2 ½ feet. Prof. Ulm calculated that a hypothetical cylinder with a diameter of 1/6th of an inch through the base mat in a torus room bay would result in the amount of water that has been seeping in under the hydraulic pressure.

Dr. Wallis questioned if the ground water seeping through the concrete could corrode the anchor bolts. The licensee explained that some amount of corrosion is seen, but small levels of corrosion increases the bonding between the steel and the concrete. However, as corrosion increases some cracking of the concrete around it could happen. So, they plan to do a more detailed inspection of the bolt corrosion. Regarding the reinforcing bars inside the concrete, given the small amount of leak, it is extremely unlikely, even if the whole leak is assumed to be through one 1/6 inch cylinder, that a reinforcement bar will be degraded by this leak, according to licensee's analysis. Given the lower pH value of about 9.4, measured in the torus room water, compared to the higher pH value of 13 for concrete, the licensee opined that concrete dissolution into the seeping water is occurring very slowly, thus, not to impact the structural integrity of the base mat within the license renewal time frame of concern. The small amount of calcium deposited in the bays where water is seeping in indicates a very localized but a slow process of concrete degradation not relevant to the time scale of concern.

The licensee plans to continue monitoring the water (amount, chemistry etc); and inspect a sample of the bolts and the grout around them to verify that the leakage is coming in from the area around the bolts, check the integrity of the bolts and the grout, and take necessary corrective actions. Upon Dr. Wallis' question regarding adequacy of the sample inspection every 10 years committed by the licensee, Mr. Bethay stated that routine (operator) rounds

would look at the bolts, and any changes identified will be addressed through the licensee's corrective action program.

The fourth open item involved the lack of benchmarking data to support plant specific neutron fluence calculations for use in time limited aging analyses (TLAAs). There was a significant difference between the fluence values indicated by Pilgrim reactor vessel surveillance capsule pulled during the 4<sup>th</sup> refueling outage and the fluence values predicted by the RAMA computer code. In addition to impacting the neutron embrittlement TLAAs, this problem impacts the modified TLAAs that use the acceptable fluence values as a basis for determining compliance with regulations. These additional TLAAs are the pressure-temperature limits, Charpy upper-shelf energy, adjusted reference temperature, reactor vessel circumferential weld inspection relief, and reactor vessel axial weld failure probability. This problem also impacts the current licensing basis in the pressure temperature curves, but the licensee stated that the current curves are validated through cycle 18 (year 2011 refueling outage) by using a conservative bias to account for the discrepancy. The licensee committed to provide a resolution plan by September 2007, and submit calculations demonstrating compliance with RG 1.190 by June 2010 to support startup from cycle 18. They are planning to pull another capsule during the upcoming 16<sup>th</sup> refueling outage. This capsule has been in the vessel much longer than the prior capsule pulled. The licensee is going to a sister plant also for additional capsule data, and reviewing the power history and other data input to their calculation, such that they are able to benchmark the RAMA code for Pilgrim before cycle 19. If a problem with the code is identified, the NRC may need to re-perform its review that approved the code.

Dr. Bonaca asked if the industry expected to develop appropriate tools for inspecting inaccessible in-vessel welds on the core spray piping and the jet pump assembly (in near future). The licensee stated that their probabilistic fracture mechanics analyses show the risk of failure for these welds to be within acceptable limits, thus justifying not doing inspections. These analyses have to be redone with higher fluence level for extended operation.

Dr. Bonaca also asked about the status of the service water cables in light of the problems identified with inaccessible medium voltage cables. The licensee stated that accessible portions of same type of cable are inspected at other locations and that industry data have not identified the service water system cables at voltage level of 480 volts (which are not considered as medium voltage) to be susceptible to the water intrusion issue. Mr. Duc Nguyen, NRC staff, stated that the service water cable voltage of concern will be treated as low voltage cables, and that NRC has issued a generic letter requesting information from the licensees regarding surveillance of inaccessible low voltage cables. Resolution of this issue through the Generic Letter process will be carried over to the license renewal period.

Mr. Barton of ACRS questioned the licensee's conclusion in their license renewal application that aluminum components, exposed to the external salt environment, have no environmental aging. Mr. Barton mentioned the experience of plant trips due to salt buildup in switchyard components. The licensee explained that the insulators in the switchyard are replaced with ones with protective coatings and there has not been a plant trip due to salt deposits on insulators. Also they credited the aggressive monitoring, repair and preventive maintenance program for this success. The licensee stated that salt deposits are much affected by weather conditions and not considered an aging effect, and thus independent of license renewal. The licensee also stated that the station blackout diesel exhaust silencer is the only aluminum component of concern in outdoor environment, and it has been found to have no significant degradation to its structural adequacy.

Mr. Barton also questioned the lack of an aging management program for fuse holders. Mr. Nguyen from the staff noted that the NRC had issued guidance regarding this matter in 2001, and considered fuse holders outside the fuse panel to require aging management review. Since Pilgrim has none outside the fuse panel, they are not subject to aging management review. Mr. Barton also questioned the adequacy of one time UT of the bottom of the condensate storage and diesel fuel tanks that sit on sand beds. The licensee pointed out that these tanks are subject to periodic visual inspection for corrosion inside and outside and maintenance review, in addition to the confirmatory UT. Also, these carbon steel tanks are lined inside, with a relining and UT scheduled for 2008.

Dr. Abdel-Khalik asked about potential corrosion of the containment liner below the floor level due to leak from components above the floor. The licensee explained that the concrete floor is bonded to the steel liner, and UT results at points on the junction of the floor to the liner and up to one inch below have shown no degradation. These confirmatory measurements are to be continued in the future. Dr. Abdel-Khalik was concerned about the potential corrosion of the torus wall. The licensee pointed out that they have an active program of inspecting the inside torus wall and doing necessary restoration of the coating every other outage. Although the same exact locations may not be UT measured at the next outage, the licensee stated that the visible nature of the corrosion provides confidence that the program is effective in identifying degradation. Also, the licensee compares data with another plant (Fitzpatrick) of same vintage to ensure the coating is appropriately maintained.

Mr. Perry Buckberg, the NRR license renewal project manager for Pilgrim, provided an overview of the staff's license renewal review, audit and regional inspections at the plant. The audit was performed by a team of NRC staff and contractors. The audit team confirmed the licensee's scoping and screening methodology and the adequacy of the scope of systems and structures within the license renewal program. The open item related to the security diesel was reviewed by the regional inspection and closed.

The ACRS members asked if the clarity of the regulatory guidance regarding the scope of the license renewal program was adequate. This question arose due to the licensee's addition to the scope as a result of staff review. The staff stated that the identification of equipment function and environment had a role in it, and not the clarity of guidance.

Mr. Glenn Meyer, team leader of the Region I inspection team, provided a summary of their inspection regarding the license renewal program scope and implementation of the aging management program. Upon members' questions he stated that the licensee's characterization of water in the torus room matched the finding of his inspection team, and that it is not unusual to find a small amount of moisture in the torus room. Regarding the location of the catch containers (buckets) for the containment refueling water drains, the licensee stated that the buckets are in place since 1987, but one has to crawl under the torus to find them. During refuel outages, the licensee performs a visual inspection of the buckets to confirm that they are dry, and document the results.

Mr. Meyer stated that their inspection found some incorrect boundaries regarding structural interaction between safety and non-safety system components. Once identified, the licensee resolved the issue to the team's satisfaction. The team identified that a flow switch that monitors the containment refueling water leak had failed, which was later repaired. Region I

plans to do another round of inspections before the period of extended operation to ensure the issues and licensee commitments are addressed. Mr. Meyer ended his presentation with a discussion on the licensee's current performance and that it was in the licensee response column. Mr. Meyer also stated that he believed that the licensee's system engineers at Pilgrim are knowledgeable and provides a generally effective program of identifying problems in the field and addressing them.

Dr. Bonaca asked if the GALL report is forcing the use of request for exceptions from the licensees and ensuing staff evaluations that could be avoided if GALL were not so prescriptive. The staff pointed out that they have been tracking and compiling individual use of acceptable exceptions that would be factored into the next update of GALL, thus making exception requests unnecessary. The staff has been made aware of this list for use in license renewal application review and audits.

Dr. Jim Davis presented the findings of the audit team. Dr. Davis pointed out that although many of the licensee's commitment implementation dates are coincident with the end of the current license, many of the commitments are expected to be completed prior to that date. As there are no inaccessible fire seals at Pilgrim, that open item was readily closed. Dr. Shack questioned if at least 10 percent of each type of fire seals are being inspected. The licensee pointed out that given the large number of each type of seals in the program, a random selection of 20 percent of all seals is expected to include at least 10 percent of each type.

The members asked for earthquake experience at the plant, and the licensee pointed out that the year 1860 earthquake was the plant's design basis. Dr. Ulm stated that he had done an analysis to determine the effect of the earthquake on the reactor building base mat, and the results show slightly higher water intrusion in the torus room, by about 33 percent (or six liters) over the normal operating conditions and no damage to the structural performance of the base mat.

In his presentation regarding closure of the open item on neutron fluence, Mr. Buckberg pointed out that the licensee is expected to propose fluence limits regarding the affected TLAA's and confirm adequacy of those limits via an acceptable method. The staff would impose a license condition to ensure adequate resolution of this open item prior to the period of extended operation.

Chairman Maynard then proceeded to identify items that would need to be discussed at the upcoming Full Committee meeting in September. He identified the neutron fluence issue and the torus room water intrusion issue to be definite items for the meeting. Dr. Abdel-Khalik stated that a more realistic calculation for the amount of water leakage may be helpful. Dr. Shack asked if any attempt has been made to identify the exact locations with the amount of water getting in. The licensee pointed to one of the pictures of bay no. 10 that showed a tented enclosure. The licensee stated that a berm was built around one of the anchor bolts and tented to capture the leak without any other condensation dripping into it. The location was completely dried and the licensee recorded the time it took for water to reappear there. Their calculation showed a leakage rate higher than that would be for the theoretical permeability of concrete, thus proving the existence of a flow path.

Dr. Bonaca pointed out that in addition to the two issues mentioned above, a presentation on the license renewal inspection may be of interest to the Full Committee. Dr. Abdel Khalik stated

that he would like to know about the licensee's processes for performing the benchmarking of the fluence code for Pilgrim (in more detail). Dr. Lois of the staff indicated that the staff had experienced similar problems before (problem with accurately identifying the location of the surveillance capsule after it is pulled, given the steep gradient of the fluence value with location), and was able to successfully resolve them. Dr. Armijo and Dr. Abdel-Khalik asked that the staff include their experience in resolving similar prior problems in their presentation to the Full Committee. Although Dr. Shack felt that the staff appeared to have a well defined process for resolving the fluence issue, Dr. Kress wondered why other BWR results could not be used to validate the RAMA code for Pilgrim fluence. Dr. Lois from the staff answered that the type of the reactor makes a big difference for BWRs, and Pilgrim is the first BWR3 providing only one data point. Mr. Barton of the ACRS stated that the licensee's application was well prepared in that it was easy to follow.

Dr. Wallis noted that he would have expected the licensee to clarify the torus room water issue in their application for license renewal, as it is a long standing issue, and not wait for an NRC inspection to identify it. Chairman Maynard and Mr. Barton noted that it is not uncommon to find water in some areas of the plant like the torus room (writer's note: they were probably hinting at condensation from the air due to lower area temperature and infrequent but potential small pipe leaks). Dr. Davis of the staff pointed out that the interim staff guidance on containment shell degradation requires an inspection of the torus room for water, thus making the staff more sensitive to the issue of water intrusion. Ms. Lund from NRR management noted the value of a license renewal inspection.

Chairman Maynard adjourned the meeting by thanking everyone attending the meeting.