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Union of Concerned Scientists

Citizens and Scientists for Environmental Solutions

May 10, 2007

Luis A. Reyes
Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: SUPPLEMENT TO PETITION PURSUANT TO §2.206 – PROTECTION AGAINST CONTROL ROD DRIVE MECHANISM (CRDM) NOZZLE LEAKAGE FAST CORROSION SCENARIO OR MORE FIRSTENERGY FALSEHOODS

Dear Mr. Reyes:

On April 30, 2007, I filed a 2.206 petition seeking actions contingent on an independent review by the Nuclear Regulatory Commission (NRC) of a report prepared by consultants to the FirstEnergy Nuclear Operating Company (FENOC). This report is available in ADAMS under ML070860211.

By memo to Michele G. Evans dated May 4, 2007, William H. Cullen and Jay W. Collins provided their assessment of the FENOC-submitted report. Cullen and Collins concluded "*that current RPV head inspection requirements under the First Revised NRC Order EA-03-009, dated February 20, 2004, are adequate to identify primary water stress corrosion cracking prior to development of significant head wastage*."

Cullen and Collins might be right. But the late Dr. Pietro Pasqua, head of the department of nuclear engineering at the University of Tennessee when I obtained my bachelor of science degree, often said, "*Having the right answers is only okay when all of the right questions have been asked.*" Cullen and Collins have answered but one of the many right questions raised by the FENOC-submitted report.

Examples of the right questions not answered include:

1. Is primary water stress corrosion cracking the ONLY failure mode leading to significant head wastage?

2. Is the probability of detection 100 percent when the NRC-mandated inspections are performed?

3. If PWSCC is not the only failure mode and/or the probability of detection less than 100 percent, what is the protection from the fast corrosion scenario outlined in the FENOC-submitted report?

It is highly unlikely that primary water stress corrosion cracking (PWSCC) is the only failure mechanism of concern. Just like it was flat-out wrong for the NRC staff to single-mindedly focus on the structural integrity of control rod drive mechanism (CRDM) nozzles and the associated probability of control rod

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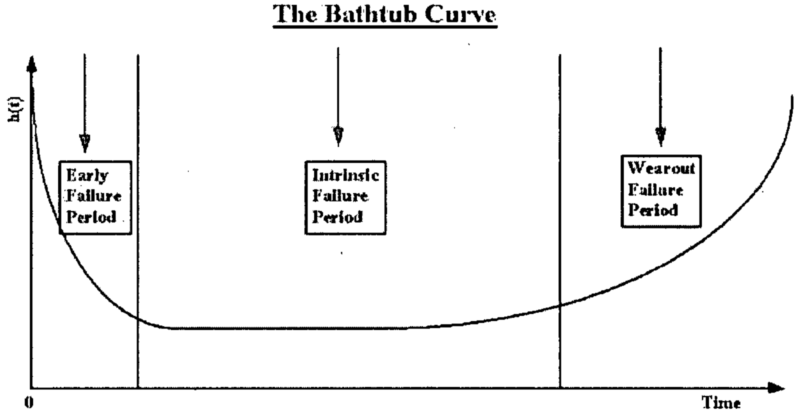
ejection events back in fall 2001, the NRC staff is equally wrong now to focus solely on PWSCC at the exclusion of all other failure modes leading to vessel head penetration nozzle cracking and leaking. NRC Information Notice 2003-02, "Recent Experience with Reactor Coolant System Leakage and Boric Acid Corrosion," dated January 16, 2003, described a reactor vessel head wastage event at Sequoyah Unit 2 caused not by PWSCC but by a leaking compression fitting. This information notice also described a leak at Comanche Peak Unit 1 caused not by PWSCC but by a CRDM nozzle seal weld failure. NRC Information Notice 2003-11 Supplement 1, "Leakage Found on Bottom-Mounted Instrumentation Nozzles," dated January 8, 2004, described two leaks discovered at South Texas Project Unit 1. This information related information from the licensee's analysis of evidence including boat samples from the flaw regions that collectively *"points toward a scenario which is not dependent on PWSCC initiation."*

Many licensees have opted to replace the reactor vessel heads at their facilities. While such replacements reset the clock with regard to the NRC-mandated CRDM nozzle inspection frequency and scope, they do not prevent failure modes other than PWSCC. As you likely recall, failure rate versus time is illustrated in what is called the bathtub curve due to its shape. The NRC-mandated inspections of CRDM nozzles are intended to manage the risk from the right side of the bathtub curve, the wear-out region. But replacement of reactor vessel heads and associated CRDM nozzles invokes the left side of the bathtub curve, the early failure region. Failures in this region are not dominated by PWSCC but by failure mechanisms stemming from material defects, manufacturing errors, installation problems, and the like.

<u>The Bathtub Curve</u>



And the bathtub curve is not merely academic theory, it's all too real. NRC Information Notice 2006-04, "Design Deficiency in Pressurizer Heaters for Pressurized-Water Reactors," dated February 13, 2006, described the fall 2004 replacement of 36 pressurizer heaters at Palo Verde Unit 3 with brand new units. By February 2005, ten percent of the new heaters had failed. By May 2005, 25 percent of the new heaters had to be replaced. By June 2005, all of the new heater units installed during the fall 2004 outage had to be replaced. Waterford had similar experience when all of the new pressurizer heaters installed during a spring 2005 refueling outage promptly failed. The problem was that *"the heaters had been incorrectly fabricated with a longer heating element ... [that] extended down into the heater sleeves and pressurizer shell thereby changing the location of the transition joint that separates the heated and unheated portion of the heater assembly."* NRC Preliminary Notification of Event or Unusual Occurrence PNO-III-06-010 dated April 7, 2006, described cracking in the steam dryer at Quad Cities Unit 2 that had been installed in May 2005 to replace the original steam dryer that had been worn out by increased vibrations resulting from the extended power uprate. The replacement steam dryer had *"one large crack, approximately 5 feet in length ... believed to have been causing by binding difficulties during the initial installation."* The NRC's files are filled to overflowing with accounts like these of problems caused by replacement parts having material imperfections, design errors, or installation miscues – in other words, events drawing the left-hand side of the bathtub curve.

It seems evident that PWSCC is not the only failure mechanism leading to leakage of borated water onto the unprotected surfaces of carbon steel reactor vessel heads. But rather than puts words into the NRC's mouth, we'll await the NRC's answer to this right question when its independent review of the FENOC-submitted report is concluded.

The NRC-mandated CRDM nozzle inspection frequency and scope provides adequate protection against PWSCC if and only if the probability of detection is 100 percent or very close to it. NRC Information Notice 2000-17 Supplement 2, "Crack in Weld Area of Reactor Coolant System Hot Leg Piping at V. C. Summer," dated February 28, 2001, described a event where workers examined a pipe weld for cracking but missed indications that were present and ultimately led to through-wall cracking and leaking. The first-ever red finding issued under the NRC's Reactor Oversight Process went to Indian Point 2 because a steam generator tube leak in February 2000 had been caused, in large part, by inspection inadequacies that detected but misdiagnosed crack indications in the tube that failed that should have evoked its repair or replacement. The NRC's files are filled with accounts like these of well-intended inspections that looked in the wrong places or looked in the right places with the wrong monitoring equipment with the result that compromised safety margins were not identified and corrected.

It seems evident that the probability of detecting PWSCC, if it is present, is not 100 percent. We will await NRC's answer to this right question, too.

If PWSCC is not the only failure mode and the probability of detecting PWSCC is less than 100 percent, the CRDM nozzle inspection scope and frequency currently mandated by the NRC may not provide adequate protection against the fast corrosion scenario presented in the FENOC-submitted report. After all, the what-if study performed by Oak Ridge researchers for the NRC concluded that the as-found hole in the reactor vessel head at Davis-Besse was 2 to 11 months away from rupturing. If the 14 to 18 week period outlined in the FENOC-submitted report (e.g., the time from October / November 2001 to February 2002 that the report suggests created the football-sized hole) is added to this ORNL estimate, it means the loss of coolant accident timeline is on the order of 4 ½ to 15 ½ months – shorter than the 18 to 24 month operating cycles at nuclear power plants and thus shorter than the most intrusive, most aggressive inspection frequency.

Thus, it seems to us that the only way for the second requested action sought in our April 30, 2007, petition is not necessary is if the fast corrosion scenario has no merit or if PWSCC is the only credible failure mechanism and the probability of detecting PWSCC is 100 percent. But we will await the NRC's answers.

Sincerely,

David O. Lochbaum

David Lochbaum
Director, Nuclear Safety Project