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Chairman Nunzio J. Palladino
Nuclear Regulatory Commission
Washington, DC 20555

Dear Joe:

First, I would like to express my appreciation for the opportunity that the EPRI group had to present a status report on our work to you and the other members of the Commission. As was evident at the close of the meeting, we plan to stay in close touch with the staff, and to present an update of our work at the same time as the staff briefs the Commissioners again this summer.

I feel badly about leaving so abruptly. Having just been transplanted to the West Coast, I have begun to appreciate the difficulties of travel. Our dash to Dulles Airport really meant the difference between having Wednesday as a productive day in the office and losing it. As it turned out, we just made our plane with about 10 minutes to spare. We felt that our presentation was important and represented a calculated risk, and that we could lose a day if necessary. However, we were led to believe that we would only have the hour from 2:30 to 3:30 and that would have given us ample time to make a 5:30 flight.

Warm prestressing is not a simple phenomenon and, personally, I found it was helpful to listen to a presentation by persons expert in this area. I have tried to summarize the subject below, and have had my statements reviewed by Ted Marston as well as by Doug Norris, our resident lecturer on fracture mechanics at EPRI:

Experiments have shown that shallow cracks are arrested and deeper cracks do not tend to extend as they are calculated to using direct application of standard fracture mechanics equations. Warm prestressing is the term used to identify situations in which the time of maximum stress intensity at the tip of an existing crack occurs some time before the temperature at that point is reduced very much. By the time the crack tip cools below a critical toughness transition temperature, the load has decreased and the crack is not driven further. The tough material may yield a little, blunting the crack tip. Then when it cools, even into a brittle range, there is no longer enough stress intensity for crack propagation. Sometimes people say that warm prestressing raises the effective fracture toughness. It also applies to the observation, which is supported by fracture mechanics theory, that when the crack-driving force is decreasing, it is impossible to initiate the new flaw, even if the material resistance falls below the driving force.

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In reviewing the discussions of the day, I am struck with the fact that we may have been talking at cross-purposes on several occasions. Let me list them:

One of the vendors analyzed the implications of an operator turning off the main coolant pumps 30 seconds after a transient event. This is theorized to be a conservative case. What the presenters were trying to explain was that after a transient, the operators might turn off the cooling pumps. The sooner they do it, the more significant the temperature transient at the vessel wall will be. Just because of the nature of the actions that might take place, it is considered unlikely that an operator would turn off the pumps faster than 30 seconds following the accident. Nevertheless, 30 seconds was chosen as the time for this action in order to make it a conservative calculation. In reality, the operator might turn off the pumps after 5 or 10 minutes. Somehow this point was not adequately explained. What the analyst had done was take 30 seconds as a worst-case; that is, the soonest that an operator might turn off the pumps. Anything that would involve a longer time to act produces a less severe temperature transient.

On the way to the airport, we discussed our impressions, and it was our general feeling that there was still an effort on the part of the Commission, or at least certain members of it, to come up with a quick zero-cost fix. There is no such thing. But most important, I surmised from the discussion that some of the Commissioners are not aware of how complex their own regulations are with regard to licensing of reload cores. The industry has been begging for years to remove the review of reactor core reloads from the licensing process. Its very susceptibility to this process introduces a long lead-time and a tremendous amount of paperwork, but even more important an uncertainty that for some reason a proposed reload would not be permitted, or might be delayed unexpectedly. This should not be news to the Commissioners, but it has been a continuing problem for utilities. Reloads have to meet certain requirements; these are well understood, and the calculations necessary to show that they do meet the requirements are extensive but not particularly controversial. At the same time, the regulatory process requires an extensive review, public notice and the opportunity for interventions. In only rare cases have interventions been attempted, because the issue is one involving a substantial amount of technical knowledge, and by the time the utility and its consultants prepare a reload submittal, there is good confidence on the part of all that the submittal will meet the requirements. Nevertheless, the potential for rejection or delay remains. This has in the past discouraged some utilities from employing innovative and cost-effective ideas.

This subtle negative influence impacts the decisions by utilities concerning 18-month fuel cycles and possible fuel management schemes that might reduce the flux at the vessel wall. Dr. Gilinsky indicated his interest in why utilities did not make immediate adjustments in order to reduce potential end-of-life exposures. Part of the answer is that these changes require extensive engineering work and analysis, a long time, and carry with them the potential for opening of a licensing issue - something no utility eagerly seeks.

Lest I leave a misimpression, I can recall work done at Commonwealth Edison several years ago to evaluate the attractiveness of a change from a 12- to an 18-month refueling cycle. We decided to go ahead with it at Zion. We decided not to go ahead with it at Dresden and Quad Cities. Moving to an 18-month cycle is not an obvious economic winner. It can be, but there are a number of important considerations that must be evaluated. One of these is the impact of NRC requirements for in-service inspection or anything else that might force a shutdown on a 12-month cycle. In addition, the increased requirements for enrichment and the somewhat increased probability of fuel failure in an 18-month rather than a 12-month exposure all have to be weighed in the balance. The result was that for the BWRs, Commonwealth Edison found that it was not attractive to go to an 18-month cycle at this time.

Similar considerations must be examined in great detail, even for the seemingly simple idea of inserting dummy fuel assemblies at the edge of the core. This does not occur without significant penalty in capacity, and it is anything but a zero-cost option. If it is not necessary, in order to keep the end-of-life estimated exposure below the target number, there is no reason why any utility should attempt it. I'm afraid I am worried that the complexity, expense and potential exposure to licensing actions involved in significant changes in fuel reload plans are not fully appreciated by the members of the Commission, despite a number of efforts on the part of the industry over the past several years to make this point.

With regard to operating procedures, those that are in place generally are designed to assure that the core remains covered, and that thermal transients of any significance are avoided. Perhaps that is why there was a hesitance on the part of the group to be explicit in response to some of the questions. In general, the existing procedures are adequate. However, we recognize that there may be exceptions, and there also may be ways in which procedures can be improved, especially considering the kinds of new developments in safety panel display systems and other operator aids that will provide better information to the operator than could have possibly been available years ago. Of utmost importance is that the real safety concerns be observed. It would be unfortunate if an operator chose to restrict cooldown in order to protect the pressure vessel from some hypothetical temperature transient and in fact permitted the core to become uncovered. Reactor safety and core integrity are the prime concerns. Pressure vessel thermal shock, while important, has been handled conservatively. It must of necessity be important to the operators, yet secondary to keeping the core covered.

I am looking forward to the opportunity this summer for EPRI to present more updated information for use by the Commission.

Sincerely,

A. David Rossin

A. David Rossin, Director
Nuclear Safety Analysis Center

ADR:jh