RAS 1732

May 15, 2000

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
CAROLINA POWER & LIGHT	)	Docket No. 50-400 -LA
(Shearon Harris Nuclear	)	ASLBP No. 99-762-02-LA
Power Plant)	)	
	)	

ORANGE COUNTY'S RESPONSE TO MAY 5, 2000, MEMORANDUM AND ORDER (REQUESTING ADDITIONAL INFORMATION)

Introduction

Pursuant to the Board's Memorandum and Order (Requesting Additional Information) (May 5, 2000), Orange County hereby submits its views regarding the relevance to this proceeding of a recent Advisory Committee on Reactor Safeguards ("ACRS") letter to the NRC Commissioners. Letter from Dana A. Powers, ACRS, to Hon. Richard A. Meserve, NRC, re: Draft Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants (April 13, 2000) ("ACRS Letter"). Although the ACRS Letter focuses on decommissioning plants only, and overlooks some key aspects of spent fuel pool accident behavior, on the whole it reinforces the County's claim that the NRC Staff does not properly understand the potential for exothermic reactions in spent fuel pools.

Discussion

The ACRS Letter provides comments and recommendations regarding the NRC Staff's Draft Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants ("Draft Technical Study"). Most significantly for purposes of this proceeding, the ACRS questions the adequacy of the Draft Technical Study to support the Staff's findings regarding the probability

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and consequences of exothermic reactions in spent fuel pools. The ACRS, like the Staff, assumes a situation in which water is completely and instantaneously drained from a pool. In that context, the ACRS's concerns about the inadequacy of the Staff's analysis of the outcome of pool drainage are applicable to the Harris plant, because there is no important distinction for these purposes between an operating plant and a decommissioning plant. In particular, the ACRS makes the following criticisms that are relevant to this proceeding:

(1) The radioactive release (source term) from a pool dryout could contain much more ruthenium and other elements than the Staff has estimated. ACRS Letter at 2-3.

(2) The Staff has incorrectly assumed that the plume rising from the pool would be narrow and low-rising. *Id.* at 3.

(3) The Staff has ignored the potential for spontaneous, exothermic combustion of zirconium hydrides in air. This phenomenon could considerably extend the age after discharge at which fuel could ignite. *Id.* at 3.

(4) The Staff has ignored the potential for an exothermic nitrogen-zirconium reaction. This reaction would have two effects. First, it could increase the total heat produced under ventilation-limited conditions. Second, it could cause zirconium-air reactions to be especially vigorous, because it causes shedding of the protective oxide layer on the cladding. Both effects could extend the age at which fuel could ignite. *Id.* at 3.

(5) The Staff has not developed appropriate criteria for determining if a dangerous fuel condition (*e.g.*, cladding rupture) would arise after pool dryout. *Id.* at 4.

(6) The Staff has ignored the potential for exothermic intermetallic reactions (e.g., aluminum with stainless steel). *Id.* at 4.

(7) The Staff has not performed uncertainty analyses for accident scenarios involving human error or earthquake. *Id.* at 4-5.

The ACRS letter identifies three types of exothermic reaction (spontaneous combustion of zirconium hydride in air, the aluminum-stainless steel reaction, and the zirconium-nitrogen reaction) that have been ignored by the Staff. *See* NRC Staff's Reply to Orange County's Response to the Board's Request for Additional Information, at 3 note 2 (April 5, 2000), in which the Staff rejects the County's use of the phrase "exothermic reaction," in favor of the phrase "zirconium fire."[1] This choice of language is indicative of the Staff's unacceptably narrow range of thinking.

The deficiencies identified by the ACRS are numerous and significant. Notably, they are also *in addition to* the other deficiencies observed by the County and gaps in information acknowledged by the NRC Staff itself. *See* Orange County's Response to Board's Information Request at 4-9. Taken together, the problems identified in the ACRS Letter and the County's comments fatally undermine any reliance on the Draft Technical Study, and raise fundamental questions about the reliability of the Staff's analytical approach to the entire question of the risks of spent fuel storage, at both decommissioning and operating nuclear plants.

The County considers the ACRS Letter to be deficient in one crucial respect, namely that is that it does not discuss the phenomenon of partial pool drainage. A situation of complete and instantaneous drainage should be analyzed, but only as part of a broader analysis that includes situations where the water level is falling, static or rising and the lower part of the fuel assemblies is submerged. We have raised this issue with the ACRS through our expert, Dr. Gordon Thompson.

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[1] Incidentally, both the Staff and the ACRS have ignored the steam-zirconium reaction, which will occur in the partial drainage case.

See attached letter from Dr. Gordon Thompson, IRSS, to Dr. Dana Powers, ACRS re: The Potential for Release of Radioactive Material from Spent Fuel Pools (May 15, 2000).

Because it focuses only on decommissioning plants and not operating plants, the ACRS letter sheds no light on whether a degraded-core reactor accident with containment failure or bypass will, as the County claims, almost certainly cause adjacent pools to lose water by evaporation.

Respectfully submitted,

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May 15, 2000

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15 May 2000

Dr Dana A Powers
Chairman
Advisory Committee on Reactor Safeguards
US Nuclear Regulatory Commission
Washington, DC 20555-0001

Dear Dr Powers:

Re: The Potential for Release of Radioactive Material from Spent Fuel Pools

I have noted your letter of 13 April 2000 to NRC Chairman Meserve, conveying the views of the ACRS on the NRC Staff's February 2000 Draft Final Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants.

In its study, the NRC Staff has set forth technical findings on the accident risk posed by spent fuel pools, and has recommended a regulatory position. Your letter shows that the Staff has done this without having first acquired an effective understanding of the relevant scientific issues.

Spent fuel pools contain large inventories of long-lived radioactive material. If a substantial fraction of the radioactive inventory of a pool were released to the atmosphere, the offsite consequences could considerably exceed the consequences from the 1986 Chernobyl accident. Thus, it is the NRC's duty to regulate spent fuel pools in a manner that draws upon the best attainable scientific understanding of the risk posed by these pools. That duty applies equally to pools at operating and decommissioning plants.

Although your letter was prepared in the context of decommissioning plants, the scientific issues that you address are equally applicable to pools at operating plants. Thus, your comments about the inadequacy of the Staff's February 2000 Draft Study could equally apply to previous Staff studies that have been prepared in the context of pools at operating plants. If those previous studies were found to exhibit the same inadequacies as you identify in the February 2000 Draft Study, it would follow that the NRC lacks an effective scientific basis for any of its regulations that affect the accident risk posed by spent fuel pools.

In light of these considerations, the ACRS should use the powers and resources at its command to take actions of two types. First, the ACRS should independently investigate the state of scientific understanding of the accident risk posed by spent fuel pools at operating and decommissioning plants. Second, the ACRS should recommend that the NRC immediately initiates a comprehensive investigation of the state of knowledge on scientific issues that are relevant to the accident risk posed by spent fuel pools at operating and decommissioning plants. Both investigations should draw upon scientific capabilities outside the ACRS and the NRC.

As a source of relevant information, I enclose a February 1999 report that I prepared for Orange County, North Carolina, and which has been filed with the NRC Licensing Board in support of contentions that seek an EIS on the risks posed by expanded spent fuel storage at the Harris nuclear power plant. Although the report was prepared in the context of the Harris plant, it contains material that has generic applicability. The report has a limited scope, and does not purport to provide definitive analysis on the issues that it addresses. Nevertheless, the report identifies two issues that significantly affect the accident risk posed by spent fuel pools, but have been neglected by the NRC.

One issue is the effect on spent fuel pool accident scenarios of situations in which fuel is partially exposed to air. If water is lost from a pool by draining or evaporation, there must be a period in which fuel is partially exposed. In fact, scenarios for water loss could involve a falling, static or rising water level at various times, potentially leading to extended periods of partial exposure. Convective heat transfer by air will be inhibited during partial exposure of fuel assemblies packed at high density, and the steam-zirconium reaction will be more significant than the air-zirconium reaction. These factors have been neglected in NRC studies.

The second issue is the potential for a spent fuel pool accident to be initiated by a degraded-core reactor accident with containment failure or bypass. The reactor accident could involve a loss of cooling to an associated spent fuel pool, and the radioactive material released by the reactor accident would almost certainly preclude access by personnel for the purpose of restoring pool cooling. Water would then be lost from the pool by evaporation. Scenarios of this type have been neglected in NRC studies.

If you or other members of the ACRS wish to discuss any of the abovementioned matters with me, I would be pleased to do so.

Thank you for your attention.

Sincerely,

G. R. Thompson

Gordon Thompson
Executive Director

Enclosure: "Risks and alternative options associated with spent fuel storage at the Shearon Harris nuclear power plant", a report prepared by Gordon Thompson for Orange County, NC, February 1999.

cc (with enclosure): Richard A Meserve
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CERTIFICATE OF SERVICE

I certify that on May 15, 2000, copies of the foregoing ORANGE COUNTY'S RESPONSE TO MAY 5, 2000, MEMORANDUM AND ORDER (REQUESTING ADDITIONAL INFORMATION) were served on the following by e-mail and/or first class mail as indicated below:

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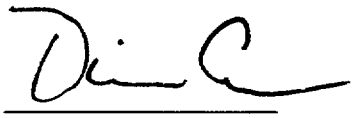

Diane Curran