UNION OF
CONCERNED
SCIENTISTS

November 12, 1999

Mr. William C. Huffman, Project Manager
United States Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: **NUCLEAR POWER PLANT DECOMMISSIONING**

Dear Mr. Huffman:

The chairman of the NEI task force on decommissioning made several statements in prepared remarks and in responses to questioning during the November 8, 1999, Commission briefing that conflict with our perspectives. Since I may not be able to attend the upcoming meeting to explore these areas, I provide the following written rebuttals to those statements:

- Statement: NUREG-0612 is not a decommissioning issue because the plants are carrying forward all applicable commitments.

  Rebuttal: NUREG-0612 is an issue if a nuclear power plant owner changes the heavy load design and licensing bases. Owners satisfied NUREG-0612 either through reliance on a single-failure proof crane or through safe load pathways. Safe load pathways were defined as pathways along which a heavy load could be dropped without resulting in damage to safety related equipment.

  During decommissioning, many plant owners are opting to isolate the spent fuel pool and its cooling system from the rest of the plant. At most facilities, the spent fuel pool cooling system is classified as a non-safety related system. Reg Guide 1.13 and Standard Review Plan 9.1.3 permitted non-safety related spent fuel pool cooling systems as long as there was a safety related makeup system. During decommissioning, the safety related makeup systems are apparently being isolated from the spent fuel pool island.

  Consequently, a heavy load could be carried along the safe load pathway over non-safety related piping and components of the spent fuel pool cooling system. If that load were dropped, it could totally disable the spent fuel pool cooling system. There would be no cooling system and no makeup system for the spent fuel pool.

  In summary, NUREG-0612 is very much an issue during the decommissioning of any nuclear power plant equipped with a non-safety related spent fuel pool cooling system if that plant used the safe load pathway option to satisfy NUREG-0612.

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- Statement: The NRC staff's end state of fuel uncovery in the spent fuel pool (without zirc fire) is meaningless because there can be no offsite consequences for this condition.

  Rebuttal: Title 10 of the Code of Federal Regulations protects public health and safety. It also protects nuclear power plant workers from adverse health consequences caused by radiation exposure. Even if it were true that uncovering irradiated fuel assemblies in a spent fuel pool posed no risk to any member of the public, this condition represents a very significant radiation threat to plant workers.

  NRC Bulletin No. 94-01 described a potential spent fuel pool problem at the permanently closed Dresden Unit 1 facility. In the subsequent analysis of that event, it was determined that the spent fuel pool water could have been drained down until the upper few feet of the irradiated fuel were uncovered. The decay heat level would not have caused fuel damage, but the radiation field at the spent fuel pool railing was estimated at 733 Rem per hour. The radiation fields were considered high enough to impair operator actions on nearby Dresden Units 2 and 3.[1]

  Northeast Utilities examined Millstone Units 1, 2, and 3 plants for the type of reactor cavity seal failure experienced at Haddam Neck. They determined that the Millstone Unit 1 spent fuel pool water level would drop to 20 inches above the irradiated fuel assemblies in 11 minutes with the resulting radiation fields estimated to be 2.4 *million* rem per hour at the spent fuel pool railing and 65 rem per hour on the refueling floor. On Millstone Unit 2, the spent fuel pool water level would drop to 12 inches above the irradiated fuel assemblies in 80 minutes with the resulting radiation fields estimated to be 4 *million* rem per hour at the pool railing and 54 rem per hour on the refueling floor. On Millstone Unit 3, the spent fuel pool water level would drop to 21 inches above the irradiated fuel assemblies in 120 minutes with the resulting radiation fields estimated to be 1.9 *million* rem per hour at the pool railing and 37 rem per hour on the refueling floor.[2]

  In summary, the NRC staff should not discard the end state of fuel uncovery without zirc fire. Instead, the NRC staff should expand its evaluation to consider potential radiation threats to plant workers.

- Statement: The NRC staff does not give industry credit for self-revealing high humidity conditions that would result from spent fuel pool heatup.

  Rebuttal: The industry's track record dealing with self-revealing problems does not warrant "credit." If anything, "debits" should be imposed. Some of the examples from the industry's track record:

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[1] Nuclear Regulatory Commission Operating Reactors Events Briefing 94-06, "Dresden Unit 1 Cold Weather Impact on Decommissioned Reactor Facility", February 9, 1994, and
Nuclear Regulatory Commission Bulletin No. 94-01, "Potential Fuel Pool Draindown Caused by Inadequate Maintenance Practices at Dresden Unit 1", April 14, 1994, and
Nuclear Regulatory Commission Information Notice No. 94-38, "Results of a Special NRC Inspection at Dresden Nuclear Power Station Unit 1 Following a Rupture of Service Water Inside Containment", May 27, 1994, and
James L. Milhoan, Deputy Executive Director for Nuclear Reactor Regulation, Nuclear Regulatory Commission, to Michael J. Wallace, Vice President, Chief Nuclear Officer, Commonwealth Edison Company, "Dresden Station - Unit 1, Notice of Violation and Proposed Imposition of Civil Penalty - $200,000 and Notice of Deviation (Inspection Report No. 50-010/94001)", June 13, 1994.

[2] W. G. Counsil, Senior Vice President, Northeast Utilities, to Dr. Thomas E. Murley, Regional Administrator, Region I, Nuclear Regulatory Commission, "Haddam Neck Plant / Millstone Nuclear Power Station Units No. 1, 2, and 3 / IE Bulletin No. 84-03 / Refueling Cavity Pool Seal," November 29, 1984.

1. Workers entered the containment building at Indian Point Unit 2 on October 17, 1980, and discovered nearly 100,000 gallons of water covering the containment floor. It filled the reactor cavity under the reactor vessel deep enough to submerge nine feet of its lower metal surface. The water came from numerous leaks from the containment fan cooling units. These coolers had a history of leaking. The rising water was not discovered sooner because *both* of the indicating lights for high water level in the basement were broken. The moisture level indicators for the containment did not reveal the flood because they were designed to sense high humidity caused by leaking hot water or steam and were not sensitive to the lower moisture levels in the air from cold water leaks. The rising water was not automatically pumped out of the reactor cavity because *both* pumps were broken – one due to a blown fuse and the other due to binding of its float switch. The rising water was eventually detected when it covered a nuclear instrument and caused it to short out. The workers who found the flooded containment had entered it to repair this nuclear instrument.[3]

2. On February 11, 1981, an auxiliary unit operator (AUO) at Sequoyah Unit 1 misunderstood an instruction given over the phone and opened a valve in the residual heat removal (RHR) system. The open valve created a path for water in the reactor vessel to flow through the RHR system piping to the containment spray header. The AUO's error caused about 110,000 gallons of water to be sprayed into the containment from the reactor vessel and from the refueling water storage tank.[4]

   The verbal instruction to the AUO came from an operator in the control room. The AUO realized his mistake almost as soon as he opened the valve. Standing in the containment building, the AUO was in a perfect spot to see, and perhaps feel, the water flowing from the spray headers. The AUO tried to relay that crucial bit of information to the control room operator. Unfortunately, the control room operator did not have time to talk. He hung up on the AUO to respond to the dropping reactor vessel water level. Reactor water sprayed into the containment building for about ten minutes before the link between cause and effect could be made and the problem corrected.

3. In 1989, a TV news reporter disclosed information from a secret Institute for Nuclear Power Operations (INPO) report that the waste building basement at the Nine Mile Point nuclear plant had been flooded since 1981. The NRC staff dispatched a special team to investigate. The NRC inspectors estimated that the radiation fields in the basement near some of the spilled drums were as high as 500 rem per hour.[5]

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[3] Nuclear Regulatory Commission, Information Notice No. 80-37, "Containment Cooler Leaks and Reactor Cavity Flooding at Indian Point Unit 2," October 24, 1980.

[4] Nuclear Regulatory Commission, Information Notice No. 81-10, "Inadvertent Containment Spray Due to Personnel Error," March 25, 1981.

[5] Malcolm R. Knapp, Director - Division of Radiation Safety and Safeguards, Nuclear Regulatory Commission, to Lawrence Burkhardt III, Executive Vice President - Nuclear Operations, Niagara Mohawk Power Corporation, "NRC Region I Augmented Inspection Team (AIT) Inspection (50-220/89-80) of the use of the Radwaste Building's sub-basement as a long-term liquid retention facility at Nine Mile Point Unit 1," October 2, 1989, and
William T. Russell, Regional Administrator, Nuclear Regulatory Commission, to Lawrence Burkhardt III, Executive Vice President - Nuclear Operations, Niagara Mohawk Power Corporation, "Notice of Violation (NRC Inspection Report No. 50-220/89-80)," February 23, 1990, and
Matthew L. Wald, "Study Says A-Plant's Handling of Waste Left Costly Mess," *The New York Times*, February 23, 1990.

4. A heavy rainfall on July 11, 1994, dumped about an inch of rain on the Sequoyah nuclear plant in about 15 minutes. The deluge exceeded the ability of the storm drainage system to carrying off the water. Consequently, the ground surface outside the turbine building flooded. Some of the flood waters ventured inside the turbine building. The water flooded the lower two inches of the 6.9 kV power supply boards. Water entered these boards and poured through holes in the floor to douse the 250 vdc distribution board and one of the 480 vac distribution panels located in the basement. A lighter rainfall on June 30, 1999, dumped about two-thirds of an inch of rain on Sequoyah in about 15 minutes. This time, the resulting flood only covered the lower one inch of the 6.9 kV power supply boards. The 250 vdc distribution board and one of the 480 vac distribution panels in the basement received another shower. The NRC staff looked into this matter after the second flood. They determined that the ground around the turbine building was improperly graded because it carried water toward instead of away from the turbine building.[6]

- Statement: The NRC staff should truncate response durations at 24 to 48 hours because it is unrealistic to assume that mispositioned valves or degraded cooling systems will go unnoticed for several consecutive shifts.

  Rebuttal: Again, the industry's track record contradicts this assertion. The track record, and not this unsubstantiated claim, should guide the NRC staff's actions. Two of the many examples from the industry's track record to supplement the Browns Ferry event discussed during yesterday's briefing:

  1. On July 8, 1995, the Hope Creek Generating Station was in cold shutdown. The residual heat removal (RHR) system was being used to take water from one of the pipes connected to the reactor vessel, put it through a heat exchanger to cool it down, and then return it to the same pipe where it flowed back into the reactor vessel. There was a closed valve in the pipe between the points where the RHR system took the water and returned it. The operators at Hope Creek chose to partially open that closed valve, in violation of plant procedures. They did it to limit the temperature differential between the water in the recirculation loop piping and the water in the reactor vessel. A portion of the cooler water being returned by the RHR system simply flowed through the partially opened valve where it got sucked back out by the RHR system again. With cooling water flow diverted from flowing through the reactor core, the water temperature inside the reactor vessel increased. The operators did not recognize this situation because the temperature instrument was in the RHR system. The cool water passing through the opened valve, essentially short-circuiting the reactor core, made the RHR system temperature much lower than the reactor water temperature. The reactor water temperature eventually reached boiling, a condition expressly prohibited by the plant's operating license.[7]

  2. On December 14, 1995, workers at the Oconee nuclear plant were moving irradiated fuel assemblies in the spent fuel pool. When they finished for the day, an irradiated fuel assembly remained suspended from the refueling bridge mast. Workers did not return to the refueling floor the next day, or the day after that. The fuel assembly was still hanging there three weeks later. The assembly was placed into a storage rack on January 8, 1996. The NRC staff fined the plant's owner $50,000. The NRC observed that had an accident occurred while the irradiated fuel assembly was left dangling, operators following emergency response procedures could have

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[6] Nuclear Regulatory Commission to J. A. Scalice, Chief Nuclear Officer and Executive Vice President, Tennessee Valley Authority, "NRC Integrated Inspection Report No. 50-327/99-04 and 50-328/99-04,"August 13, 1999.
[7] Nuclear Regulatory Commission, Information Notice No. 96-05, "Partial Bypass of Shutdown Cooling Flow From the Reactor Vessel," January 18, 1995.

pumped water out of the spent fuel pool. The irradiated fuel assembly could have been uncovered.[8]

3. In December 1987, an operator at Wolf Creek forgot to close a valve in the pipe connecting the spent fuel pool to the refueling water storage tank. The open valve created a path for water to drain out of the spent fuel pool due to gravity. The control room operators did not notice the spent fuel pool water level as it dropped steadily during the next **two** days. Operators relied on the spent fuel pool low level alarm to warn them. Unfortunately, the level alarm was not functioning properly and the level dropped **below** the alarm point. The operators also failed to notice the rising level in the refueling water storage tank during these two days.[9]

- Statement: The NRC staff must recognize that there's not much to monitor at a permanently closed plant, thus making it highly unlikely that anything will be overlooked.

  Rebuttal: This "any one can juggle one ball" argument is deflated by the reality of the industry's actual performance. The classic example is Dresden Unit 1 in January 1994. ComEd, by its own admission, focused its attention on the two running units at the expense of Unit 1. Since there are numerous multiple unit sites across the country, the "one ball" argument is invalid.

Because the spent fuel pool cooling system is classified as a non-safety related system at most nuclear power plants, problems with this system generally do not have to be reported to the NRC. When I researched fuel storage problems for *Nuclear Waste Disposal Crisis*, most of the documentation came not from the NRC's file but from the industry's files (e.g., INPO). The absence of problems in the NRC's files should not be misinterpreted to mean that there have been no spent fuel pool problems.

For example, when I was a reactor engineer at Browns Ferry, we offloaded over 100 irradiated fuel assemblies into a newly installed high density fuel storage rack. It took more than three shifts to accomplish this feat. Each individual movement was signed by the fuel handler and by an independent verifier as being the correct movement. Then we learned that all of this irradiated fuel had been mistakenly loaded into an unqualified rack. Two racks had been installed, but time only permitted one of them to be tested before the outage. The fuel pool map used by the installers looked upward, while the map used by the reactor engineers looked downward. The fuel movement sequence had been prepared by one reactor engineer, verified by another reactor engineer, approved by the Technical Support supervisor, and reviewed by the Plant Operating Review Committee. Thus, more than 200 separate reviews failed to prevent irradiated fuel from being placed into an unqualified rack. To the best of my knowledge, Browns Ferry's owner did not submit a licensee event report to the NRC about this problem.

More recently, one of the units at Byron recently experienced an unreported spent fuel pool cooling problem during refueling. There are two trains, or loops, of fuel pool cooling that return to the pool via a common line. A throttle valve in the common line controls the flow rate through the system. Vibration caused this valve to inadvertently close more than desired. An operator noted unusual pump performance and investigated. Had the valve closed more fully, both of the spent fuel pool cooling pumps could have been disabled by a common-mode failure mechanism. The pumps, as I understand it, are not provided

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[8] Stewart D. Ebneter, Regional Administrator, Nuclear Regulatory Commission, to J. W. Hampton, Vice President - Oconee Site, Duke Power Company, "Notice of Violation and Proposed Imposition of Civil Penalty - $50,000 (NRC Inspection Report Nos. 50-269/96-02, 50-270/96-02 and 50-287/96-02)," March 5, 1996.

[9] Nuclear Regulatory Commission Information Notice No. 88-65, "Inadvertent Drainages of Spent Fuel Pools," August 19, 1988.

with a minimum flow recirculation line.

Sincerely,

David A. Lochbaum
Nuclear Safety Engineer
Union of Concerned Scientists

cc: Chairman and Commissioners
Mr. Paul Blanch
Mr. Michael T. Masnik
Mr. Michael Meisner
Mr. Ray Shadis