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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	
PENNSYLVANIA POWER & LIGHT COMPANY and ALLEGHENY ELECTRIC COOPERATIVE, INC.	Docket Nos. 50-387 50-388
(Susquehanna Steam Electric Station, Units 1 and 2)	

APPLICANTS' STATEMENT OF MATERIAL FACTS AS TO WHICH THERE IS NO GENUINE ISSUE TO BE HEARD (CONTENTION 11 -- ONSITE STORAGE OF SPENT FUEL)

Pursuant to 10 CFR §2.749(a) Applicants state, in support of their Motion for Partial Summary Disposition of that portion of Contention 11 in this proceeding which deals with on-site storage of spent fuel, that there is no genuine issue to be heard with respect to the following material facts:

1. At the Susquehanna Steam Electric Station ("Susquehanna"), nuclear fuel which has been discharged from the reactor is stored in water-filled basins called spent fuel pools. The water provides both for heat removal and for radiation shielding. Affidavit of D. W. James in Support of Partial Summary Disposition of Contention 11 ("James Aff."), para. 3.

2. Each of the Susquehanna units has its own spent fuel storage facility. This facility, located in the reactor building, consists of a water-filled reinforced concrete basin lined with stainless-steel ("the spent fuel pool"), racks for storing the

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fuel, cranes and material handling equipment, a heat exchanger for cooling the water, a clean-up system for controlling water purity, and pumps to circulate the water. Both units share a common cask pit that accepts the spent fuel shipping casks and accommodates underwater fuel transfer from either unit through its respective transfer canal. Id., para. 4.

3. The spent fuel pool walls are six foot thick reinforced concrete. The spent fuel pools themselves are part of the reactor building structure and meet all the codes and standards for the reactor building. The pools are also designed for the same loads and loading conditions as the reactor building. Id., para. 5.

4. The spent fuel pool stainless steel liner is not load bearing and is directly supported by a system of stiffeners and anchors embedded in the pool wall. The pool wall with its embeds and liner is designed to withstand all credible loading combinations resulting from natural phenomena and plant operation. Liner material is intended to minimize corrosion formation and possible leakage. Experience with stainless steel in demineralized water service has shown no measurable corrosion. Therefore, liner corrosion over the lifetime of the plant is considered insignificant. Id., para. 6. The liner is also capable of withstanding a temperature of 212°F during an accident situation involving pool boiling. Id., para. 7.

5. A leak detection system is provided to verify leak tightness following liner installation and during plant operation.

Any leakage through the liner would be contained by a system of channels welded behind the liner weld joints which permit free gravity flow through isolation valves to a leak detection station. Liner repairs, if necessary, can be (and have been) made even when there is spent fuel in a pool. Id., para. 7.

6. The spent fuel racks are of all anodized aluminum, bolted construction and are attached to the pool walls through embeds and anchors. Seismic restraints of welded stainless steel construction tying to the pool liner embeds are provided to enable the racks to withstand all credible loading combinations resulting from natural phenomena and plant operation. To reduce any galvanic corrosion, inconel pins are used between the wall seismic restraints and the racks. For the same purpose, the leveling screws of the racks butt against plastic discs that are crimped into stainless steel pads. Id., para. 8.

7. The spent fuel racks contain "poison cans" which are filled with a neutron absorber material. This material is completely encapsulated in aluminum and is totally isolated from the pool water. Each poison can is pressure and vacuum leak-tested prior to installation. Id., para. 8.

8. The design features of the spent fuel racks will prevent any significant degradation of the racks from water submersion, radiation, thermal, hydrodynamic, and seismic loading conditions over the 40 year design lifetime of the plant. Furthermore, test coupons consisting of actual poison can sections installed

adjacent to the racks will permit verification of the long-term mechanical and material integrity of the poison cans over the plant lifetime. Id., para. 9.

9. The fuel pool water temperature is maintained below 125°F by normal and backup cooling systems. Normally, fuel pool cooling is provided by the Fuel Pool Cooling and Cleanup (FPCC) system. One FPCC system is provided for each spent fuel pool. The fuel pool cooling pumps circulate the pool water in a closed loop, taking suction from the skimmer surge tank through heat exchangers where the decay heat of the irradiated fuel is transferred to the service water system. A partial flow from the cooling loop is directed through filter demineralizers and returned with the by-pass flow back to the pool. Id., para. 10.

10. The FPCC system is sized to cool the maximum normal heat load, which is the heat that would be generated by the 2,840 fuel assemblies which could be placed in the spent fuel pool, assuming that all the fuel assemblies are discharged at the normal refueling rate. Id., para. 10.

11. The Residual Heat Removal (RHR) system serves as backup to the FPCC system and would also be used to carry the emergency heat load. The emergency heat load would occur if the fuel pool were filled to its maximum capacity of 2,840 fuel assemblies and the last discharge were a full core unload rather than the 1/4 core discharge which would occur in the maximum normal case. Id., para. 11.

12. One out of the four RHR pumps and one out of the two RHR heat exchangers will provide sufficient cooling for either the maximum normal or emergency heat load. The remaining RHR pumps and heat exchanger provide additional backup capability. The RHR system discharges to the pool through two independent Seismic Category I lines. Id., para. 12.

13. In the highly unlikely event that both the FPCC system and its backup (the RHR system) are lost, the primary consequence would be to significantly increase the evaporative losses from the pool as a result of pool boiling. (This "boiling" would be in the form of steam escaping from the surface, rather than violent bubbling.) Using very conservative assumptions (such as no heat loss through conduction or evaporation), this boiling would not begin until 25 hours after loss of all external cooling at the maximum normal heat load and 8 hours after cooling at the emergency heat load. During these time periods, one or more of the cooling systems could be isolated and repaired to restore cooling. Neither loss of external cooling nor pool boiling restricts accessiblity to the cooling systems for repairs. Id., para. 13.

14. Even if boiling occurs, fuel damage cannot take place so long as the fuel remains under water. There are at least four independent sources of makeup water for evaporative losses, each one capable of providing water at a rate greater than the maximum boil-off rate. Makeup for evaporative losses is normally supplied from the Makeup Demineralizer System. Two independent, Seismic Category I backup sources of water are provided from the

Emergency Service Water System. As further backup to these backup systems, makeup water to the pool can be provided through a fire hose on the refueling floor. Because the tops of the spent fuel are under twenty-three feet of water, the plant would have a long time in which to add makeup water before reaching a situation where damage to the fuel could occur. The redundancies in cooling systems and makeup water sources assure that the spent fuel will not be damaged due to failures in cooling or makeup systems. Id., para. 14.

15. The spent fuel pools have no bottom drains or connections from which the water could be inadvertently drained. Check valves and siphon breakers are provided at the high points of supply lines to prevent siphoning of water from the pools. The manual valves for backup cooling or backup water supplies are in accessible areas in the reactor building. There is no credible mechanism for a sudden loss of water from the pools. Id., para. 15.

16. Fuel storage is essentially a passive system and requires little operator intervention. Alarms indicating a high pool water temperature, high or low water level in the pool, and high area radiation are provided in the control room. Id., para. 16.

17. The spent fuel pool including the spent fuel racks, the redundant fuel pool cooling system (RHR) and the redundant water makeup provisions, are designated Seismic Category I and, as such, are designed to withstand a Safe Shutdown Earthquake. They are therefore protected against any credible seismic event. Id., para. 17.

18. The spent fuel racks are designed to assure that the spent fuel remains in a subcritical condition under both normal and abnormal storage conditions. A criticality analysis was performed for the Susquehanna spent fuel pools using diffusion theory calculations and conservative assumptions favoring criticality. Id., para. 18. The analysis shows that the spent fuel will remain subcritical. Id., para. 19.

19. The probability of the spent fuel pool suffering damage as the result of impact from aircraft, spacecraft or meteors is low enough to be negligible. Id., para. 20.

20. The spent fuel storage facilities at Susquehanna can safely store spent fuel for at least the duration of the Susquehanna licenses (i.e., through the year 2013). Id., paras. 2, 21.

21. With respect to spent fuel itself, it is best characterized by its inactivity. There is little stored energy in the spent fuel system which would act as a mechanism for fission product release from it. After fuel is discharged from the reactor to the fuel pool, it continues to generate heat from the decay of fission products. However, the amount of decay heat generated decreases rapidly and continuously. Each fuel assembly's radioactive decay power output is reduced by about 97% within one month after shutdown. The overall result is that the heat generation rate diminishes and therefore the margin of safety for the storage system

increases with time in storage. After only a few weeks of pool cooling, the surface cladding temperature is only about 10°C above the bulk water temperature in the pool (30°-60°C) compared to a cladding temperature of 290°-400°C while the fuel is in the reactor. In short, the storage system is a benign environment, particularly in comparison with the pre-storage power generation environment. Affidavit of Clair C. Herrington in Support of Partial Summary Disposition of Contention 11 ("Herrington Aff."), para. 4.

22. The spent fuel in storage in the spent fuel pool is readily accessible for visual monitoring. This enables the examination for defects as the fuel is brought in for storage; the further examination for defects or review of known defects at later dates; and the final observation as spent fuel is moved for shipment. Visual monitoring of the fuel in storage may also detect escaping gas bubbles, and the accessibility permits sampling escaping gas or the water around a suspected "leaker". Radiation levels of the pool water are monitored frequently. Concentrations of airborne radioactive materials above the pool are monitored continuously. Id., para. 6.

23. If some mechanism should arise that could allow radioactive material to escape from the spent fuel, its genesis would be gradual because low energy systems do not undergo rapid changes. Available instrumentation and monitoring programs assure that adequate time would be available for identification and development

of remedial action without subjecting plant personnel or the public to significant risk. Id., para. 7.

24. The Zircaloy cladding surrounding the fuel pellets is an important containment barrier that keeps the fission products within the fuel isolated. Zircaloy-clad fuel has been stored satisfactorily in pools for over twenty years. This is as expected, since the cladding has been designed to endure several years of the much more corrosive conditions of reactor operations where one year of reactor exposure is equivalent to many years of pool storage exposure. The amount of estimated corrosion for Zircaloy cladding in pool storage is 0.037 to 0.062% of the initial Susquehanna cladding thickness over a period of one hundred years. No other degradation mechanisms have been identified that would pose a substantial threat to fuel cladding integrity. Id., para. 8.

25. The uranium oxide ceramic fuel pellets themselves provide a remarkably efficient barrier to the leaching of radioactive material into basin water. The pellets are virtually inert to pool water and there has been no observable physical degradation in several years of exposure of bare pellets to pool water. This lack of interaction of the fuel pellets with water minimizes the impact of a potential defect in the fuel cladding and enhances the isolation of fission products within the fuel. Id., para. 9.

26. Defective or failed fuel in spent fuel storage can be isolated by encapsulation. Encapsulation has been routinely used in Canada for the storage of defective fuel, but has not been

deemed necessary in this country even where known failed fuel is in storage because the impact of fuel rod failures during storage has been found to be relatively slight. However, encapsulation could be used in the event that severe degradation of the spent fuel assemblies should occur. Id., para. 10.

27. The experience with extended storage of spent fuel has been excellent. Assemblies have been stored for a period of some twenty years, with no apparent degradation due to storage. Some Zircaloy-clad PWR fuel has been in water basin storage since 1959. In addition, at least nine Zircaloy-clad fuel bundles from the Canadian NPD reactor have been in water storage since 1962 and eight bundles loaded in the NPD reactor in 1963 are still incore and intact. Id., para. 11. A survey of pool operators representing some 20 U. S. pools has found no instances of degradation of stored commercial power reactor fuel. Id., para 12. Canadian experience, including occasional examination during 17 years of storage, has also indicated no evidence of significant corrosion or other chemical degradation. Even where the uranium oxide pellets were exposed to pool water as a result of prior fuel assembly damage, the pellets have been relatively inert to pool water, a conclusion also demonstrated in laboratory studies. Id., para. 12.

28. Further experience concerning the ability of spent fuel to withstand extended water basin storage includes metallurgical examination of Zircaloy-clad fuel after 11 years of pool storage, metallurgical examination of Zircaloy-clad PWR and BWR

high burn-up fuel after five and six years in pool storage, return of fuel bundles to a reactor after 10 years of pool storage, and hot cell examination of high burn-up fuel bundles over 6 years of pool storage at the WAK Fuel Reprocessing Plant in Germany. Favorable experience in other countries with Zircaloy-clad fuel includes United Kingdom, 13 years; Belgium, 12 years; Japan, 11 years; Norway, 11 years; West Germany, 9 years; and Sweden, 7 years. Id., para. 13.

29. Since there have been no indications of spent fuel storage problems, either theoretical or actual, major development and test programs to provide safe storage capabilities have not been required. Ongoing development is proceeding, however, to further improve storage efficiencies. Id., para. 3.

30. After their review of storage of spent fuel for extended periods of time, the Advisory Committee on Reactor Safeguards stated its belief that the issues and concerns about storage of spent fuel have been adequately addressed and that safe interim storage well beyond 30 years can be provided should it be required. Id., para. 3.

31. It has been demonstrated that spent fuel can be safely stored in water filled pools on site for extended periods of time. The Zircaloy-clad fuel to be used at Susquehanna can safely be

stored in the spent fuel pools at least through the expiration of the operating licenses in 2013. Id., para. 14.

Respectfully submitted,

SHAW, PITTMAN, POTTS & TROWBRIDGE

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