UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of DUKE POWER COMPANY, et al. (Catawba Nuclear Station, Units 1 and 2)	))))))	Docket Nos. 50-413 50-414

AFFIDAVIT OF A. L. SNOW REGARDING PALMETTO ALLIANCE CONTENTION 16

1. My name is A. L. Snow. I am employed by Duke Power Company as Design Engineer II. I have been employed in this position since 1979 and with the Company in various engineering assignments since 1968. My professional qualifications are contained in an attachment to this affidavit.
2. My job responsibilities include spent fuel decay heat and criticality evaluations. My familiarity with the issues discussed in this affidavit results from educational background, experience on Catawba fluid systems design and current assigned responsibilities for decay heat generation and criticality for all stations.
3. The purpose of this affidavit is to address Palmetto Alliance's Contention 16 as it relates to the Catawba spent fuel storage facility cooling and criticality control capability. In particular, Intervenor maintains that the spent fuel storage facility at Catawba does not comply with General Design Criteria (GDC) 44, 61 and 62 of 10 C.F.R. Part 50, Appendix A.
4. GDC 44 requires that a "system to transfer heat from structures, systems and components important to safety, to an ultimate heat sink shall be provided." Such systems have been provided at Catawba to transfer the

spent fuel decay heat from the spent fuel storage facility to the ultimate heat sink. These systems are described in Catawba FSAR Sections 9.1.3, 9.2.1 and 9.2.2. The Spent Fuel Pool Cooling (KF) System (FSAR Section 9.1.3) is cooled by the Component Cooling (KC) System (FSAR Section 9.2.2), which in turn is cooled by the ultimate heat sink - Nuclear Service Water (RN) System (FSAR Section 9.2.1). These systems provide the mechanism to transfer heat from the spent fuel pool to the ultimate heat sink "under normal operating and accident conditions" as required by GDC 44.

5. As stipulated by GDC 44, the KF, KC and RN Systems are redundant in components and features and have been provided with interconnections, leak detection provisions and isolation capabilities such that the safety function of heat transfer is assured, assuming that either offsite or onsite electric power is available and assuming a single failure. Therefore, the systems provided for spent fuel pool cooling do constitute design compliance with GDC 44 for Catawba. This assertion of compliance with GDC 44 assumes the presence of Oconee, McGuire and Catawba spent fuel in the Catawba spent fuel pool.

6. That this Catawba system does comply with GDC 44 is demonstrated in FSAR Section 9.1.3, which presents cooling system performance parameters under maximum Oconee - McGuire - Catawba spent fuel heat loading conditions. The cooling system performance complies with all NRC guidance found in Standard Review Plan 9.1.3, "Spent Fuel Pool Cooling and Cleanup System," and Regulatory Guide 1.13, "Spent Fuel Storage Facility Design Basis." In addition, it should be noted that this guidance precludes the consideration of a concurrent failure of one cooling train

with an abnormal heat load (full core unload) condition (referenced by PA in their interrogatory responses).

7. GDC 61 pertains to spent fuel pool cooling by requiring that fuel storage and handling systems be designed "with a residual heat removal capability having reliability and testability that reflects the importance to safety of decay heat and other residual heat removal," and "to prevent significant reduction in fuel storage coolant inventory under accident conditions." Such capability has been designed into the spent fuel storage facility at Catawba.

8. The KF System, as presented in Catawba FSAR Section 3.2, Table 3.2.2-2, is a Seismic Category I, NRC Safety Class C system. This demonstrates that the KF System is designed to assure adequate safety under normal and postulated accident conditions and with reliability and testability that reflects the importance to safety of decay heat removal. In addition, the KF System, as discussed in FSAR Section 9.1.3.1.4, prevents any significant reduction in fuel storage coolant inventory under accident conditions by providing spent fuel pool makeup capability from redundant Seismic Category I, NRC Safety Class C makeup sources. These manually initiated makeup sources can provide virtually unlimited fuel pool makeup from the refueling water storage tank (by means of gravity feed) and the ultimate heat sink - (Nuclear Service Water System). Therefore, the system provided for spent fuel pool decay heat removal and coolant makeup does establish Catawba's design compliance with GDC 61.

9. As discussed above for GDC 44, this assertion of compliance with GDC 61 is made assuming the presence of Oconee, McGuire and Catawba spent fuel in the Catawba spent fuel pool. Demonstration of this compliance is

found in Catawba FSAR Section 9.1.3. In addition, the reliability and testability of the Spent Fuel Pool Cooling System is assured to the extent that the system seismic design classifications meet Regulatory Guide 1.29 "Seismic Design Classification," and that the system quality group classifications meet Regulatory Guide 1.26, "Quality Group Classifications and Standards for Water, Steam and Radioactive-Waste- Containing Components of Nuclear Power Plants."

10. It should be noted that the NRC also requires that an analysis be performed to show that stored fuel assemblies remain covered for at least 72 hours assuming the complete loss of all cooling and makeup. The NRC recognizes that 72 hours is sufficient time for the operator to initiate corrective actions in recovering from beyond-design basis fault conditions (e.g., sabotage). Meeting this requirement (see FSAR Section 9.1.3.3.1) demonstrates that the Catawba fuel storage facility can safely maintain spent fuel in storage following a beyond-design basis event (i.e., loss of onsite/offsite power). Meeting this requirement, therefore, adds one more level of safety to the Catawba fuel pool design beyond any required by GDC 44 or 61.

11. GDC 62 requires that criticality in the fuel storage and handling system be prevented by physical means, preferably by maintaining safe geometric configurations. (I would note that the criticality issue is unrelated to the cooling issue). The Catawba fuel storage and handling system complies with GDC 62 by providing spent fuel storage racks which physically maintain stored fuel in safe geometric configurations and by providing a fuel handling system designed to operate in a safe manner. The Catawba spent fuel storage racks are described in FSAR Section 9.1.2 and the Fuel Handling System is described in FSAR Section 9.1.4.

12. In the Catawba spent fuel storage racks, fuel is stored vertically in a fixed array with a nominal center-to-center spacing distance of 13.5 inches maintained by physical means between assemblies to assure criticality is prevented. The Fuel Handling System is basically comprised of cranes, handling equipment and a fuel transfer system. As discussed in FSAR Section 9.1.4.1, criticality during fuel handling operations is prevented by geometrically safe configuration of fuel handling equipment. Therefore, design provisions for criticality control in the fuel storage do provide for Catawba design compliance with GDC 62.

13. This observation of compliance with GDC 62 is made assuming the presence of Oconee, McGuire or Catawba spent fuel in the Catawba spent fuel pool. Demonstration of this compliance is found in CAtawba FSAR Section 9.1.2 where criticality evaluations for all fuel types proposed for storage at Catawba are presented. The criticality analyses presented comply with all NRC guidance found in Standard Review Plans 9.1.1, "New Fuel Storage," and 9.1.2, "Spent Fuel Storage," and Regulatory Guide 1.13, "Spent Fuel Storage Facility Design Basis." In addition, the criticality analyses also comply with American National Standard ANSI N210-1976, "Design Objective for Light Water Reactor Spent Fuel Storage Facilities at Nuclear Power Stations.".

14. In summary, the Catawba FSAR presents the necessary information concerning the spent fuel storage facility cooling, makeup, and fuel storage and handling systems to make the determination of Catawba design compliance with General Design Criterias 44, 61 and 62.

I, A. L. Snow, of lawful age, being first duly sworn, state that I have reviewed the foregoing affidavit, and that the statements contained therein are true and correct to the best of my knowledge and belief.

Arthur Lowell Snow
A. L. Snow

STATE OF NORTH CAROLINA
County of Mecklenburg

Subscribed and sworn to before
me this 8th day of July, 1983.

Marguerite J. Jennings (Watson)
Notary Public

My Commission expires: 8-1-84

DUKE POWER COMPANY

ARTHUR LOWELL SNOW

EDUCATION: B.S., Nuclear Engineering, University of Tennessee
M.E., Mechanical Engineering, University of South Carolina
Additional Courses:
Graduate Course Work in Mechanical Engineering toward PhD

CERTIFICATIONS/PROFESSIONAL AFFILIATIONS

Professional Engineer - North Carolina 7397
- South Carolina 6145
Member of the American Nuclear Society

YEARS EXPERIENCE: 15

SUMMARY OF PERTINENT EXPERIENCE

- Supervisor, Mechanical and Nuclear Division, Nuclear Activities - All Duke Nuclear Power Stations: System-wide radwaste design review activities, licensing activities, probabilistic risk assessment and safety reviews, evaluation of nuclear accident scenario and corrective actions, radioactive effluents analysis, and nuclear fuel criticality analysis for spent fuel storage designs.

- Supervisor, Pipe Support/Restraint Design - Design, engineering and constructability of ASME III and B31.1.0 piping support/restraints for Catawba Nuclear Station. Development of design criteria and specifications, technical contract administration, scheduling and coordination of design activities.

- Assistant Design Engineer - Design and engineering of nuclear fluid process systems for Catawba Nuclear Station, review of operating procedures, testing procedures, start up assistance, operating parameters and cost evaluations.

- Assistant Design Engineer - Development of computer codes for radiation shielding, radioactive liquid and gaseous discharge. Preparation of Safety Analysis Reports/Environmental Reports. Radiation shielding designs. All this work for Oconee, McGuire and Catawba Nuclear Stations.

EXPERIENCE: DUKE POWER COMPANY since 1968

1979 to Present: Design Engineer II - In charge of Nuclear Sub-Group responsible for: system-wide radwaste design review activities; technical interface for Mechanical/Nuclear Division with licensing, probabilistic risk assessment and safety review groups; radioactive effluent analysis for normal and accident conditions; nuclear fuel criticality and generic engineering activities. Generic engineering activities include steam generator chemical cleaning, technical review of responses to TMI concerns, other regulatory and quality assurance matters.

1977-1979 Design Engineer/Assistant Design Engineer - In responsible charge of Pipe Support/Restraint Group for Catawba. Multi-discipline group of Duke and contract personnel included clerks, draftsmen, designers, Mechanical and Civil Engineers (B.S., M.S., and PhD's). Activities included setting up initial organization, design criteria and specification preparation, contract administration, scheduling, interface with Construction Department, and other Design groups. Group produced in excess of 30,000 designs for ASME Section III, Class 2 and 3, and ANSI B31.1.0 piping systems and supports for HVAC seismically designed ducting.

1972-1977 Assistant Design Engineer - Responsible charge of fluid systems design for all Catawba nuclear process systems. Supervised preparation of Flow Diagrams, Design Criteria, System Descriptions, Data Sheets for Mechanical Equipment, Safety Analysis Report preparation for Mechanical/Nuclear systems. Developed operating parameters, costs, review of testing/operating procedures, piping system start up assistance.

1968-1972 Assistant Design Engineer/Associate Engineer/Jr. Engineer - Responsible charge of Radiation Analysis Group. Activities included direct effort and supervisory responsibility for: development of radiation shielding computer codes, development of radioactive liquid and gaseous discharge computer codes, cost evaluation of Turbine-Generator bids using part load heat rates, Safety Analysis Report and Environmental Report preparation, response to NRC (then AEC) questions, and appearances before ACRS and NRC Staff for Oconee, McGuire and Catawba Nuclear Stations, design radiation shielding for McGuire and Catawba.

PUBLICATIONS: "Criteria For Evaluation of Interim Radwaste Solidification Systems" '83 Waste Management Symposium, Tuscon, Arizona 2/28/83.

4. Before Oconee or McGuire spent fuel is received and unloaded at the Catawba Station, certain precautions and conditions will be observed. These include the following:

(a) The reactor engineer or the operation's fuel handling supervisor will receive notification of the spent fuel shipment and will authorize receipt and storage.

(b) The Catawba health physicist or his representative will receive notification of the shipment.

(c) Periodic tests of the overhead fuel handling bridge crane and the auxiliary hoist, including daily inspections, will have been performed pursuant to applicable regulatory requirements.

(d) Lifting equipment (short and long lift adapter, lifting yoke) will have been inspected as necessary.

(e) Water and air supplies will have been checked.

(f) Spent fuel building radiation monitors will be operable.

(g) A radiation work permit for receipt of the cask will be issued by the Catawba health physics department.

(h) The necessary tools and equipment will have been inventoried and readied.

(i) Sufficient underwater lighting equipment will be available.

5. Once the vehicle transporting the spent fuel cask from Oconee or McGuire arrives at the Catawba gate, the general outline of the procedures which will be used is as follows. First, Catawba security will perform a visual inspection of the trailer and of the interior and exterior of the cab of the truck. Security then advises the operations staff that the truck has arrived, and escorts the truck from the gate to a point outside of the receiving area of the spent fuel building.

6. After approval from health physics personnel is received, the door to the receiving area is opened the vehicle (including the transport trailer and cask) is driven into a designated part of the receiving area. The necessary shipping documents and isotopic analysis are obtained from the truck driver.

   The trailer brakes are then set, chocks are installed on the trailer wheels, and the trailer is detached. The truck is driven out of the fuel building after health physics approval is received. The door to the receiving area is then closed.

7. Health physics personnel then survey the transport trailer and personnel barrier for external radiation contamination levels. The trailer and personnel barrier are inspected by the operations staff for any physical damage. If any of the personnel barrier tamper seals have been broken or damaged, or indicate an attempt to render them inoperable, the shift supervisor will be contacted and work will cease. The NRC will be notified pursuant to applicable regulations. If any damage to the barrier or the trailer is evident, the cask vendor representative and the Duke representative must concur on the advisability of continued use of equipment.

8. Bolts and tamper seals are removed from the personnel barrier on the truck. Upon approval of health physics personnel, the personnel barrier is removed and placed in a suitable location.

9. Health physics personnel survey the cask for external radiation contamination levels. All work then stops on the cask until health physics gives approval to continue.

10. Once such approval is given, the impact-limiting structures on the top and bottom of the cask are removed with the use of the auxiliary hoist and sling. The cask tie-down bolts are then removed.

11. After verifying that the ventilation system in the spent fuel pool is operating in the filtered mode, a lifting device (125 ton crane and short lift adapter) is moved into position above the cask. The cask is raised to a vertical position, with the crane moving as required to keep the hoist cable vertical. When the cask is fully vertical, it is raised and moved to the decontamination pit. The lifting device is then disengaged and raised out of the decontamination pit.

12. The operating staff then begins preparing the cask for the removal of the fuel assembly. The outer closure head bolts are removed and, using a sling on the auxiliary hoist, the outer closure head of the cask is removed and placed on the work platform. It is inspected for damage. Health physics personnel then survey the top portions of the inner closure head (now exposed) and adjacent cask surfaces, and work halts until they give approval to continue.

13. A water supply hose and a vent hose are attached to the cask and the cask is filled with water. The displaced helium is routed to the spent fuel ventilation system. The inner head bolts are then loosened, but not

removed, and long inner head guide pins are installed (for later removal and replacement of the inner head.)

14. The lifting rig (the overhead fuel handling bridge crane and the cask short lift adapter) is then prepared and moved into position for movement of the cask into the spent fuel pool. After the lifting device has been attached to the cask, the cask is lifted out of the decontamination pit. The cask is then moved into position and lowered into the shallow portion (i.e. the upper platform) of the cask handling area of the spent fuel pool.

15. When the cask rests in a vertical position on the upper platform, the lifting rig is disengaged. The short lift adapter is disconnected from the yoke and the 125 ton crane hook, and is replaced with the long lift adapter, which is then connected to the crane hook and the yoke. The inner head lift slings are then installed.

16. The lifting rig is then engaged, the cask is lifted, and the inner closure head slings (for removal of the inner head) are attached. The cask is moved into position and lowered until it rests on the deep end of the cask handling area (i.e., the lower platform). With the cask resting on the lower platform, the long lift adapter is disengaged.

As the crane is raised, the slings become taut and the inner head of the cask is lifted.*/ It is raised until it clears the upper platform of the cask handling areas.

17. The appropriate spent fuel handling tool (the exact tool used will depend upon the fuel assembly design) is then lifted by the east manipulator crane auxiliary hoist, is positioned over the fuel assembly, and is attached to the assembly. The assembly is then lifted and transported to the location in the spent fuel pool to be designated by the reactor engineer.

18. After this process is complete, the reactor engineer is notified and the event is entered into the station's documentation system.

19. The spent fuel pool is periodically inspected by using an underwater camera or binoculars, as required by 10 C.F.R. Part 72.

20. The procedures set forth above comply fully with General Design Criteria 61.

---

*/ In my deposition of May 12, 1983, beginning on page 101 I discussed removal of the inner lid from the spent fuel cask. I stated that this lid was removed while the cask was on the platform in the cask handling area. This information was incorrect. The inner cask lid is not removed until the spent fuel is in the deep end of the cask handling area.

I, Michael S. Tuckman, of lawful age, being first duly sworn, state that I have reviewed the foregoing affidavit and that the statements contained therein are true and correct to the best of my knowledge and belief.

Michael S. Tuckman

State of North Carolina

County of Mecklenburg

Subscribed and sworn to me the 8th day of July, 1983.

Marguerite J. Jennings (Watson)

Notary Public

My Commission Expires 8/1/84

RESUME OF MICHAEL STEVEN TUCKMAN

Holds a Bachelor Degree in Electrical Engineering from Georgia Institute of Technology - 1965

Attended Navy Nuclear Propulsion Training Program (Officer)

Graduate School at University of Tennessee in Electrical Engineering

NRC Certified Senior Reactor Operator

Registered Professional Engineer in North Carolina and South Carolina

Work Experience

6 years Navy nuclear experience

3 years Electrical Development Engineer at Union Carbide Corporation, Oak Ridge, Tennessee

3½ years Duke Power Company, Oconee Licensing Engineer

5½ years Duke Power Company, Superintendent of Technical Services, Catawba Nuclear Station