UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
DUKE POWER COMPANY	)	Docket No. 70-2623
	)	
(Amendment to Materials License SNM-1773 for Oconee Nuclear Station Spent Fuel Transportation and Storage at McGuire Nuclear Station)	)	

AFFIDAVIT OF JACK N. DONOHEW

I, Dr. Jack N. Donohew, being duly sworn, do depose and state:

I am employed by the Environmental Evaluation Branch, Division of Operating Reactors, U. S. Nuclear Regulatory Commission.

Q. Would you describe your background experience and training that comprise your professional qualifications?

A. I am qualified by both training and experience to calculate occupational dose from radiation exposure. My professional qualifications were briefly described at Tr. 4434. A copy of my professional qualifications have been furnished with other documents that have been filed in this proceeding.

Q. What is the purpose of this document?

A. This affidavit addresses questions concerning occupational doses caused by rupture of Oconee spent fuel assemblies, at least 270 days in age, store in the McGuire spent fuel pool. The rupture of the spent fuel assemblies is postulated to be from the impact of a 25-ton truck cask

falling onto the spent fuel assemblies stored in the McGuire spent fuel pool. My affidavit analyzes the occupational dose to employees in response to the request in the Licensing Board's Order of October 31, 1979 which, in pertinent part, states:

> . . . However, regarding the question about consequences of a cask drop into the fuel storage pool, the Board notes that replies to its questions about criticality and radioactive emissions to the public were in the nature of summary statements (Tr. 4439-47). The Board therefore requests that the parties supplement these answers with numerical analysis, and include the additional question of radioactive exposure of operating employees.1/

Q. What is the Board Question concerning exposure to plant workers?

A. Provide a numerical analysis of radioactive exposure of operating employees from a shipping cask falling into the McGuire spent fuel pool and damaging Oconee spent fuel.

Q. What were the assumptions for your calculations?

A. Table 1 enclosed lists the assumptions for the estimate of the exposure to operating employees from the shipping cask falling into the McGuire spent fuel pool and damaging Oconee fuel stored therein. The estimated exposure to workers is based on the expected damage to spent fuel during the postulated accident. The assumptions used are consistent with those used to estimate exposure to the population outside McGuire in the McGuire Final Environmental Statement dated April, 1976.

1/ Order Concerning CESG's Petition to Compel Discovery (October 31, 1979).

Q. How does the fuel building arrangements affect your calculations?

A. The ventilation system for the fuel building consists of supply air ducts along one side of the fuel pool and exhaust ducts along the opposite side of the fuel pool. Thus there is a sweep of air across the pool collecting radioactivity released from the pool. The workers can exit the pool area via stairways which are either in the path of the ventilation supply air or of the ventilation exhaust air. I assumed that workers occupying the SFP area during the postulated cask drop exit the pool area through the ventilation supply air path; thus, they are exposed to the gamma rays from the noble gases and radioiodine for the conservatively estimated time of two minutes necessary for them to leave the area. However, if the crane operator inadvertently exits the pool area through the exhaust path he may be additionally exposed to the radioiodines by inhalation. I estimate that he would take 20 seconds to travel the 80 feet along the side of the pool to the stairway exit from the area and would, therefore, receive an inhalation exposure from radioiodine during this time.

Q. Does the Licensee have accident evacuation procedures for plant workers?

A. It should be pointed out that Duke Power Company has evacuation procedures for workers to be followed if an accident occurs. In the case of the plants at Oconee/McGuire, the following procedures are used:

Area monitors are located on the SFP Bridge. When a radiation monitoring alarm sounds (in the SFP area and control room), workers are expected to evacuate the area immediately and go to the preassigned locations. Alarm setpoints levels are as follows: For Oconee, a so-called "High

Alarm" is set at 9 mr/hr and an "Alert" or evacuation alarm is set at 30 mr/hr. Personnel would evacuate immediately to the Personnel Change Decontamination Room, Hot side. For McGuire, evacuation from the SFP area is required in any situation that is likely to expose personnel to an increase of the background radiation dose rate to 10 mrem/hr. The above levels are much lower than that which could be reached following a heavy-load drop accident in the SFP that might cause spent fuel damage.

The licensee has requirements for all plant personnel to be trained in alarm sounds and procedures to respond to evacuation alarms. Plant personnel are trained with respect to their evacuation assembly points. Plant personnel are given training in these procedures at their employment date and annually thereafter.

Q. What is the estimate of plant workers exposure?

A. Calculation of the occupational exposure to personnel in the spent fuel area SFP) and in the control room following a cask drop accident in the SFP as described above are based on equations in Appendix B, Regulatory Guide 1.109 and the McGuire FSAR description of the spent fuel pool area and control room. These calculations indicate that the exposure to workers in the vicinity of the SFP is less than 40 mrem whole body and less than 10 mrem thyroid. The exposure to workers in the control room is less than 1 mrem whole body and 0.1 mrem thyroid.

Q. What are your conclusions based on your calculations?

A. The doses to workers as discussed above are within the exposure guidelines of 10 C.F.R. Part 100 for accidents (i.e., 25 rem whole body and

300 rem thyroid). The whole body doses are also a small fraction of the quarterly limit (i.e., 3 rem) for occupational exposure to workers in 10 C.F.R. Part 20.

From the above, the staff feels that, by use of administrative procedures and controls, the licensee can keep his occupational exposure to workers to reasonable levels in emergency situations in the SFP area.

I hereby certify that the above statements are true and correct to the best of my knowledge and belief.

Jack N. Donohew

Subscribed and sworn to before me
this 10th day of April, 1980

Notary Public

My Commission expires: July 1, 1982

Table 1

Assumptions for estimating the exposure to workers from a postulated cask drop into the McGuire spent fuel pool.

Scenario Assumptions	Comments
Fuel assemblies damaged (Oconee fuel)	
Last refueling	250 1/
Age of fuel damage	
Last refueling	270 days
Activity released from damaged pins	1% of pin activity
(activity in gap)	
Reduction factor for radioiodine retention in pool water	500
Power Level (MWt)	2620
Oconee	
Fuel exposure time	3 years
Fuel assemblies in core	
Oconee	177
Stay time of personnel in vicinity of pool	2 minutes 3/
Approximately volume of activity above pool	40,000 ft.^{3} 4/
Dose calculations	finite cloud 5/

1/ The number of assemblies in the shadow area of the cask is 96 assemblies.

2/ The Oconee fuel assemblies stands above the McGuire spent fuel racks.

3/ Estimated by licensee (1 to 2 minutes for crane operator who will remain in the vicinity of the pool the longest).

4/ Based on McGuire FSAR, Section 9.1.2 and 9.4.2, Figures 9.1.1-1, 9.1.1-2 and 9.4.2-3.

5/ K.G. Murphy, et. al., Nuclear Power Plant Control Room Ventilation System Design For Meeting General Design Criterion 19, 13th AEC Air Cleaning Conference.

Table 1 (con't)

Meteorology for the control room CA	800 m^2
Atmospheric dilution	1.25×10^{-3} sec/m^3
Source Inventory Correction Factors, etc.	See tables 2, 3 and 4
Number of Pins Damaged in Fuel Assembly	
96 assemblies	all the pins 1/, 2/
154 assemblies	one row

Table 2

Inventory of Activity in Pool from Cask Drop Accident

Radionuclide	Curies (Ci) Oconee Fuel	McGuire Fuel
131 I	1.6	27
85 Kr	402	6670
131 Xe	25	427
133 Xe	29	488

Table 3

Adult Dose Factors Used in Calculations (R.G. 1.109)

For Semi-Infinite Cloud

^{131}I	1.49×10^{-3}	$\frac{\text{mrem}}{\text{PCi intake}}$
^{85}Kr	1.6×10^{-5}	$\frac{\text{mrem/yr}}{\text{PCi/m}^3}$
^{131}Xe	9.15×10^{-5}	$\frac{\text{mrem/yr}}{\text{PCi/m}^3}$
^{133}Xe	2.94×10^{-4}	$\frac{\text{mrem/yr}}{\text{PCi/m}^3}$

Table 4

Correction Factors for 40,000 ft^3 finite cloud

^{85}Kr = 0.03

^{131}Xe = 0.139

^{133}Xe = 0.07

^{131}I = 0.03