SUPPLEMENTAL CRITICALITY ANALYSIS FOR THE PROPOSED TRANSFER OF SPENT FUEL FROM OCONEE TO MCGUIRE

Q. What is the scope of your criticality analysis for the proposed transfer of Oconee spent fuel from Oconee for storage in the McGuire spent fuel pool assuming a cask drop accident? Include any assumptions that form the basis for your analysis.

A. This testimony is on the likelihood of attaining criticality in the fissile fuel in the Oconee or McGuire Unit 1 spent fuel pools during or after a postulated accident involving the 25-ton truck cask, which is to be used for the proposed transfer of 300 spent fuel assemblies from the Oconee Nuclear Station to the McGuire Unit 1 spent fuel pool.

NRC analyses have shown that in the McGuire fuel storage pool the fuel that has the greatest potential for attaining a critical condition is new, unirradiated fuel. Fuel assemblies that have produced power for the full three-year cycle no longer have the potential for creating a criticality.

Q. What facts and assumptions form the basis for your analysis with respect to the potential for criticality being reached in the McGuire spent fuel pool from a cask drop accident?

A. The racks for the fuel assemblies in the McGuire Unit 1 pool are made up of open, square cross-section containers with an inside dimension of about nine inches. These containers are fabricated from one-quarter inch thick angles of stainless steel which are 2.5 inches wide. There is one of these open containers for each of the 500 fuel assemblies that can be stored in the pool.

Page 9.1-7 (Revision 6) of the McGuire FSAR states that the lower limit of the boron concentration in the fuel pool water is 2000 ppm. None of

8004160 230

the 300 Oconee spent fuel assemblies that the Duke Power Company is proposing to send to McGuire will be new fuel assemblies. Thus, if there is new fuel in the McGuire pool at the time this shipping cask is being handled near the pool, it will be McGuire fuel.

If, out of the present storage capacity of 500 assemblies, space is reserved for 300 spent fuel assemblies from Oconee, there would still be room for a full-core complement of 193 McGuire Unit 1 new fuel assemblies. Since the Duke Power Company is expecting to have McGuire Unit 1 ready for operation sometime in 1980, there could be some new or relatively new McGuire fuel assemblies from the first core in the pool when the 25-ton cask used to transport Oconee spent fuel is being handled near the McGuire pool.

The characteristics of these new fuel assemblies are given in the McGuire FSAR. Table 4.1-1 shows that the maximum enrichment of uranium-235 in this first core will be 3.1 weight percent.[1/] This will be for one-third of the core, i.e., the 65 fuel assemblies of Region 3. The average enrichment for the whole core will be 2.6 weight percent uranium-235. Table 4.3.2-1 of the FSAR states that in this first core there will be 1518 burnable poison rods which will decrease the core reactivity about 5.5 percent when it is in the cold condition. Table 4.3.2-2 of the FSAR states that the neutron multiplication factor in this core will be 0.99 with the control rods removed if there is 1435 ppm boron in the water.

1/ Duke Power Company's FSAR shows a maximum enrichment of uranium-235 of 3.1 percent by weight, although a maximum enrichment to 3.5 percent uranium-235 by weight is allowable.

Q. What are the results of your analysis? Include the considerations you used in arriving at those results.

A. After any compaction accident, the structural stainless steel angle material will continue to be present between fuel assemblies. The neutron multiplication factor in the McGuire spent fuel pool will be <0.99 during any cask handling accident if the minimum concentration of boron dissolved in the spent fuel pool water is 2000 ppm. If it is further postulated that during this accident the stainless steel liner gets torn and the resulting leakage necessitates that make-up water be supplied, borated make-up water can be supplied to the fuel pool from the refueling water storage tank, as stated on page 9.1-7 of the FSAR.

Q. What other factors did you consider?

A. Credit can be taken for the burnable poison that is in the fuel assemblies. This will be about 5.5 percent in reactivity in the McGuire pool for the maximum uranium-235 enrichment of 3.1 percent by weight of fresh McGuire fuel now in the pool. The burnable poison would have to be increased to meet the technical specifications for reactor operation, if sometime in the future the uranium-235 enrichment were to be increased to the maximum allowable of 3.5% by weight. Realistic initial conditions may be assumed when analyzing postulated accidents in a spent fuel pool. Thus, uranium-235 enrichment by weight of 3.1 percent may be used for the cask drop analysis since the maximum enrichment to be used, as stated in the FSAR will be 3.1 percent by weight.

Q. What conclusions did you reach based on your criticality analysis of an assumed drop of a truck cask into the McGuire spent fuel pool?

A. The maximum neutron multiplication factor (k_{eff}) in the McGuire pool with the refueling concentrations present will be approximately 0.97. The maximum k_{eff} will be less than 0.99, if approximately 2 percent is used as an uncertainty factor. From the above considerations, I conclude that it is highly unlikely that any cask handling accident at the McGuire spent fuel pool during the proposed shipment of 300 spent fuel assemblies would result in a criticality.

EDWARD LANTZ

DIVISION OF OPERATING REACTORS

U.S. NUCLEAR REGULATORY COMMISSION

PROFESSIONAL QUALIFICATIONS

As an Engineering Systems Analyst in the Plant Systems Branch I am responsible for technical reviews and evaluations of component and system designs and operating characteristics of licensed nuclear power reactors.

I have a Bachelor of Science degree in Engineering Physics from the Case Institute of Technology and a Masters of Science degree in Physics from Union College and a total of 28 years of professional experience, with over 20 years in the nuclear field. My experience includes work on reactor transients and safeguards analysis, nuclear reactor analysis and design, research and development on nuclear reactor and reactor control concepts and investigations of their operational and safety aspects.

I have held my present position with the Commission since December 1975. My previous position, which I held for about two and one half years, was Project Manager in the Gas Cooled Reactors Branch, Division of Reactor Licensing, U. S. Nuclear Regulatory Commission, where I was responsible for the technical review, analysis, and evaluation of the nuclear safety aspects of applications for construction and operation of nuclear power plants. For about ten years prior to that I was Head of the Nuclear Reactor Section in NASA. My section was responsible for the development and verification of nuclear reactor analysis computer programs, conceptual design engineering, and development engineering contracting. Prior to my employment with NASA, I was a nuclear engineer at the Knolls Atomic Power Laboratory for about six years, where I worked on the safeguards and nuclear design of the S3G reactors and the initial development of the nuclear design of the S5G reactors. Previous experience includes system engineering and electrical engineering with the General Electric Company and electronic development engineering with the Victoreen Instrument Company.