ENVIRONMENTAL IMPACT OF ACCIDENTS

A high degree of protection against the occurrence of postulated accidents in the Oconee reactors is provided through correct design, construction, testing, and operation, and through the quality assurance program for establishing a high integrity of reactor systems, as considered in the Commission's Safety Evaluation dated December 29, 1970. Engineered safety features are nevertheless provided to mitigate the consequences of postulated accidents and occurrences. The highly conservative assumptions and calculations used in the Safety Evaluation are not suitable for environmental risk evaluations because the probability of occurrence for the unfavorable combinations of circumstances used in establishing the adequacy of reactor design is remote. In recognition of the need for a realistic approach to environmental risk, the Commission issued guidance to applicants on September 1, 1971, requiring the consideration of a spectrum of accidents with assumptions as realistic as the state of knowledge permits. The applicant's response was contained in the "Supplement to the Environmental Quality Features of Keowee-Toxaway Project" dated October 1971.

Nine classes of postulated accidents and occurrences ranging in severity from trivial to very serious have been identified by the Commission. In general, accidents in the high consequence end of the spectrum have a low occurrence rate and those on the low consequence end have a higher occurrence rate. The examples selected by the applicant for these classes are shown in Table 1. The examples given are reasonably homogeneous in terms of probability within each class, although we consider the release of the

waste gas decay tank contents as more appropriately in Class 3. The radiological consequences calculated by the applicant for Classes 2 through 8 are summarized in Table 2. The radiological consequences of Class 1 accidents are within those for routine effluents. The applicant considers the consequences of Class 3 accidents to be limited by their radiation monitoring system, and even if this system were not to function properly the consequences would not exceed those of Classes 2 and 5. The applicant calculates the Annual Average fraction of 10 CFR Part 20 MPC received by an individual at the exclusion area boundary, and the Annual Average dose received by any individual within a 50 mile radius of the plant. (The average dose computed by this method takes wind variability as well as average meteorology into account). The doses in Table 2 were calculated by the staff from the applicant's dose estimates.

We consider the results in Table 2 to represent reasonable radiological consequences, given the occurrences of the postulated events. Certain assumptions made by the applicant, such as the assumption of no prior steam generator tube leaks in the evaluation of the steam generator tube rupture and the omission of the primary coolant source in evaluating secondary system incidents are questionable, but the use of alternative assumptions does not significantly affect overall environmental risks. To

establish a realistic annual risk, the calculated doses in Table 2 must be multiplied by estimated probabilities. In general, we consider the events in Classes 2 through 5 as improbable but not unlikely during the 40-year life of the plant. Accidents in Classes 6 through 7 are relatively less probable but are still conceivable. The probability of occurrence of Class 8 accidents is very remote. The occurrences in Class 9 involve sequences of postulated successive failures more severe than those postulated for the design basis of protection systems and engineered safety features. Their consequences could be severe. However, the probability of their occurrence is so small that their environmental risk is extremely low. Defense in depth (multiple physical barriers), quality assurance for design, manufacture, and operation, continued surveillance and testing, and conservative design are all applied to provide and maintain the required high degree of assurance that potential accidents in this class are, and will remain, sufficiently remote in probability that the environmental risk is extremely low.

Table 2 indicates that the realistic radiological consequences of the postulated accidents for an assumed average individual at the site boundary are within the limits of 10 CFR Part 20. It also shows that the man-rem contribution for each postulated accident is orders of magnitude smaller than that from the natural background radiation of 117,000 man-rem/yr. When multiplied by the probability of occurrence, the annual potential radiation exposure of the population within 50 miles from all the postulated accidents identified is an even smaller fraction of that from natural background radiation and well within naturally occurring variations. Therefore, it is concluded from the results of this analysis that the realistic environmental risks due to postulated accidents are exceedingly small.

TABLE I

CLASSIFICATION OF POSTULATED ACCIDENTS AND OCCURRENCES

NO. OF CLASS	AEC DESCRIPTIONS	APPLICANT'S EXAMPLE(S)
1	Trivial Incidents	Not Considered
2	Misc. Small Releases Outside Containment	Frequent small spills and leaks. Infrequent larger pump seal or valve leaks Releases Due to Piping Failures
3	Radwaste System Failures	Inadvertent Discharge of the Contents of a Reactor Coolant Waste Receiver Tank or Waste Gas Decay Tank
4	Events That Release Radioactivity Into the Primary System	Not Applicable
5	Events That Release Radioactivity Into Secondary System	Normal Operation with Fuel Failures and Steam Generator Leaks Transient Operation with Fuel Failures and Steam Generator Leaks Steam Generator tube rupture
6	Refueling Accidents Inside Containment	Dropped Fuel Assembly
7	Accidents to Spent Fuel Outside Containment	
8	Accident Initiation Events Considered in Design-Basis Evaluation in the Safety Analysis Report	Steam Line Break Accident Rupture of Waste Gas Decay Tank Loss of Coolant Accident
9	Hypothetical Sequences of Failures More Severe than Class 8	Not Considered

TABLE II

SUMMARY OF RADIOLOGICAL CONSEQUENCES OF POSTULATED ACCIDENTS

CLASS	INCIDENT	EXCLUSION AREA BOUNDARY AVERAGED AND DIVIDED WHOLE BODY DOSE MREM	50 MILE ANNUAL AVERAGE MAN-REM*
2	Misc Small Leaks	5	19
5	Loss of Load	1.5×10^{-3}	6×10^{-2}
	Steam Generator Tube Leak	5	19
	Steam Generator Tube Failure	0.3	1.3
6&7	Spent Fuel Accidents	1	4.1
8	Steam Line Failure	3×10^{-2}	0.12
	Waste Gas Decay Tank Rupture	0.6	2.3
	Design Basis Loss of Coolant	3	11

*Based on 900 000 people in 50 miles