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G. Dicker, Chief, Project Branch No. 2, DRLP

THREE MILE ISLAND REALISTIC ACCIDENT SECTION OF THE DRAFT ENVIRONMENTAL STATEMENT

Enclosed is a mark-up of the realistic accident section of the draft environmental statement for Three Mile Island. There have been some minor revisions to the dose table due to a refinement of the dose calculations performed by E. G. Adensam. However, our opinion that the environmental risk remains extremely low has not changed.

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Postulated

ENVIRONMENTAL IMPACT OF ACCIDENTS

A. Plant Accidents

A high degree of protection against the occurrence of postulated accidents in the Three Mile Island Nuclear Station, Unit 1 and Unit 2, is provided through correct design, manufacture, and operation, and the quality assurance program used to establish the necessary high integrity of the reactor system as will be considered in the Commission's Safety Evaluation for each unit. Deviations that may occur are handled by protective systems to place and hold the plant in a safe condition. Notwithstanding this, the conservative postulate is made that serious accidents might occur, in spite of the fact that they are extremely unlikely, and engineered safety features are installed to mitigate the consequences of these postulated events. The probability of occurrence of accidents and the spectrum of their consequences to be considered from an environmental effects standpoint have been analyzed using best estimates of probabilities and realistic fission product release and transport assumptions. For site evaluation in ~~our~~ the Staff's safety review, extremely conservative assumptions were used for the purpose of comparing calculated doses resulting from a hypothetical release of fission products from the fuel, against the 10 CFR Part 100 siting guidelines. The computed doses that would be received by the population and environment from actual accidents would be significantly less than those that will be presented in ~~our~~ the Staff's Safety Evaluations. 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 is contained in "Environmental Report - Operating License Stage" for the Three Mile Island Nuclear Station, Unit 1 and Unit 2, dated December 10, 1971.

The applicant's report has been evaluated using the standard accident assumptions and guidance issued as a proposed Annex to Appendix D of 10 CFR Part 50 by the Commission on December 1, 1971. Nine classes of postulated accidents and occurrences ranging in severity from trivial to very serious were 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 I.17. The examples selected are reasonably homogeneous in terms of probability with two exceptions. It was considered to be more appropriate to classify (1) the failure of the waste gas decay tank as an accident in Class 3 (applicant uses Class 8) and (2) the steam generator tube rupture as an accident in Class 5 (applicant uses Class 8). The following assumptions made by the applicant are questionable: (1) no steam generator tube leaks prior to the steam generator tube rupture, (2) primary coolant activity is based on 0.1% failed fuel, and (3) the consequences of various releases are evaluated based on release rates applicable for specified times. However, the use of alternative assumptions does not significantly affect overall environmental risks.

Staff

~~Our~~ estimates of the dose which might be received by an assumed individual standing at the site boundary in the ~~windward~~ downwind direction, using the assumptions in the proposed Annex to Appendix D, are presented in Table ~~II~~ 18. ~~Our~~ 6 estimates of the integrated exposure that might be delivered to the population within 50 miles of the site are also presented in Table ~~II~~ 18. The man-rem estimate was based on the projected population around the site for the year 2014. The estimates presented in Table II refer to a single unit.

To rigourously establish a realistic annual risk, the calculated doses in Table ~~II~~ 18 would have to be multiplied by estimated probabilities. The events in Classes 1 and 2 represent occurrences which are anticipated during plant operation and their consequences, which are very small, are considered within the framework of routine effluents from the plant. Except for a limited amount of fuel failures and some steam generator leakage, the events in Classes 3 through 5 are not anticipated during plant operation but events of this type could occur sometime during the 40-year plant lifetime. Accidents in Classes 6 and 7 and small accidents in Class 8 are of similar or lower probability than accidents in Classes 3 through 5 but are still possible. The probability of occurrence of large Class 8 accidents is very small. Therefore, when the consequences indicated in Table ~~II~~ 18 are weighted by probabilities, the environmental risk is very low. The postulated occurrences in Class 9 involve sequences of successive failures more severe than those required to be considered in 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 small in probability that the environmental risk is extremely low.

Table 18 indicates that the realistically estimated radiological consequences of the postulated accidents would result in exposures of an assumed individual at the site boundary to concentrations of radioactive materials within the Maximum Permissible Concentrations (MPC) of Table II of 10 CFR Part 20. The table also shows that the estimated integrated exposure of the population within 50 miles of the plant from each postulated accident would be orders of magnitude smaller than that from naturally occurring radioactivity, which corresponds to approximately 394,000 man-rem/yr based on a natural background level of 130 mrem/yr. When considered with the probability of occurrence, the annual potential radiation exposure of the population from all the postulated accidents is an even smaller fraction of the exposure from natural background radiation and, in fact, is well within naturally occurring variations in the natural background. It is concluded from the results of the "realistic" analysis that the environmental risks due to postulated radiological accidents are exceedingly small.

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TABLE 1

CLASSIFICATION OF POSTULATED ACCIDENTS AND OCCURRENCES

Class	AEC Description	Applicant's Example(s)
1	Trivial Incidents	~~Not considered~~ None
2	Small Releases Outside Containment	Spill in Sample Hood
3	Radwaste System Failure	Inadvertent Release of Waste Gas Decay Tank
4	Fission Products to Primary System (BWR)	Not applicable
5	Fission Products to Primary and Secondary Systems (PWR)	One day Operation with Primary System Leak to Reactor Building Normal Operation with Steam Generator Tube Leak and Release from Condenser
6	Refueling Accidents	Drop of Fuel Assembly or Drop of Heavy Object on Fuel Assembly
7	Spent Fuel Handling Accident	Drop of Fuel Assembly
8	Accident Initiation Events Considered in Design Basis Evaluation in the Safety Analysis Report	Uncompensated Operating Reactivity Changes Startup Accident Rod Withdrawal Accident Moderator Dilution Accident Cold Water Accident Loss of Coolant Flow Accident Stuck-Out, Stuck-In, or Dropped Control Rod Accident Loss of Electric Load Accident Steam Line Failure Steam Line Leakage Steam Generator Tube Failure Rod Ejection Accident Loss of Coolant Accident Waste Gas Tank Rupture
9	Hypothetical Sequences of Failures More Severe Than Class 8	~~Not considered~~ None

TABLE ~~II~~ 18

SUMMARY OF RADIOLOGICAL CONSEQUENCES OF POSTULATED ACCIDENTS

(Single Unit Only)

Class	Event	Estimated Fraction of 10 CFR Part 20 Limit at Site Boundary[1]	Estimated Dose to Population in 50 Mile Radius, man-rem
1.0	Trivial incidents	2/	2/
2.0	Small releases outside containment	2/	2/
3.0	Radwaste system failures		
3.1	Equipment leakage or malfunction	0.072 ~~.028~~	10 ~~3.250~~
3.2	Release of waste gas storage tank contents	0.29 ~~.112~~	40 ~~15,600~~
3.3	Release of liquid waste storage tank contents	0.003 ~~Negl.~~	0.47 ~~Negl.~~
4.0	Fission products to primary system (BWR)		
4.1	Fuel cladding defects	N.A.	N.A.
4.2	Off-design transients that induce fuel failures above those expected	N.A.	N.A.
5.0	Fission products to primary and secondary systems (PWR)		
5.1	Fuel cladding defects and steam generator leaks	2/	2/
5.2	Off-design transients that induce fuel failure above those expected and steam generator leak	.002	0.2 ~~253~~
5.3	Steam generator tube rupture	0.096 ~~.117~~	13 ~~15,600~~

TABLE 18 (cont'd)

Class	Event	Estimated Fraction of 10 CFR Part 20 Limit at Site Boundary[1]	Estimated Dose to Population in 50 Mile Radius, man-rem
6.0	Refueling accidents		
6.1	Fuel bundle drop	0.015 ~~.004~~	2.1 ~~.550~~
6.2	Heavy object drop onto fuel in core	0.26 ~~.074~~	36 ~~10.290~~
7.0	Spent fuel handling accident		
7.1	Fuel assembly drop in fuel storage pool	0.01 ~~.004~~	1.3 ~~.550~~
7.2	Heavy object drop onto fuel rack	0.038 ~~.002~~	5.3 ~~.256~~
7.3	Fuel cask drop	N.A.	N.A.
8.0	Accident initiation events considered in design basis evaluation in the safety analysis report		
8.1	Loss-of-coolant accidents		
	Small Break	0.16 ~~<.001~~	40 ~~.033~~
	Large Break	1.2 ~~.370~~	1000 ~~50.820~~
8.1(a)	Break in instrument line from primary system that penetrates the containment	N.A.	N.A.
8.2(a)	Rod ejection accident (PWR)	0.17 ~~.030~~	100 ~~1.07~~
8.2(b)	Rod drop accident (BWR)	N.A.	N.A.
8.3(a)	Steamline breaks (PWR's outside containment)		
	Small Break	<.001	~~<.033~~
	Large Break	~~<0.001~~ ~~.007~~	~~0.13~~ ~~.990~~

TABLE 1B (cont'd)

Class	Event	Estimated Fraction of 10 CFR Part 20 Limit at Site Boundary 1/	Estimated Dose to Population in 50 Mile Radius, man-rem
8.3(b)	Steamline breaks (BWR)		
	Small Break	N.A.	N.A.
	Large Break	N.A.	N.A.

1/ Represents the calculated fraction of a whole body dose of 500 mr, or the equivalent dose to an organ.

2/ These releases will be comparable to the design objectives indicated in the proposed Appendix I to 10 CFR Part 50 for routine effluents (i.e., 5 mrem/yr to an individual from all sources).

B Transportation accidents

To be supplied