UNITED STATES
NUCLEAR REGULATOR COMMISSION
WASHINGTON, D. C. 20555

Enclosure

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
REGARDING THE FUEL HANDLING ACCIDENT INSIDE CONTAINMENT

CALVERT CLIFFS NUCLEAR POWER PLANT UNITS 1 AND 2
BALTIMORE GAS AND ELECTRIC COMPANY
DOCKET NOS. 50-317, -318

Introduction

By letter dated January 17, 1977, the staff requested the Baltimore Gas and Electric Company (the licensee) to evaluate the previously unevaluated potential consequences of a postulated Fuel Handling Accident Inside Containment (FHAIC) at Calvert Cliffs 1/2. The licensee submitted, in a letter dated March 21, 1977, an evaluation of the FHAIC. The licensee stated that the potential consequence of this postulated accident is 4.4 Rem thyroid at the Exclusion Area Boundary (EAB). The The licensee concluded that this dose is well within the guidelines of 10 CFR Part 100.

Evaluation

We have completed our review of the licensee's March 21, 1977, submittal which addresses the potential consequences of an accident involving spent fuel handling inside containment. We have performed an independent analysis of the FHAIC. Our assumptions and the resulting potential consequences at the EAB are given in Table 1. The calculated potential consequences of the postulated fuel handling accident inside containment are appropriately within the guidelines of 10 CFR Part 100 and are, therefore, acceptable. Appropriately within the guidelines of 10 CFR Part 100 has been defined as less than 100 Rem to the thyroid. This is based on the probability of this event relative to other events which are evaluated against 10 CFR Part 100 exposure guidelines. Whole body doses were also examined, but they are not controlling due to decay of the short-lived radioisotopes prior to fuel handling. The potential consequences of this postulated accident at the Low Population Zone Boundary are less than those given for the EAB In Table 1.

A recent study[1/] has indicated that dropping a spent fuel assembly into the core during refueling operations may potentially cause damage to more fuel pins than has been assumed for evaluating the Fuel Handling Accident Inside Containment. This study has indicated that up to all of the fuel pins in two spent fuel assemblies, the one dropped and the one hit, may be damaged because of the embrittlement of fuel cladding material from radiation in the core.

---

1 J. N. Singh, "Fuel Assembly Handling Accident Analysis," EG&G Idaho Technical Report RE-A-78-227, October 1978.

The probability of the postulated fuel handling accident inside containment is small. Not only have there been several hundred reactor-years of plant operating experience with only a few accidents involving spent fuel being dropped into the core, but none of these accidents has resulted in measurable releases of activity. The potential damage to spent fuel estimated by the study was based on the assumption that a spent fuel assembly falls about 14 feet directly onto one other assembly in the core; an impact which results in the greatest energy available for crushing the fuel pins in both assemblies. This type of impact is unlikely because the falling assembly would be subjected to drag forces in the water which should cause the assembly to skew out of a vertical fall path.

Based on the above, we have concluded that the likelihood of a spent fuel assembly falling into the core and damaging all the fuel pins in two assemblies is sufficiently small that refueling inside containment is not a safety concern which requires immediate remedial action.

We have, however, conservatively calculated the potential radiological consequences of a fuel assembly drop onto the reactor core with the rupture of all the fuel pins in two fuel assemblies. We have also assumed for this postulated accident that the source term for both spent fuel assemblies is that given in Regulatory Guide 1.25. This is conservative because (1) these two assemblies should not have the power peaking factor and clad gap activity recommended in Regulatory Guide 1.25 and (2) the pool decontamination factor for inorganic iodine should be greater than that recommended in Regulatory Guide 1.25. The calculated potential radiological consequences at the exclusion area boundary for the complete rupture of fuel pins in two assemblies are twice the values given in Table 1. These conservatively calculated potential consequences, due to the lower probability of two assembly failures, have been judged against and found less than the guidelines of 10 CFR Part 100. Consequently, we have concluded that the potential consequences of this postulated accident are acceptable.

Environmental Considerations

The environmental impacts of an accident involving the handling of spent fuel inside containment have been addressed in Section VI.A of the Final Environmental Statement (FES) dated April, 1973, for the operation of Calvert Cliffs 1/2.

Conclusion

The staff has evaluated the licensee's analys[illegible] the postulated FHAIC. After performing an independent analy[illegible]f the radiological consequences of a FHAIC to any individual loca[illegible] at the nearest exclusion area boundary, the staff concludes that the doses for one assembly failure are appropriately within the guideline values of 10 CFR Part 100 and for failure of two assemblies within the guideline values of 10 CFR Part 100 and are, therefore, acceptable.

Table .

ASSUMPTIONS FOR AND POTENTIAL CONSEQUENCES OF THE POSTULATED FUEL HANDLING ACCIDENTS AT THE EXCLUSION AREA BOUNDARY FOR CALVERT CLIFFS NUCLEAR POWER PLANT UNITS 1 AND 2

Assumptions:

Guidance in Regulatory Guide 1.25	
Power Level	2700 Mwt
Fuel Exposure Time	3 years
Power Peaking Factor	1.65
Equivalent Number of Assemblies damaged	1
Number of Assemblies in core	217
Charcoal Filters available	None
Decay time before moving fuel	72 hours
0-2 hours X/Q Value, Exclusion Area Boundary (ground level release)	1.1×10^{-4} sec/m^3

	Doses, Rem	
	Thyroid	Whole Body
Exclusion Area Boundary (EAB) Consequences from Accidents Inside Containment	24	0.1