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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REGARDING THE FUEL HANDLING ACCIDENT INSIDE CONTAINMENT

JOSEPH M. FARLEY NUCLEAR PLANT UNIT NO. 1

ALABAMA POWER COMPANY

DOCKET NO. 50-348

Introduction

By letter dated March 11, 1977, the staff requested the Alabama Power Company (APCo) to evaluate the potential consequences of a postulated fuel handling accident inside containment (FHAIC) at Farley Nuclear Plant Unit No. 1. The licensee submitted the evaluation of the FHAIC in Amendment No. 67 to the Final Safety Analysis Report (FSAR) dated September 9, 1977. In addition, by letter dated June 8, 1978, the staff requested APCo to modify the charcoal filter for the containment purge system to meet seismic Category I requirements. These modifications were required to assure that the consequences of a FHAIC at Farley were well within the guidelines of 10 CFR Part 100. APCo's response dated August 7, 1978 stated that the modifications associated with the charcoal adsorbers in the containment purge exhaust system would be completed prior to startup following the first refueling outage in accordance with NRC requirements. The licensee further stated that the analysis for the FHAIC, which includes credit for the charcoal adsorbers in the containment purge exhaust system, is provided in FSAR Section 15.4.5.4 (Paragraph 15.4.5.4.4, Case 1). APCo concluded that, since this analysis demonstrates that the calculated offsite doses for the Farley plant are within the NRC determined limit of 25% of 10 CFR Part 100 guideline values, no revised analyses are required. The following is our evaluation of APCo's submittals.

Evaluation

The staff has reviewed the FHAIC analysis provided by APCo in FSAR Amendment No. 63. We determined that the calculated offsite dose due to radioactive gas released from the postulated damaged fuel would exceed the staff's acceptance criteria (25% of 10 CFR Part 100) for the postulated FHAIC accident. In making this determination, we did not allow credit for the reduction of iodine activity by the charcoal adsorbers because these units were not seismically qualified. Thus, APCo, in response to the staff's request by letter dated June 8, 1978, proposed to modify the charcoal filters for the containment purge system to meet seismic Category I requirements. FSAR Amendment No. 71, dated December 29, 1978, indicates that the filters would be made seismically qualified prior to startup following the first refueling outage for Unit 1 and prior to initial fuel loading for Unit 2. The licensee has orally stated that the work on Unit 1 was completed during the March 1979 outage. The staff concludes that this is a satisfactory means of providing assurance that

the consequences of a FHAIC will be well within the dose guidelines of 10 CFR Part 100 and are, therefore, acceptable. Assumptions used in the analysis are shown in Table 1 and the potential offsite doses are shown in Table 2.

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 FHAIC. This study has indicated that up to all 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.

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 and low population zone for the complete rupture of fuel pins in two assemblies are twice the values given in Table 1. Because these potential consequences are within the guidelines of 10 CFR Part 100 using the conservative assumptions of Regulatory Guide 1.25, we have concluded that the potential consequences of this postulated accident are acceptable and no additional restrictions on fuel handling operations and plant operating procedures are needed.

The results of this analysis warranted an investigation of a similar accident in the spent fuel pool. For this, a drop of 2-1/2 feet was postulated and the analysis performed in the same manner as previously described. Results indicate that in this scenario damage to the missile or target is minimal. No fuel pins in either fuel assembly were calculated to be ruptured.

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

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 June, 1972, for the operation of Farley Nuclear Plant Unit No. 1.

Conclusion

The staff has evaluated APCo's analysis of the postulated FHAIC. After performing an independent analysis of the radiological consequences of a FHAIC to any individual located at the nearest exclusion area boundary, the staff concludes that the doses for one assembly failure are well 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.

The staff has also concluded, based on the considerations discussed above, that: (1) because this action does not involve a significant increase in the probability or consequences of accidents previously considered and does not involve a significant decrease in a safety margin, it does not involve a significant hazards consideration, (2) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (3) such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Date: April 9, 1980

TABLE 1

FUEL HANDLING ACCIDENT ASSUMPTIONS

Shutdown Time, hours	100
Total Number of Fuel Rods in the Core	32,028
Number of Fuel Rods Involved in the Refueling Accident	204
Power Peaking Factor	1.65
Iodine Fractions Released from Pool	
Elemental	0.75
Organic	0.25
Effective Filter Efficiency, %	
Elemental	90
Organic	30
X/Q Values, Sec/m^3 *	
0-2 hours @ 1235 meters	3.9×10^{-4}
0-8 hours @ 3218 meters	8.3×10^{-5}

* Memorandum from L. Hulman to G. Knighton, dated September 4, 1979.

TABLE 2

POTENTIAL OFFSITE DOSES DUE TO DESIGN BASIS ACCIDENTS

	Two-Hour Exclusion Boundary (1260 Meters)		Course of Accident Low Population Zone (3200 Meters)	
Accident	Thyroid (rem)	Whole Body (rem)	Thyroid (rem)	Whole Body (rem)
Fuel Handling	27	<1	6	<1