3.12 CASK HANDLING

Applicability: Applies to limitations during cask handling.

Objective: To minimize the possibility of an accident during cask handling operations that would affect the health and safety of the public.

Specifications: During cask handling operations:

(1) The spent fuel cask shall not be moved into the spent fuel pit until all the spent fuel in the pit has decayed for a minimum of one thousand (1,000) hours.

(2) Only a single element cask may be moved into the spent fuel pit.

(3) A fuel assembly shall not be removed from the spent fuel pit in a shipping cask until it has decayed for a minimum of one hundred twenty (120) days.*

*The Region 10 fuel which was in the Unit 3 reactor during the period of April 19, 1981 thru April 24, 1981 may be removed from the Unit 3 spent fuel pit in a shipping cask after a minimum decay period of ninety five (95) days.

BACKGROUND & BASES

1) The assemblies Florida Power and Light proposes to move were in a critical reactor for ~67½ hours, some 8 hours of this at a power level of 3%. This will have resulted in a very small accumulation of transuranic products.

2) Referring to the enclosed table of Important Fission Products, it is evident that the gases of greatest concern (Iodine and Xenon) will have undergone more than 7 half-life decays by the 95th day of cooling. Seven half-lives will of course reduce the initial quantity by >99%.

3) In consideration of Items 1 and 2, it is felt that the requirements of 10 CFR 100 are met as referenced in the Technical Specification Bases.

4) Health Physics estimates show that a minimum of 4 Man-Rem and possibly upwards of 7 Man-Rem will be saved if the fuel can be moved in conjunction with the current transfer.

7-23-81

Re: Turkey Point Units 3 & 4
Docket Nos. 50-250, 50-251
Fuel Assembly Decay Time

SAFETY ANALYSIS: FUEL SHIPMENT < 120 DAYS

I. With respect to an accident previously evaluated in the FSAR:

The probability of occurrence or consequences of an accident or malfunction of equipment important to safety previously evaluated in the FSAR is not increased.

II. With respect to the possibility of an accident of a different type than analyzed in the FSAR:

All plant parameters will be maintained within Technical Specification Limits. (with the exception of 3.12). No conditions will be set up to create the possibility of an accident that has not been previously analyzed and submitted in licensing correspondence.

III. Within respect to the margin of safety as defined in the basis for any technical Specification:

This test requires that all Technical Specification Limits (aside from 3.12) be maintained. Thus, the margin of safety as discussed in Technical Specifications will not be decreased.

7-23-81

CORE DECAY HEAT CALCULATION

$$\frac{P}{P_o} = 6.1 \cdot 10^{-3} \left[(\Upsilon - T_o)^{-0.2} - \gamma^{-0.2} \right]$$

Where:
P = Decay Heat w/ same units as P_o
P_o = Reactor Operating Power
$\Upsilon - T_o$ = Cooling Time in days
T_o = Operating Time in days

$$\frac{P}{22} = 6.1 \cdot 10^{-3} \left[(87 - 3)^{-0.2} - 87^{-0.2} \right] \quad {*1}$$

$P = 0.387 \cdot 10^{-3}$ MW_T = .387 KW_T (Total core) *2

Conservative 1% power = .01·2200 = 22 MW_T

Conservative 3 operating days

∴ No problem with cask requirement of < 2.5 kw per assembly

*1 Calculation performed 87 days after startup.

*2 Based on model using all fresh fuel for ease of calculation since no fuel of higher burnup (exposure) will be moved.

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IMPORTANT FISSION PRODUCTS AND HALF LIVES

ISOTOPE	$T_{1/2}$	7 HALF LIVES
I - 131	8.05 days	∿ 56
I - 132	2.3 hours	
I - 133	20.3 hours	
I - 134	52 minutes	
I - 135	6.7 hours	
XE-131m	11.8 days	∿ 82.6
XE-133	5.3 days	∿ 37
XE-133m	2.3 days	
XE-135	9.1 hours	
XE-135m	15.6 minutes	
XE-138	17.5 minutes	
CS-138	32.2 minutes	
CS-134	2.05 years	
CS-137	30 years	
SR-89	∿ 53 days	
SR-90	27.7 years	

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[illegible]

GLASSTONE & SESONSKE

2.184. The rate of emission of beta and gamma energy is often called the *decay heat power*, since the decay energy appears in the form of heat. If this power is expressed in watts, by using the conversion factor 1 Mev = 1.6×10^{-13} watt-sec (§ 1.45), and is represented by P, it follows that

$$\frac{P}{P_0} = 6.1 \times 10^{-3}[(\tau - T_0)^{-0.2} - \tau^{-0.2}], \quad (2.56)$$

where P and P_0 can be expressed in any convenient, but identical, units, since the ratio is dimensionless. In equation (2.56), $\tau - T_0$ is the time in days after shutdown, i.e., the cooling period. For long irradiation periods (> about 1 year) and short cooling times (< about 10 days), the approximate equation (2.56) can be simplified by neglecting the second term in the brackets. The rate of release of the decay energy is then dependent only on the cooling time, $\tau - T_0$, and not on the operating time.

2.185. The results of equation (2.56) can be represented in graphical form, as in Fig. 2.29. This gives the ratio of the beta and gamma decay heat power to the reactor operating power (P/P_0) as a function of time after shutdown

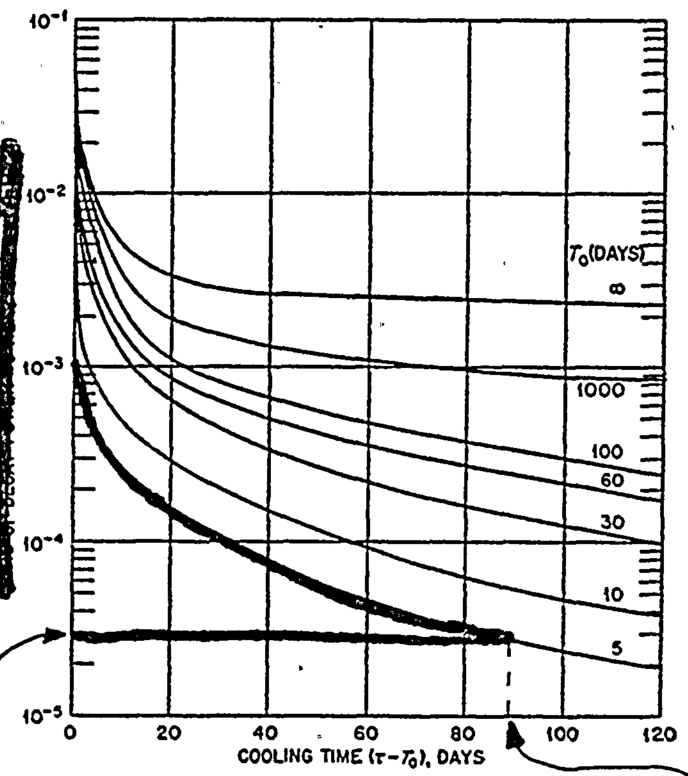

Fig. 2.29. Decay power as function of time after shutdown

90 DAYS

7-23-81

2.187]

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TABLE 2.1

Operating Time	
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30 days........	
1 year.........	
Infinite........	

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