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Date: Monday, August 21, 2000 05:22 PM
Subject: heatup times with new peaking factors

new adiabatic heatup times with BWR peaking factor of 1.2 and PWR peaking factor of 1.1

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The times calculated are in hours for an adiabatic heatup from 30 C to 800 C with no oxidation heat source. Adiabatic Heatups are based on a Peaking Factor of 1.1 for PWRs and 1.2 for BWRs. The decay heats at these burnup values are interpolations or extrapolations of the decay heat from NUREG/CR-5625. The thermal mass of the BWR fuel is modeled as 9x9 fuel assemblies and the associated fuel rack structure. The mass per assembly is 170 kg UO2, 97.5 kg Zirconium and 42.4 kg stainless steel. The thermal mass PWR fuel is modeled 17x17 fuel assemblies and the associated rack structure. The mass per assembly is kg UO2, 101 kg Zirconium, and 68.6 kg stainless steel. Temperature dependent values of the specific heat are used for steel, zircaloy, and UO2.

Adiabatic Heatup Time at 1 Year

Burnup	PWR	BWR
50	6.1	10.1
55	5.6	9.2
60	5.2	8.5
70	4.4	7.2
80	3.8	6.4

Adiabatic Heatup Time at 2 Years

Burnup	PWR	BWR
50	11.2	17.9
55	10.2	16.1
60	9.4	14.9
70	8.0	12.8
80	7.1	11.1

Adiabatic Heatup Time at 5 Years

Burnup	PWR	BWR
50	28.0	40.0
55	25.4	36.4
60	23.3	33.4
70	19.9	28.5
80	17.4	25.0

Adiabatic Heatup Time at 10 Years

Burnup	PWR	BWR
50	42.8	58.0
55	38.9	52.9
60	35.6	48.4
70	30.5	41.5
80	26.7	36.2

Decay Time in Years for a 10 Hour Adiabatic Heatup Time

Burnup	PWR	BWR
50	1.8	1.0
55	2.0	1.2
60	2.2	1.3
70	2.6	1.6
80	2.9	1.9

Decay Time in Years for a 24 Hour Adiabatic Heatup Time

Burnup	PWR	BWR
50	4.3	2.8
55	4.8	3.2
60	5.1	3.5
70	6.6	4.1
80	8.4	4.9

Spent Fuel Pool Heatup and Boiloff Time in hours to 3 feet Above Active Fuel. Fuel Burnup is 62.5 Gwd/MTU with a 2 year cycle time. The decay heat at this value of burnup is an extrapolation of the decay heat from NUREG/CR-5625. The BWR pool holds 4200 9x9 fuel assemblies. The pool surface are is 105.7 square meters. The PWR pool holds 965 17x17 fuel assemblies. The pool surface are is 61.3 square meters. The pools have a water depth of 11.54 meters and are assumed to be at an initial temperature of 30 C. An estimated volume fraction of 0.5 of water in the racks and assemblies was used. Errors in this value can impact the heatup time portion of the heatup and boiloff calculation. The specific heat of water was assumed to be constant at 4200 J/kg for the heatup calculation. Temperature dependent properties were used for steel, zircaloy, and UO2. The enthalpy change due to vaporization used in the boiloff calculation is 2257 KJ/kg.

Decay Time	PWR	BWR
1 year	195	253
2 year	272	337
5 year	400	459
10 year	476	532