

Report

NDS3/01/0028

Subject/Title

HTR
Nuclear Waste
Fuel at EOL

Place	Date
Erlangen	30.11.2001

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Project

HTR FANP/
HTR-N (EC-Project)

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Summary

Pages of Text: 3 Appendices: -

This report serves as an information to the members of WP 4 of the HTR-N (EC-Project: FIKI-CT-2000-00020) and is foreseen as an input to the SINTER network.

Abstract

In the last HTR-N, WP4 meeting CEA was presenting the results of calculations for EOL for reflector graphite and pointed out that they are doing calculations for the EOL content of fuels of the GT-MHR what means weapon-grade enriched fuel particles.

This report summarizes the results of calculations made for the HTR Module (Siemens design of the 80ies for a uranium pebble bed reactor) with a given burn-up, U-content at BOL etc.. But these data can easily be adopted for other HTRs. Likewise it can be done to the comparison herein between LWR and HTR Module.

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1. Introduction

The data in this report are based on calculations made for the HTR Module – a Uranium pebble bed reactor designed by Siemens in the 80ies.

2. Assumptions for the Calculations

Nominal Data for Equilibrium Core		
Thermal Power	200	MJ/s
Core diameter	3	m
Core height (avg.)	9.4	m
Power density (avg.)	3.0	MW/m ³
Primary coolant temperatures (avg.)	250/700	°C
Primary system pressure	60	bar
Number of fuel elements	360,000	
Number of radial enrichment zones	1	
Number of fuel cycles	15	
Reactivity reserve for load cycle	1.2	%
U235 enrichment	8	w-%
Heavy metal charge of fuel element	7	g
U235 content per fuel element	0.55	g
Fuel element dwell time (avg.)	1007	EFPD
Fuel element run time per cycle (avg.)	67	EFPD
Average burnup	80,000	MWd/Mg U
Conversion rate	0.47	
Overall power peaking factor	1.77	
Neutron loss from pebble bed	13.7	%
Heavy metal (excluding fission products)	2396	kg
Fissionable material	106.9	kg
U235	91.2	kg
Pu239	12.6	kg
Pu241	3.1	kg

3. Results

Characteristic fuel date			
Fuel content [g]			
	fresh fuel	burnup fuel	ratio
U235	0.551	0.092	6.0
U236		0.072	-
Np237		0.001	-
U238	6.449	6.154	1.05
Pu238		0.0002	
Np239		0.0006	-
Pu239		0.041	-
Pu240		0.028	-

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Pu241		0.016	-
Am241		0.0004	-
Pu242		0.011	-
Am243		0.001	-

Fuel content per kg Uran (BOL); Comparison: PWR - HTR Module

	PWR (Power Station Stade)		HTR-Modul	
Enrichment (U235)	3.3		8	w-%
Burnup	33,000	35,600	80,000	MWd/t
Nuclide:				
U235	8.6	7.6	13.1	g
U236	4.1	4.3	10.2	g
U238	946.5	944.6	879.2	g
Pu239	5.1	5.2	5.9	g
Pu240	2.2	2.4	4.0	g
Pu241	1.3	1.4	2.3	g
Pu242	0.4	0.5	1.6	g
Other actinides	0.4 – 0.7	0.6 – 0.9	~2.4	g
Fission products	~30.9	~33.4	~84.0	g