4 Dy Burnup Validation

R.T. Jones
Senior Physicist
Reactor & Radiation Physics Branch, AECL

Presented to US Nuclear Regulatory Commission
Chalk River Laboratories
2004 July 27-29

AECL
TECHNOLOGIES INC.

Objectives

- To describe the data available from NRU irradiations of fuel-elements containing Dy
- To show how the data is used to validate the WIMS calculation of Dy isotopic distribution as burnup proceeds
- To outline how the results of the validation can be used to assess the impact of code biasses on the CVR bias for a particular fuel design

Nuclear Properties of Dysprosium

Isotope	Dy156	Dy158	Dy160	Dy161	Dy162	Dy163	Dy164	Dy165
Natural Abundance (Atm %)	0.06	0.10	2.34	18.90	25.50	24.90	28.20	T½ 2.33 h
Thermal Capture Cross Section (Barns)	33	43	56	600	194	124	2650	3600
Capture Resonance Integral (Barns)	884	120	1160	1200	2755	1470	340	22000

General Irradiation Behaviour of Dy

Data From NRU Irradiations

PIE Measured Data

- La content of sample (number of fissions) by high-performance liquid chromatography (HPLC)
- Dy, Ho and Er content of sample by HPLC
- Dy isotope atom fractions by mass spectrometry

Calculations

- WIMS-IST
- NRU loop super-cell model
- 89 energy groups
- Enhanced spatial subdivision
- Normalized to measured La

Calculated/Measured Comparisons

Summary of Atom Fraction Comparisons

Presentation of the Data in a Way That Is Useful for Assessment of Du-doped Bundle Designs

Plotted Data Summarizing the WIMS Validation

Summary

- The data available from NRU loop irradiations of Dy containing fuel-elements and their use to validate WIMS 2-5d have been described, and
- A way of parameterizing the results for application to a fuel design has been outlined
- Further irradiation data will be available from other NRU irradiations

AECL

TECHNOLOGIES INC.