



# Current Status of the CNEA Qualification Programs for the Fabrication of High Density MTR Fuel

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## 2005 Status of the CNEA Qualification Programs

### SCOPE

- Review of CNEA high density MTR fuel qualification programs
- Current activities
- Proposed irradiation of a UMo Full Scale Fuel Assembly





## 2005 Status of the CNEA Qualification Programs

# CNEA Qualification Programs for High Density Fuel Fabrication

- $U_3Si_2$  Fuel Fabrication: completed in 2003
  - Activities: Fuel design, fabrication, irradiation, pool-side post-irradiation examination and hot cell destructive testing
- UMo Fuel (Dispersion) - in progress
- UMo Fuel (Monolithic) - development stage





## 2005 Status of the CNEA Qualification Programs

# UMo Development and Qualification

## Main Activities

- Development of basic knowledge about materials interaction
  - Development of technology to avoid or to reduce undesirable UMo-Matrix interaction
  - Development of fabrication procedures to obtain sound UMo plates
- Irradiation in RA-3 (miniplates and full size FA)





## 2005 Status of the CNEA Qualification Programs

### Development of technology to fabricate sound plates using different UMo powders

- Development of devices and procedures for blending the powder and fabricating the compacts
- Improvements and modifications of QC procedures for UMo plates

#### RESULT:

- Fuel plates suitable for irradiation





## 2005 Status of the CNEA Qualification Programs

### In-Pile UMO Behaviour: Results from the International Experience (RRFM2004 and RERTR2004)

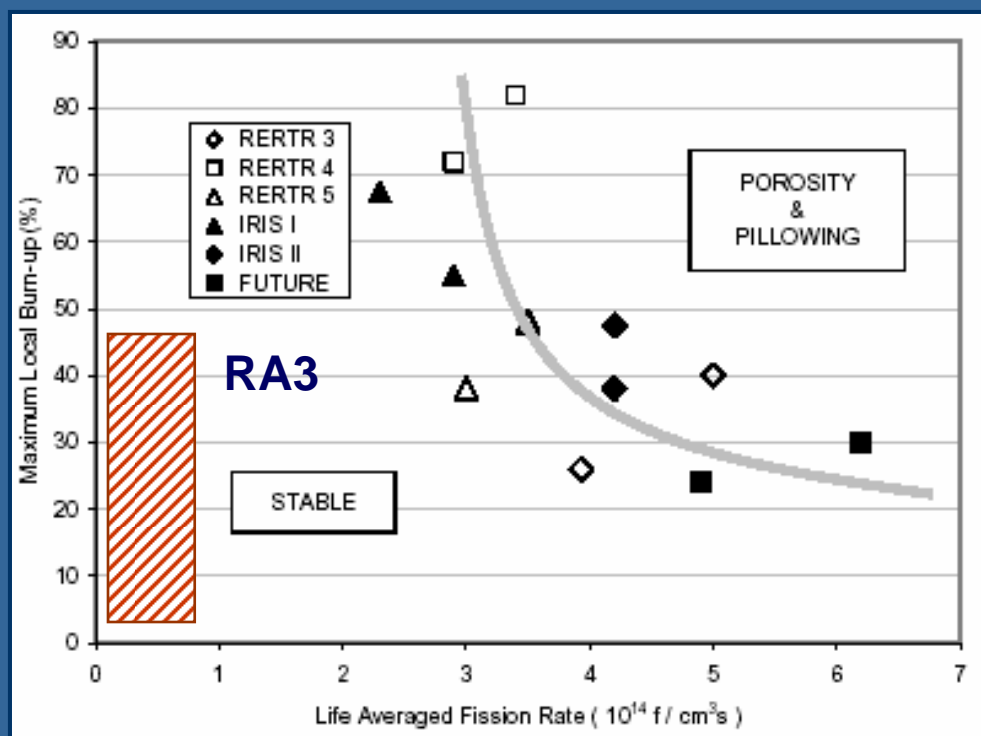
- The irradiation behaviour of the U-Mo alloy is very stable and predictable
- The undesirable behaviour related with U-Mo and Al matrix interaction is not present at low power and low temperature conditions





## 2005 Status of the CNEA Qualification Programs

### UMo Behaviour



G. Hofman et al, RRFM 2004

### RA3 Parameters

Average Fission Rate

$2,58\text{E}+12 \text{ f/cm}^3\text{s}$

Maximum Fission Rate

$7,49\text{E}+13 \text{ f/cm}^3\text{s}$





## 2005 Status of the CNEA Qualification Programs

### CONSIDERING

International  
Experience



Operating conditions  
in RA3



**Full scale irradiation in RA3 is possible**





## 2005 Status of the CNEA Qualification Programs

# Details of the Proposed UMo Full-scale Irradiation

- Where: in the Argentine RA-3 Reactor
- Objective: to start the qualification of the domestic technology for the fabrication of U-Mo fuel
- Fuel fabrication: at the ECRI facility in the Constituyentes Atomic Center
- Target burnup: >50 %





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**RA-3**



### Main characteristics

- Pool type
- Coolant and moderator: light water
- Cooling by down going forced convection
- Nominal power 10 MW
- 25 fuel assemblies





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Fuel Material			U-7wt%Mo	
Fuel Plates			20	
Meat dimensions	Length	[mm]	615	
	Width	[mm]	60	
	Thickness	Outer	[mm]	*
		Inner		
Fuel Plate dimensions	Length	Outer	735	
		Inner	665	
	Width	Outer	[mm]	70,5
		Inner		
	Thickness	Outer	[mm]	1,5
		Inner		1,35
Cladding Thickness		Outer	*	
		Inner	*	
Enrichment U <sup>235</sup>			20 % U weight	
U Density		[g/cm <sup>3</sup> ]	6	
Gap between fuel plates		mm	2,6	

### Fuel description





## 2005 Status of the CNEA Qualification Programs

### Preliminary Schedule

Id	Task	2005				2006				2007				2008				2009				
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
1	FA Final Design																					
2	Analysis by the Licensing Authority																					
3	Fuel Fabrication																					
4	Irradiation																					
5	Final Pool-Side inspection																					
6	Cooling time																					
7	Hot Cell PIE																					

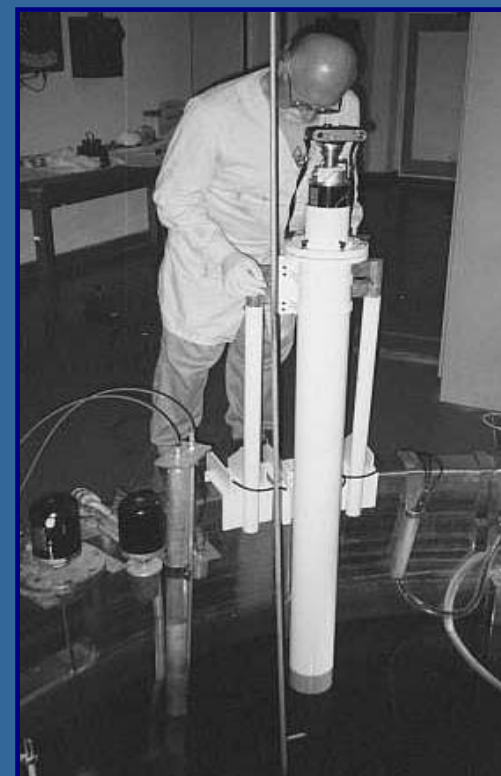


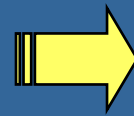


## 2005 Status of the CNEA Qualification Programs

### Additional Activities During the Irradiation

- Intermediate visual inspections at the RA-3 pool-side station
- Measurement of the gap between fuel plates





- $U_3Si_2$  stage was completed in 2003.  
This technology is currently applied to the fabrication of FA for the first cores of the Australian OPAL Reactor
- UMo stage:
  - Initial fabrication plans were stopped at the beginning of 2004
  - A new irradiation of a full size fuel element in RA-3 is being considered
  - The results could be available by 2009

