

Technology Readiness Levels (TRL) for Fuels

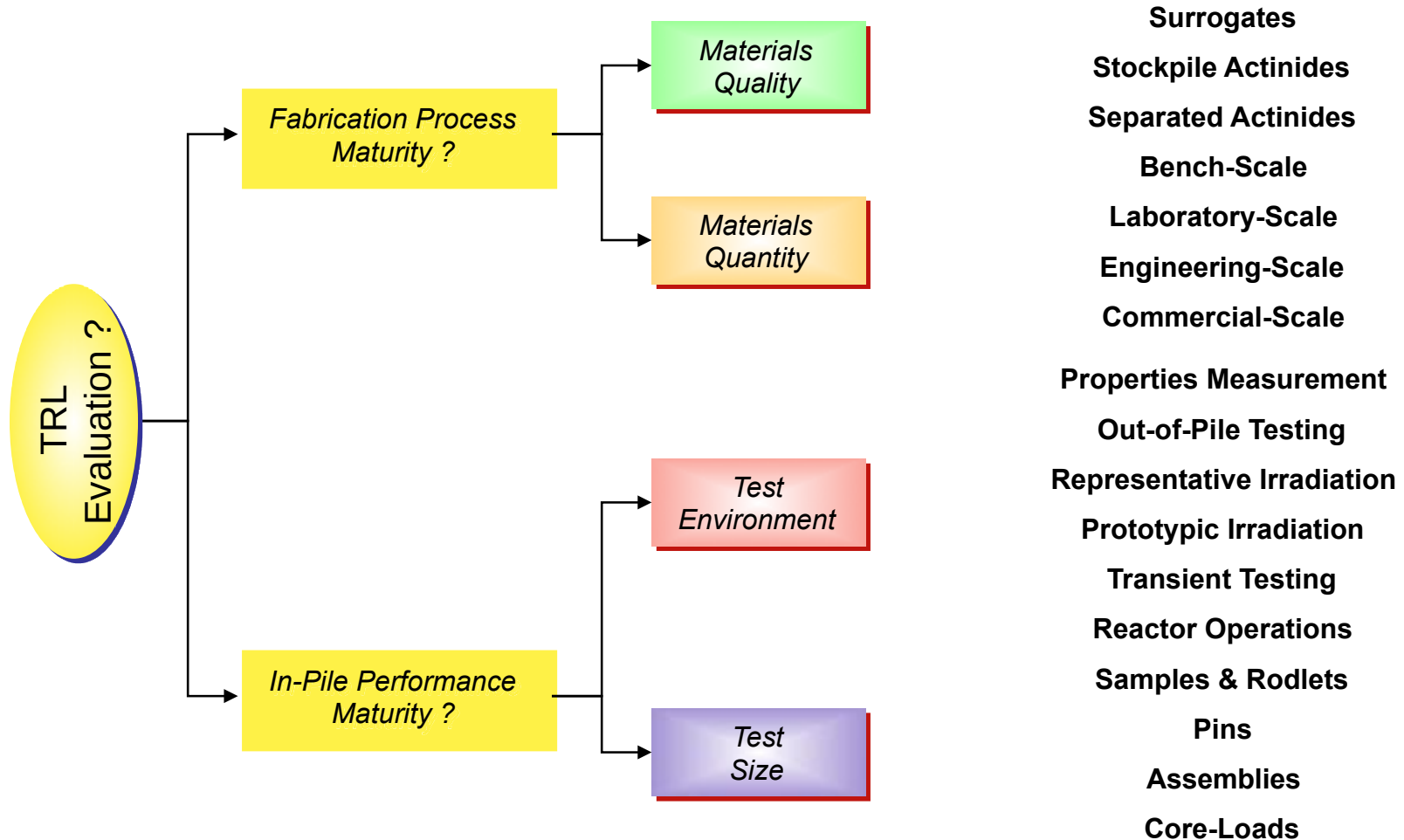
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There are two elements to assessing the maturity of a new fuel type in terms of readiness for deployment

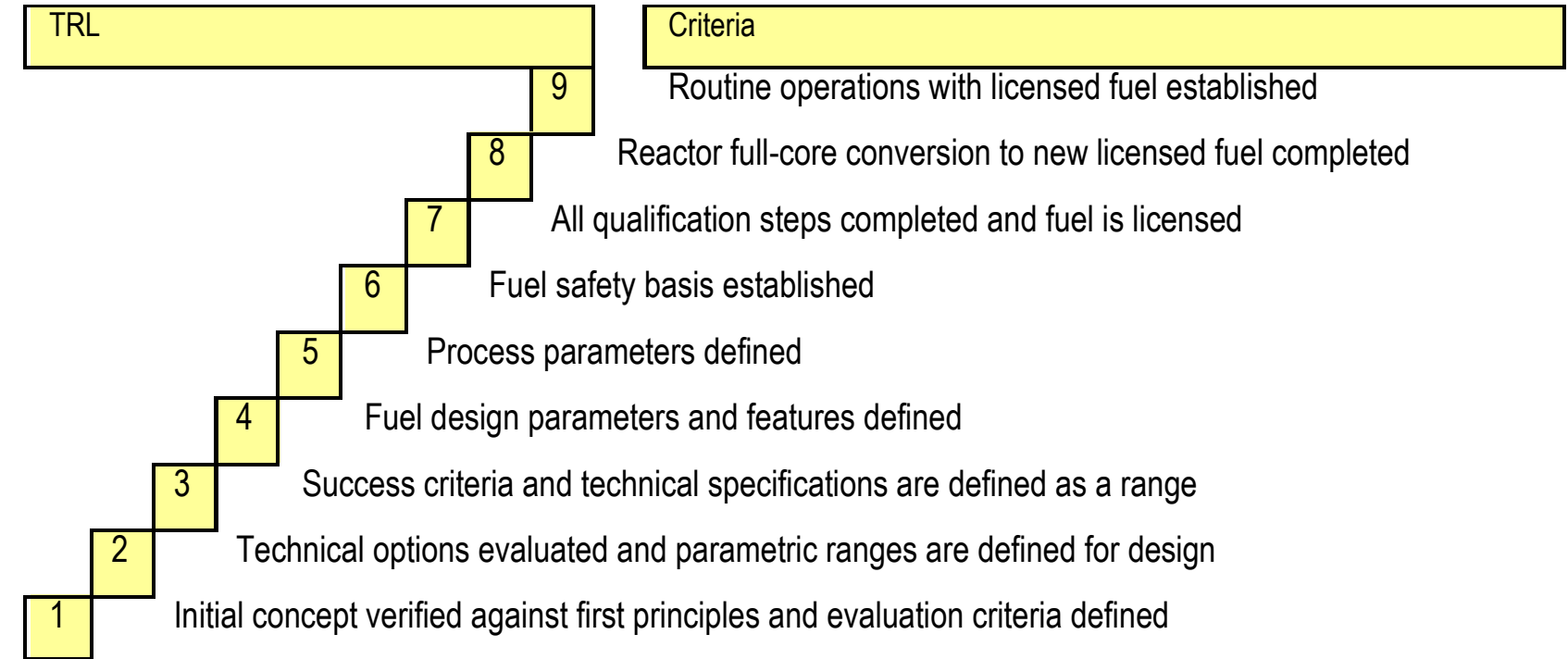
- Fabrication Process Maturity, which measures how well the fabrication process is understood and validated; and
- Fuel Performance Maturity, which measures how well the in-pile performance of the fuel is understood and validated.

A TRL definition that provides a balance between these two elements is essential.

Summary of TRL evaluation elements, attributes and bins



TRL Completion Criteria



Representative Materials from Separations Process	TRL 4 - 5	TRL 6	TRL 7	TRL 8 - 9
Representative Materials from Stockpile	TRL 4	TRL 4 - 5		
Surrogate Materials	TRL 3			
	Bench-Scale (1g - 1 kg)	Laboratory-Scale (1 - 10 kg)	Engineering-Scale (10 - 100 kg)	Commercial-Scale (> 1 ton)

Correlated TRL bins for process and performance maturity

Multiple Assemblies (Core Loads)						TRL 8 - 9
Bundle / Sub-assemblies				TRL 6 - 7	TRL* 7 - 8	TRL 8
Pins		TRL 4	TRL 5	TRL 6	TRL 6 - 7	
Samples & Rodlets	TRL 4	TRL 4	TRL 4	TRL 5	TRL 5 - 6	
	Fundamental Property Measurements	Out-of-Pile Testing	In-Pile Testing with Intermediate conditions (< target burnup)	In-Pile Testing with Prototypic conditions (> target burnup)	Transient Testing	Reactor Operations

4 Phases of Fuel Development

- Selection Phase: TRL 1 – 3
- Development Phase: TRL 3 – 5
- Optimization Phase: TRL 5 – 7
- Qualification phase: TRL 7 - 9