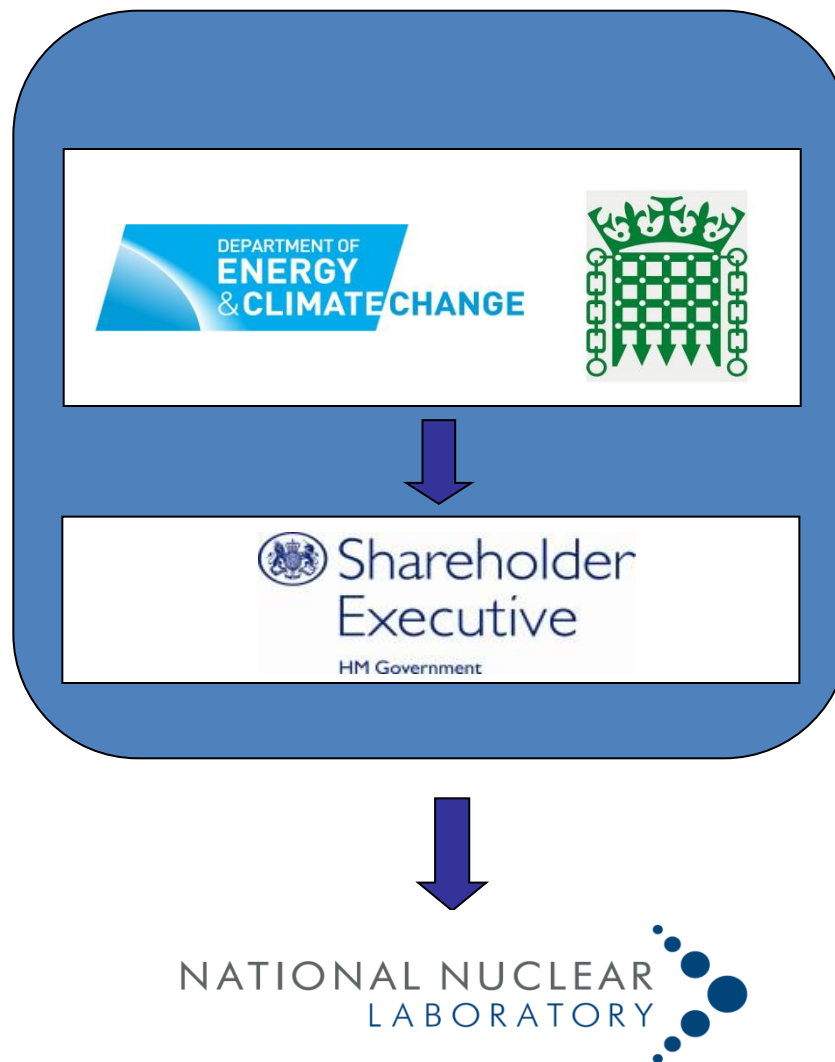


Update on NNL Programmes on ATF

Emma Johnston

March 2015



Programme areas -

- Facility and capability development
- National programmes
- International programmes

Enabling HMG's vision: UK being a "top-table" nuclear nation while enabling economic growth

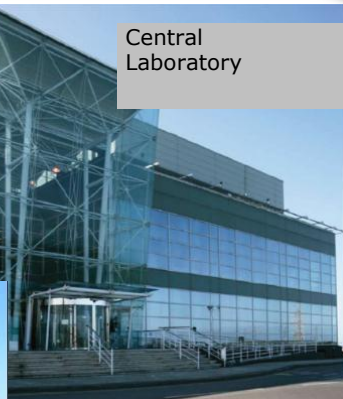


Facility & capability development

Preston
Laboratory



Central
Laboratory



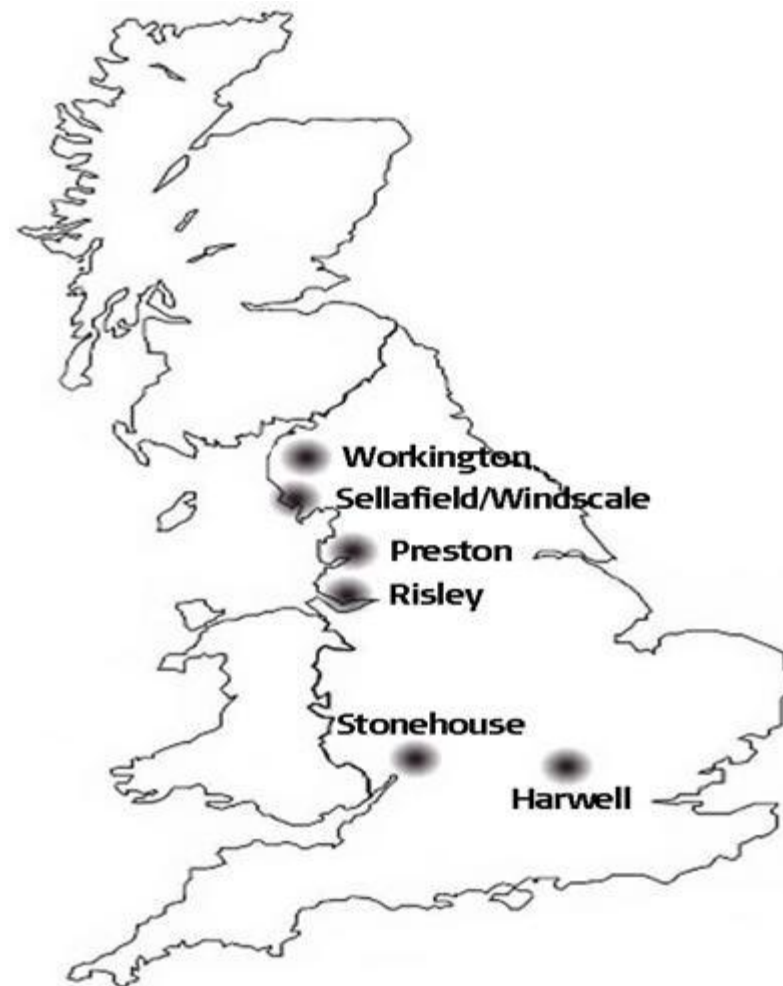
Manchester's Dalton
Nuclear Institute



Dalton Cumbrian Facility

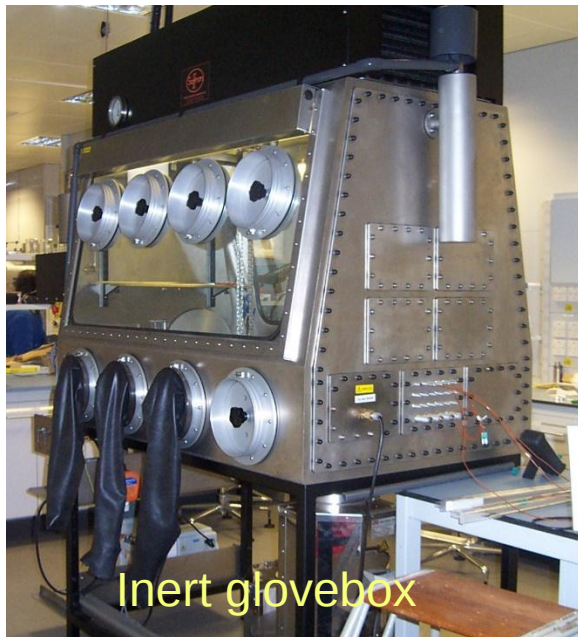
NFCE

ATF considered key
component in future
fuel programmes



New equipment

- Inert gloveboxes for carbide/nitride fuel processing/handling
- Arc melter, vacuum furnace, blender, hydraulic press, hot rollers (for metal fuel routes e.g. U-Si)



- Spark Plasma Sintering
- Selective Laser Melting 3D printer



Laser flash analyser



Spark Plasma Sintering

- Laser Flash Analyser (thermal diffusivity)
- Dilatometer/TGA/DSC/mass spectrometer
- WDX and EBSD for SEM

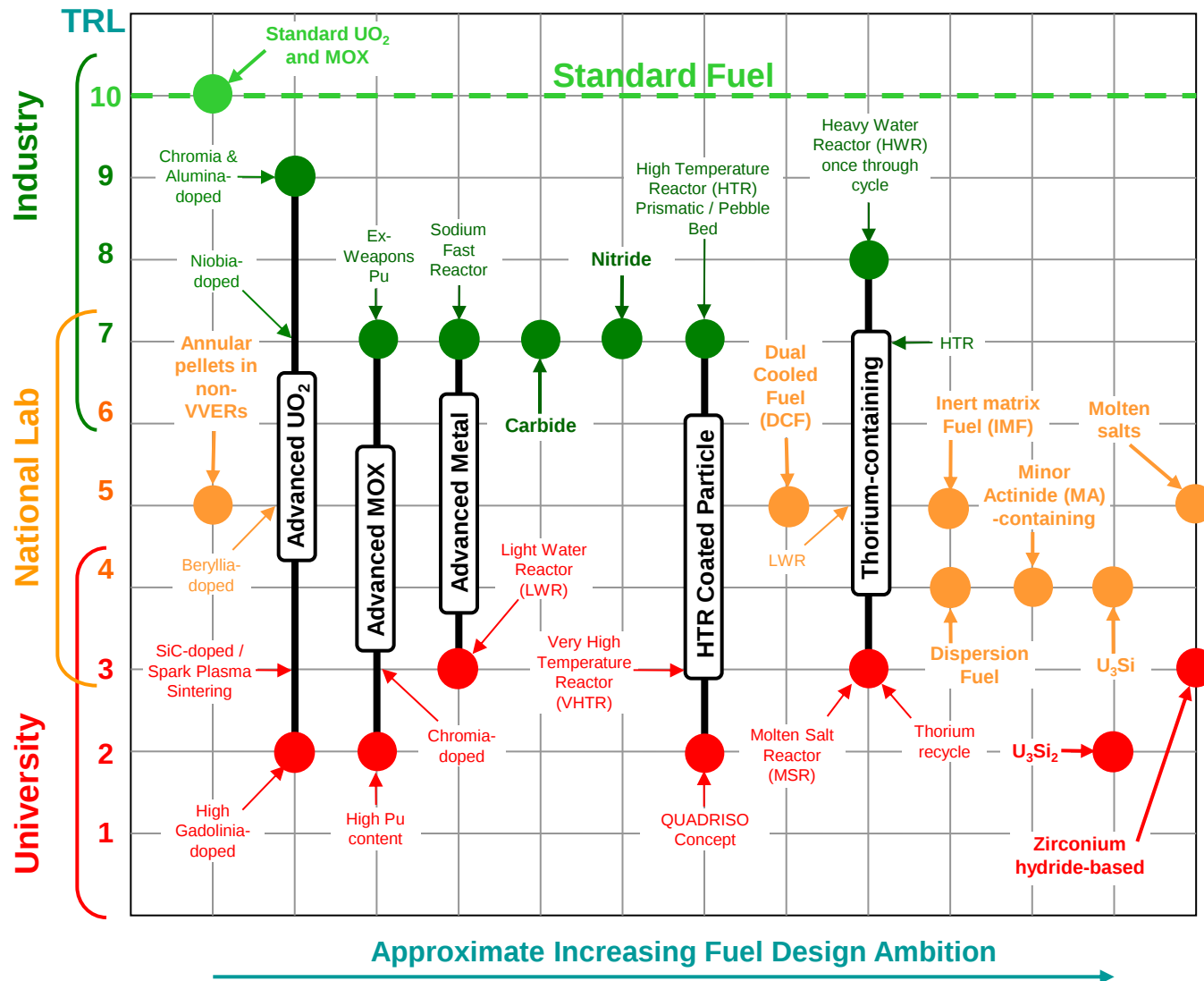
Programme areas -

- Facility and capability development
- National programmes
- International programmes

- Initial National Programmes have been established over the last couple of years looking at
 - TRL's for advanced fuels and cladding (including ATF)
 - Preliminary materials investigations in ATF (fuels & cladding)
 - Modelling studies on ATF (ENIGMA)

- Develop links with academia and other research centres

Advanced Fuel TRLs



Fuel TRL vs Reactor type

		Generation	II	II-III+	IV					
		Specific reactor	AGR	L/HWR	SFR	HTR / VHTR	LFR	SCWR	GFR	MSR
		Outlet temperature	650°C	~325°C (PWR)	550°C	650 – 1000°C	480 – 800°C	510 – 625°C	850°C	700 – 800°C
Advanced Fuel Categories	Standard	UO ₂	10	10		7		3		
		MOX		10	8	7	5	3	3	
	New geometries	Annular pellets in non-VVER		5						
		Dual Cooled Fuel (DCF)		5				2		
	Evolutionary	Advanced UO ₂	3	TRL9 – TRL2		2		2		
		Advanced MOX		TRL7 – TRL2	4	2	4	2	2	
		Advanced Metals		3	7		4			
	New compounds	Carbide		3	7	3	4	2	3	
		Nitride		3	7	3	4	2	3	
		U ₃ Si		4				2		
		U ₃ Si ₂		2				2		
	Including new elements	Thorium		TRL8 – TRL5	3	7	3	2	2	3
		Minor Actinides (MAs)		3	4	3	3	2	3	3
	Including inert material	Inert Matrix Fuels (IMFs)		5	5		3	2	3	
		Dispersion fuels		4				2		
		Zr hydride-based		3				2		
		Coated particle-based				TRL7 – TRL2			2	
	Molten salt -based	FLiBe salt containing U								5

- EU framework programmes
 - ASGARD – Carbide fuel
- International collaborations
 - CARAT
 - US DoE (Westinghouse led USi)

NATIONAL NUCLEAR LABORATORY

