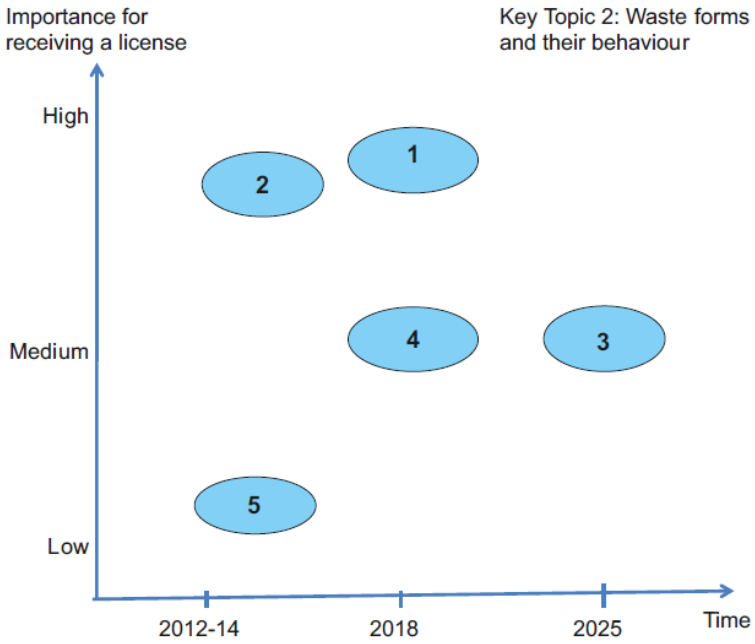
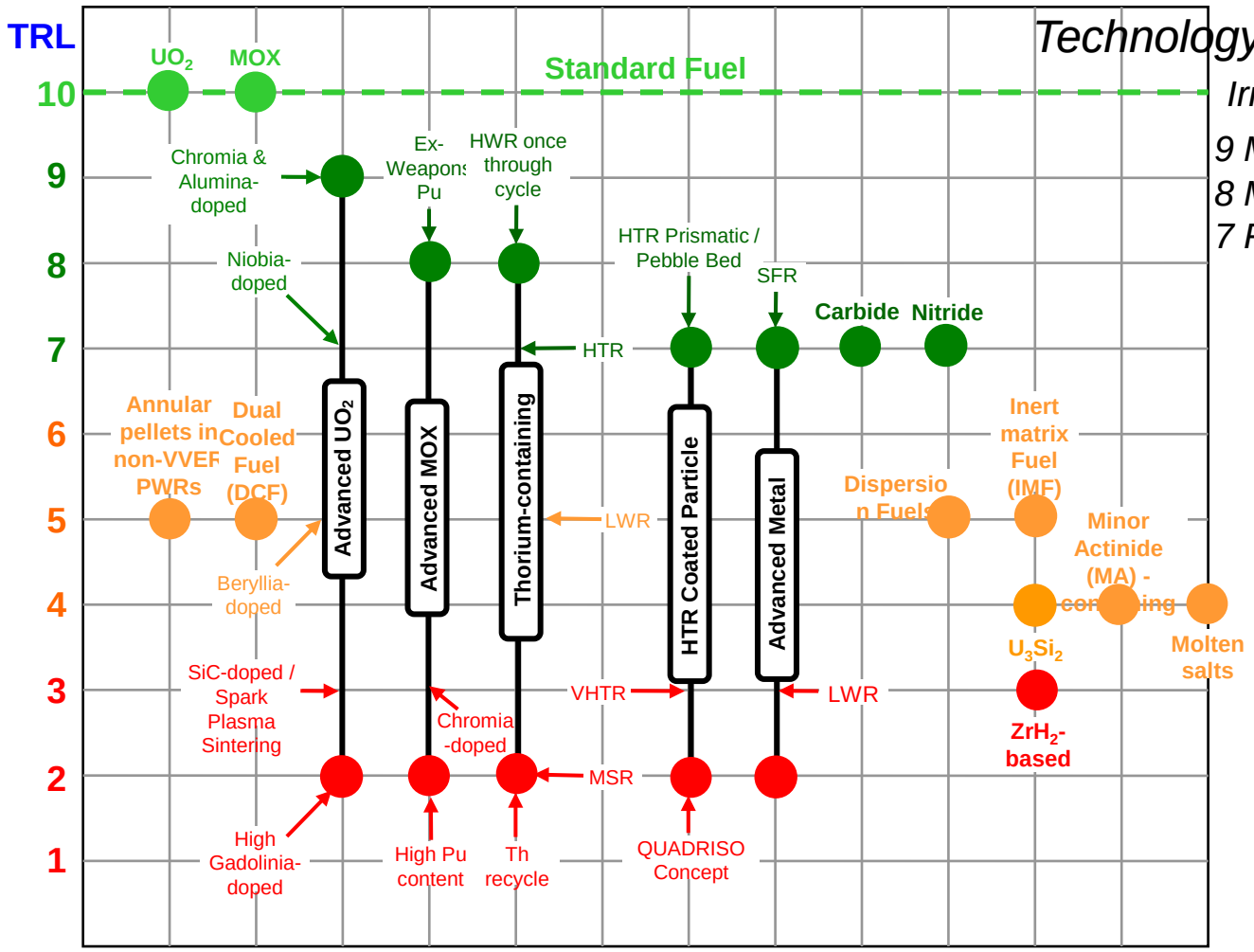
WG 4 - Background, motivation

Spent fuel dissolution and chemistry in a high-level waste container
Needs identified in IGD-TP SRA, Euratom call as well as from research groups.
- Improved understanding of behaviour of the expected waste form in expected repository conditions.
- Test dissolution rate of the waste form in direct relation to expected chemistry inside a corroding waste container.



Expected fuel evolution in Sweden (pers. comm. Vattenfall 2011):
2011: doped pellets in one reactor
2016: doped pellets in 50% of reactors
2021: doped pellets in all reactors
NB: doped pellets, made by different manufacturers do not have uniform properties

Fuel evolution



David Hambley, NNL, EF5 2014: Technology Readiness Level / Irradiation Performance Maturity

9 Multiple assemblies/core loads
8 Multiple assemblies/core loads
7 Few assemblies

Availability of doped fuel pellets for dissolution experiments?

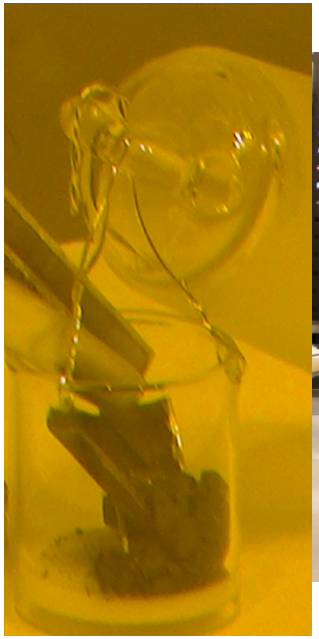
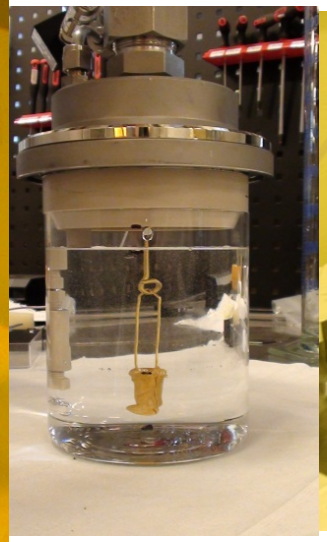
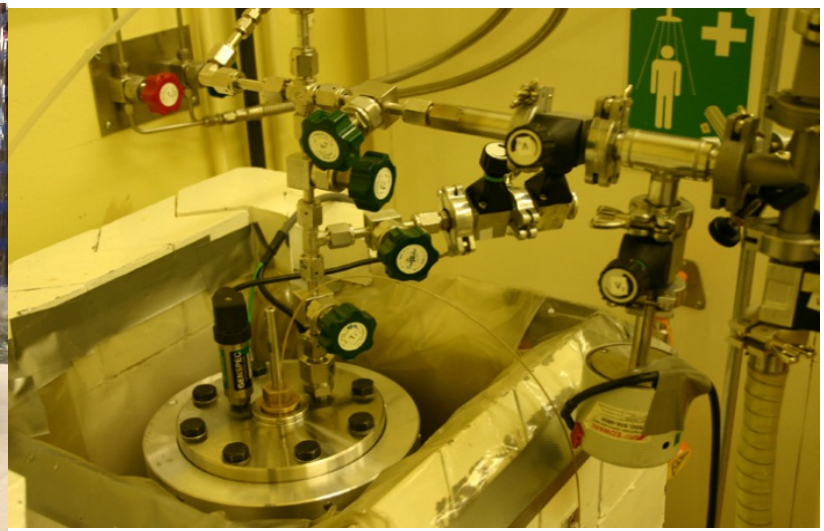
Licensing facilities for existing SNF as well as future SNF, but so far based on standard fuel data…
Requirements to formulate clear waste acceptance criteria

WG 4 - Presentations

WG 4 Spent fuel dissolution & chemistry in container		
03-Nov		Title
14:00	INTRO JA Leader: SKB (L.Z. Evins, J. Andersson)	Waste form and behaviour: Chemistry and dissolution in a high-level waste container
14:15	Studsvik (Olivia Roth)	Leaching of doped irradiated fuel under H2 conditions
14:35	JRC-ITU (Detlef Wegen)	Dissolution rate of MOX and Cr-doped UO2 fuel
14:55	KIT-INE (Bernhard Kienzler)	Remaining questions after FIRST-Nuclides
15:15	PSI (Enzo Curti)	Thermodynamics as a support for the interpretation of spent fuel leaching experiments
15:40	***COFFEE BREAK***	
16:00	University of Cambridge (Ian Farnan)	Simfuel approaches to understanding spent fuel behaviour
16:20	VTT (Kaija Ollila, E. Myllykylä)	UO2 interactions inside canister conditions
16:30	FZ Jülich (Dirk Bosbach)	Corrosion mechanisms of modern LWR-fuels using UO_2-based model systems
16:40	ANDRA (Christelle Martin)	Andra proposal for a future European project dealing with geochemical processes within a HLW/Spent fuel disposal cell
17:00	General Discussion (All)	
17:30	END day 1	

Real spent fuel

Contributors: Studsvik, KIT, ITU, CTM, SCK*CEN, Rez, CEA, (Hungarian contribution?)
Materials: Doped fuel or MOX, UO2 - to close issues from First Nuclides – with possible addition of reactor fuels (Rez)
Conditions: both Reducing and oxidating

Model systems

Contributors: Julich, Cambridge, Sheffield, VTT, Ciemat

Model systems - synthesized materials

Planning needs to be performed in collaboartion with real plans for real SNF samples.

Important coordinate the experimental conditions.This can be done i aseparate work package - sample and system characterisation.

Materials includes UO2 doped with alpha-emitter, as wel as other dopants such as Cr, Al, Si, Cs/volatiles depending on qustion asked

Chemical modelling

Contributors: Amphos PSI, NNL, Andra, Quintessa

Several lines :
1, primary state of spent fuel once discharged, oxygen potential
2, evolution of fuel during dry period, from storage to water contact,
3, effect of the doping agents on the fuel (only fuel system), and molecular modelling of selenium in the UO2 matrix.
4, coupling the fuel and the container under aqueous conditions.

Important with input from experimentalists, and set-up exchange points: once model is set up exchange with the experimentalists

WG 4 Summary

DISCO: Modern Spent Fuel DISsolution and Chemistry in Container
Hypothesis: Modern fuel (advanced fuel and mox) dissolution differs only insignificantly from standard fuel.

General Hypothesis: Modern fuel (advanced fuel and mox) dissolution in real repository condiitions differs only insignificantly from standard fuel. (zero-hypothesis)

Motivation: there are knowledge gaps and need for extended data base for the modern fuels and for the chemical system in a degraded HLW waste canister

3-4 year project. Preliminary work package structure

- WP1 Management, Coordination and Dissemination/Knowledge Management
  SKB (Coord) , Amphos21
- WP2 Sample preparation and characterisation of the chemical systems (All)
- WP3 Fuel leaching experiments WP Leader: (Studsvik /KIT-INE)
  Contributors: Studsvik, KIT, ITU, CTM, SCK*CEN, Rez, CEA, (Hungarian contribution?)
- WP4 Model materials experiments WP Leader: (Univ. Cambridge/FZ Jülich), Contributors: FZ Julich, Univ. Cambridge, Univ. Sheffield, VTT, Ciemat
- WP5 Chemical modelling WP Leader Amphos21/PSI, Contributors: Amphos PSI, NNL, Andra, Quintessa