

Radioactive waste and spent fuel strategy

Fuel cycle options and impact on Waste Management

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CEA

International Atomic Energy Agency Scientific Forum

**RADIOACTIVE WASTE:
MEETING THE CHALLENGE**

Science and Technology for
Safe and Sustainable Solutions

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Waste main issue is directly related to spent fuel strategy

USED FUEL CONTENT : WHAT IS WASTE ?



1																	2
H																	He
3	4											5	6	7	8	9	10
Li	Be											B	C	N	O	F	Ne
11	12											13	14	15	16	17	18
Na	Mg											Al	Si	P	S	Cl	A
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
55	56	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	
Cs	Ba	Ln	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
87	88	104	105	106	107	108	109	110									
Fr	Ra	An	Rf	Db	Sg	Bh	Hs	Mt	Uun								

LANTHANIDES	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
ACTINIDES	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

TRANSURANICS
 FISSION PRODUCTS

ACTIVATION PRODUCTS
 FISSION AND ACTIVATION PRODUCTS

Spent fuel composition

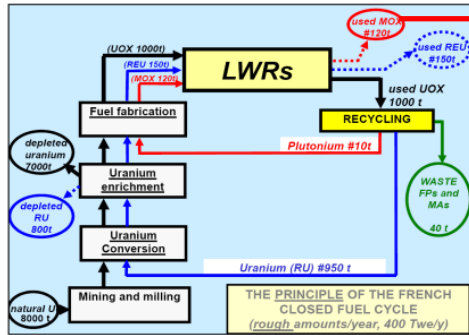
- **Uranium** : **95%**
- **Plutonium** : **1%**
- **Fission Products** : **4%**
- **Minor Actinides** : **0,1%**

FROM LWRS RECYCLING TO FRS RECYCLING

DECADE OF EXPERIENCE IN HYDRO PROCESS & LWR MOX FUEL

SFR CYCLE NEEDS ADAPTATION, NOT BREAKTHROUGH

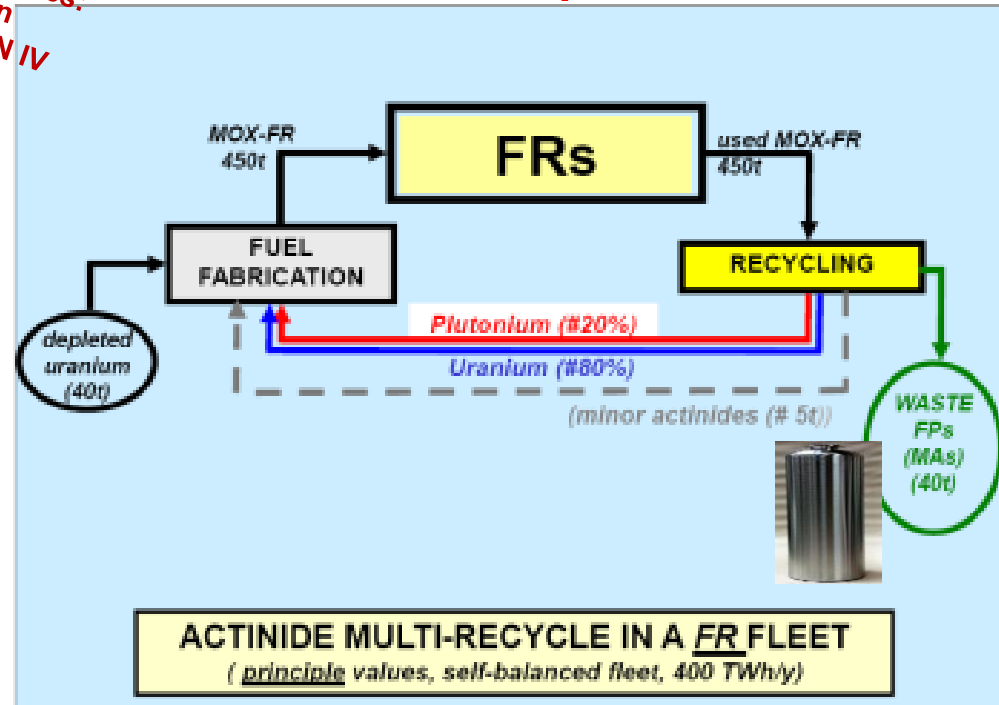
Present



Current technologies: a bridge between GEN II/III and GEN IV

Pu stored in MOX Spent Fuel recycled in MOX SFR to start the SFRs deployment

Future



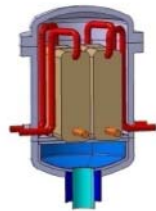
Scenario can be flexible
Both systems can coexist during a transition phase

SFR merits as regards to fuel cycle

1. Multi-recycling of Pu
2. Use depleted U
3. Possible recycling of Minor Actinides

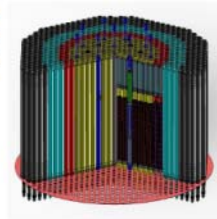
THE ASTRID PROJECT

A breakthrough compared to existing FNRs



Tertiary circuit filled with nitrogen to prevent any sodium-water reaction

Low void coefficient core with enhanced safety ("CFV")



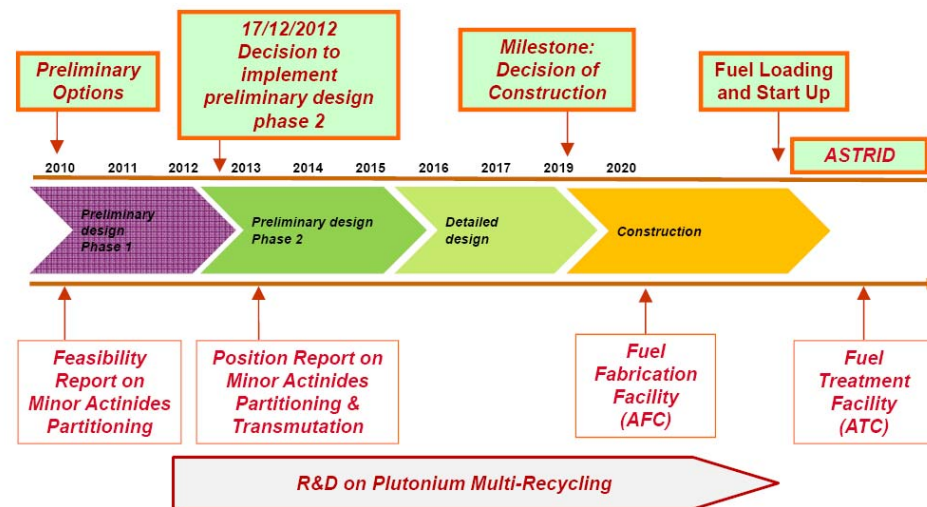
In-Service Inspection addressed since design phase



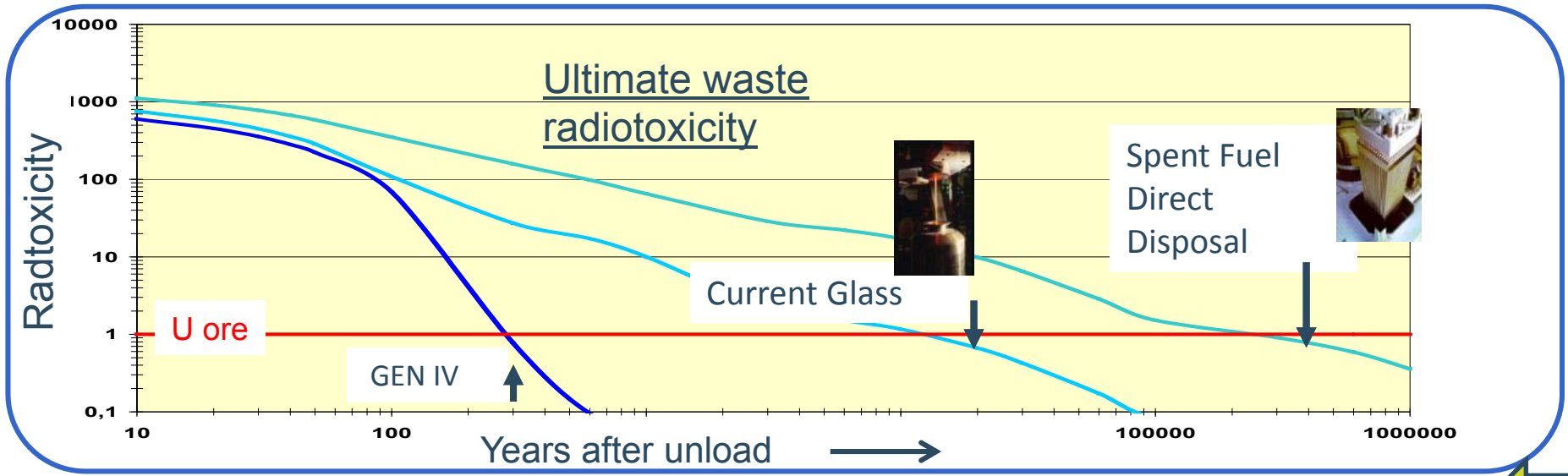
No early or important radioactive release in case of core melting

A DEMONSTRATOR TO REACH GEN IV STANDARD

ASTRID SCHEDULE CONSISTANT WITH FUTURE DEPLOYMENT
Start up in mid-2020 for enough feedback in mid-2030



TRANSMUTATION : IMPACT ON ULTIMATE WASTE



High level waste repository footprint

