

Statens strålevern
Norwegian Radiation Protection Authority

Measuring Progress in Reactor Conversion and HEU Minimization Towards 2020 – the Case of HEU-fueled Research Facilities

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Objective:

- **To provide the technical basis for:**
 - assessing the progress in minimising the use of HEU in research reactors
 - identifying the most relevant measures for a future HEU clean-out in all research reactors

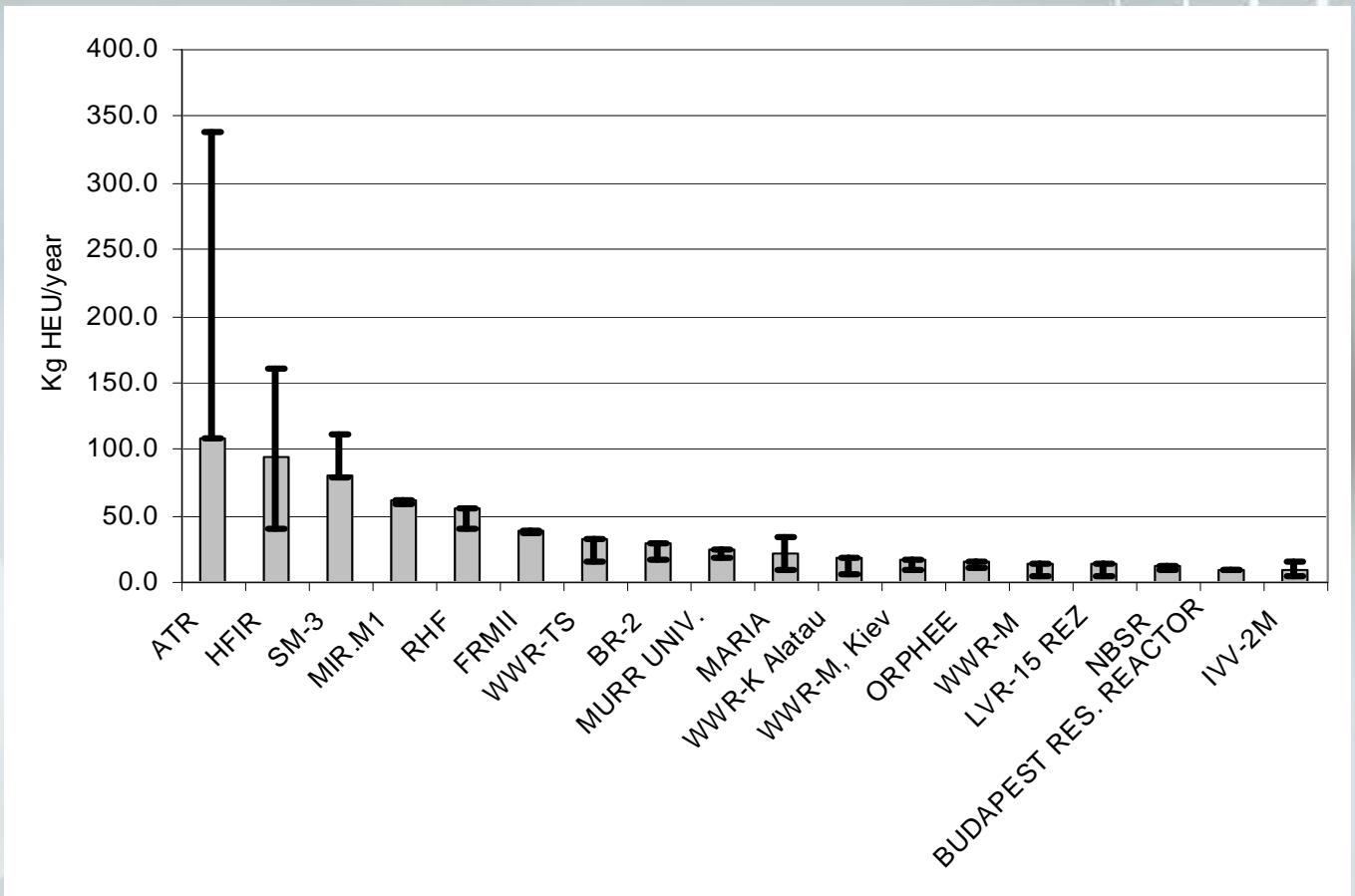


Outline:

- **Establish a baseline measurement for HEU in research reactors**
 - number of facilities
 - amount of HEU consumed annually
- **Assess the annual progress due to:**
 - conversion
 - decommissioning
- **Discuss the continued HEU minimisation effort**



HEU consumption in civilian steady-state research reactors (Top 20) – 2007



Operational HEU-fueled Research Reactors 1978

		Russia & NIS	China	Europe	U.S.	Other	Total
Critical assemblies		38	1	11	18	4	70
Pulsed reactors		12	0	1	7	0	20
Steady-state research reactors (MW)	< 0,25	1	0	18	18	11	48
	0,25-2	0	0	10	14	5	29
	2 – 10	12	0	18	12	16	58
	10 – 250	7	0	12	5	4	28
Total		68	1	70	74	40	253

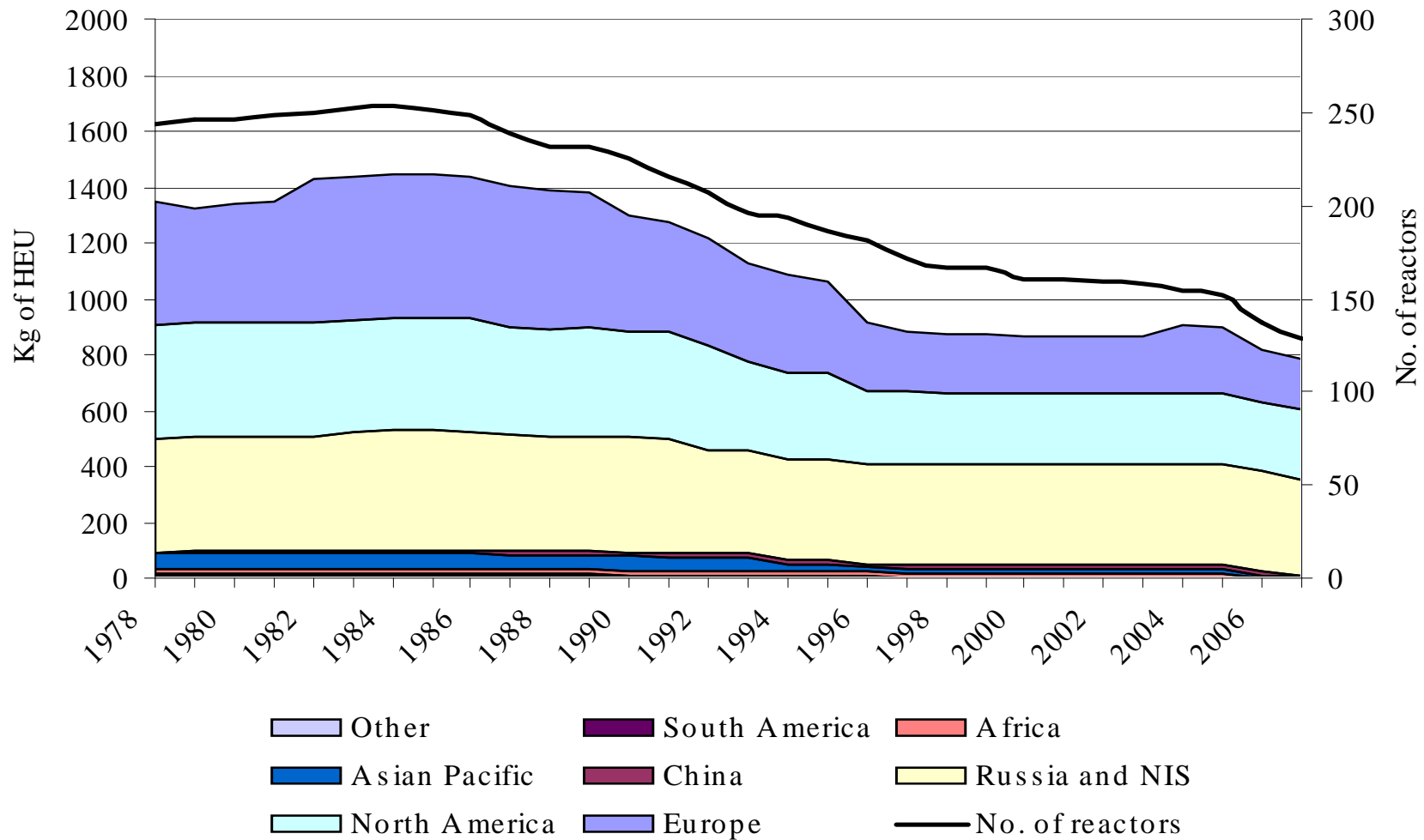


Operational HEU-fueled Research Reactors 2007

		Russia & NIS	China	Europe	U.S.	Other	Total
Critical assemblies		39	1	5	5	2	50
Pulsed reactors		14	0	1	3	0	18
Steady-state research reactors (MW)	< 0,25	1	3	5	1	12	22
	0,25-2	1	0	0	4	2	7
	2 – 10	7	0	1	2	2	12
	10 – 250	8	0	7	4	0	19
Total		70	4	19	19	18	130

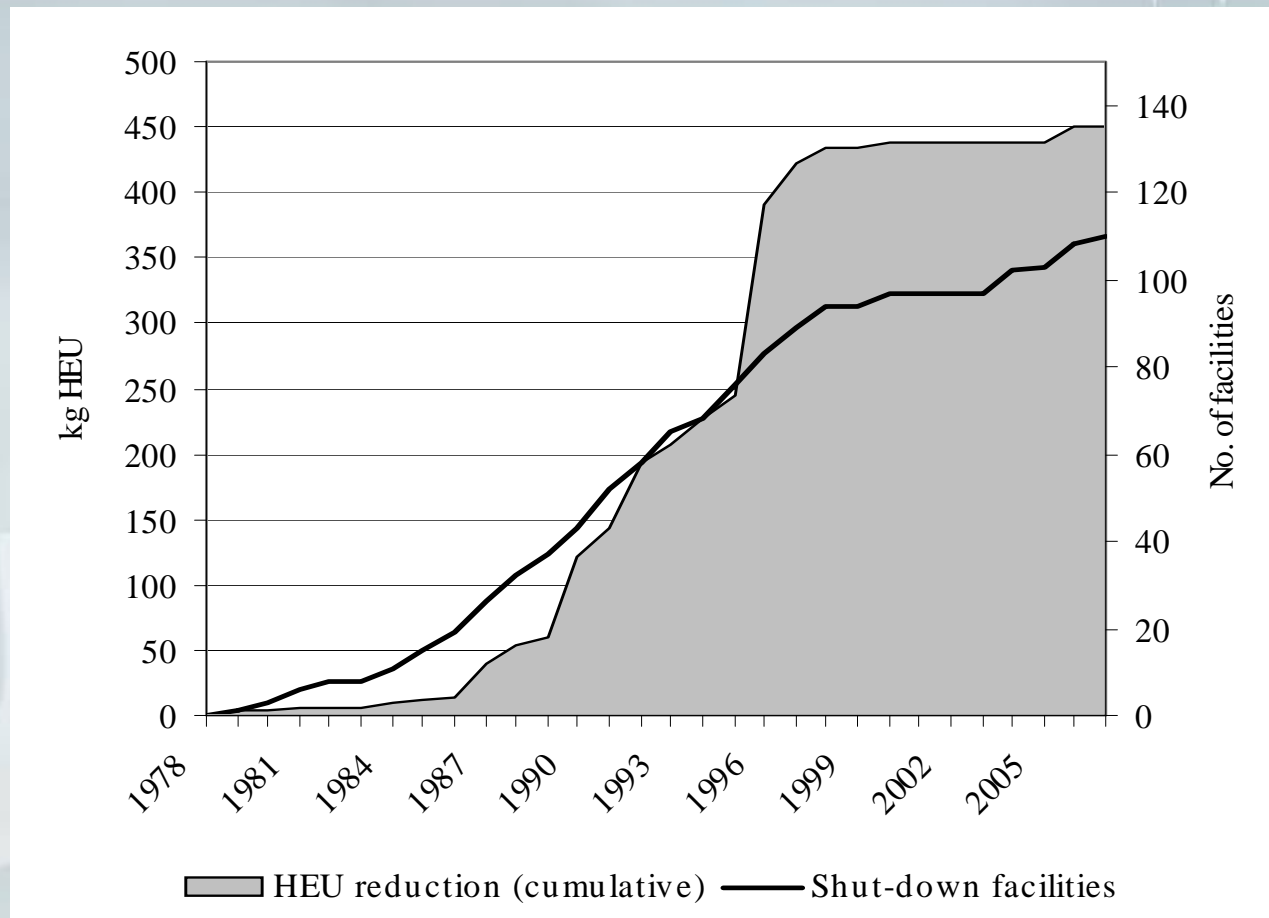


Operational HEU-fueled Research Reactors and associated HEU consumption (kg) 1978 – 2007

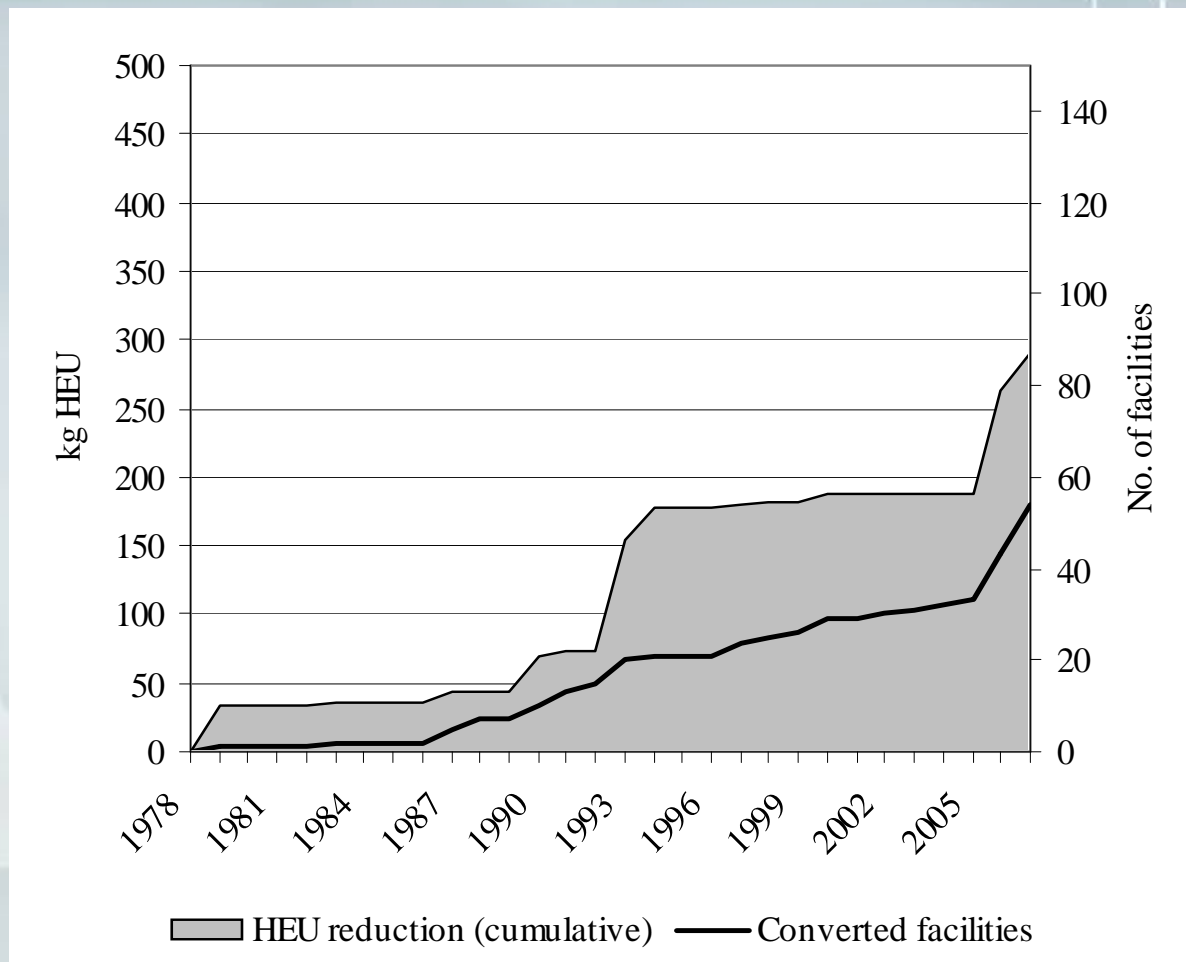


Shutdown HEU-fueled research reactors and associated annual HEU consumption (kg) (cumulative)

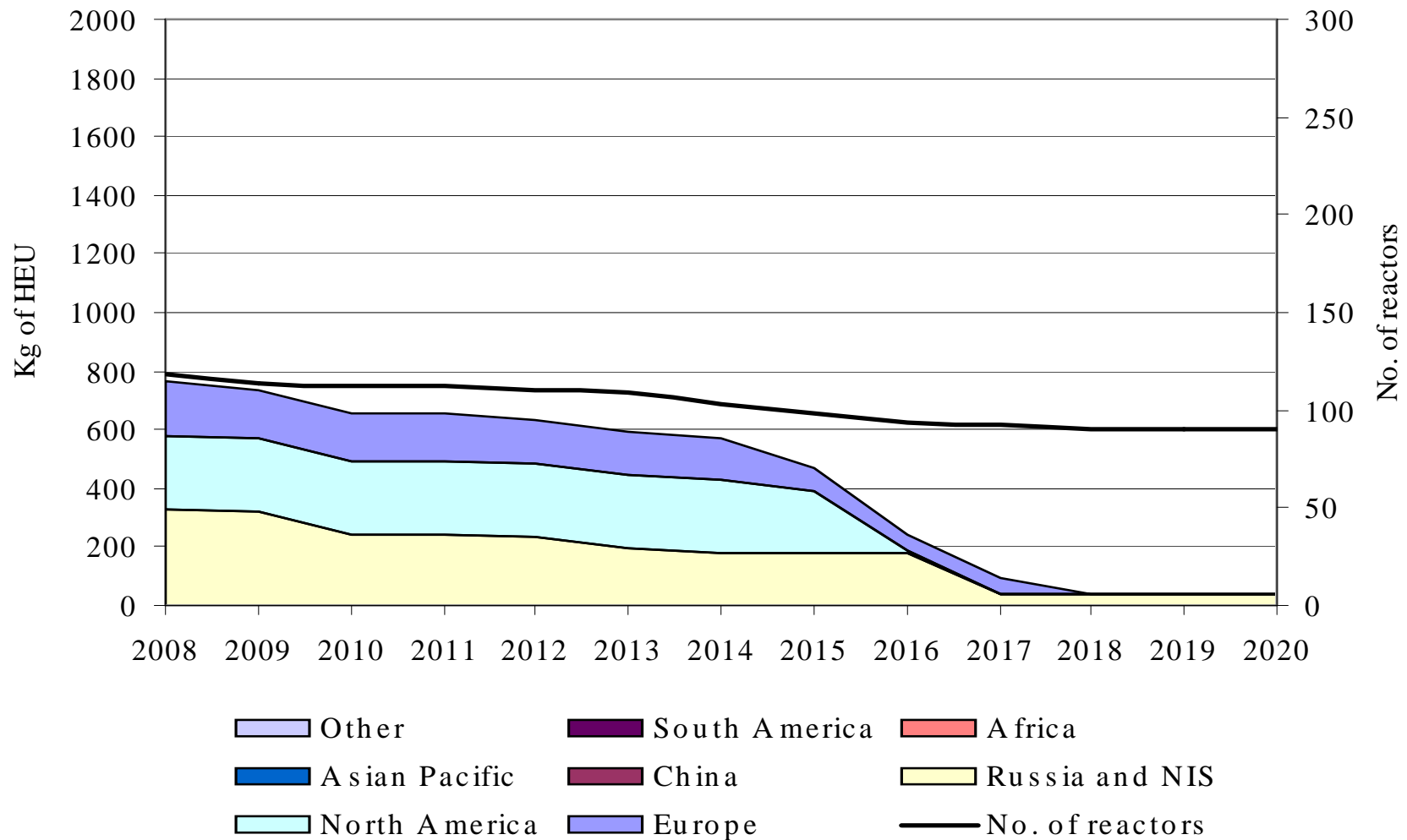
1978–2007



Converted HEU-fueled research reactors and associated annual HEU consumption (kg) (cumulative) 1978–2007



A realistic prognoses?



Conclusions:

- **From 1978 to 2007:**
 - 26 research reactors with a combined HEU consumption of 130 kg/year have been put into operation
 - 107 research reactors with a combined HEU consumption of 450 kg/year have been shutdown, including 70 civilian steady-state research reactors
 - 49 research reactors with a combined annual HEU consumption of 278 kg/year have been converted to LEU



Conclusions:

- **All HEU-fueled reactors outside US, Russia and France – 22 – are presently part of the international Minimization Programmes**
- **A final phase out of (most) of the HEU-fuel in research reactors may not be achieved before the end of the next decade**



A possible accelerated approach?

- **Only a small number of the existing 130 HEU-fueled research reactors still in operation should be converted**
- **The large number should be decommissioned and provisions for assisting the operator and the country with the decommissioning, and with access to similar research facilities elsewhere, should be established (regional cooperation)**



A possible accelerated approach?

- **The obvious candidate for assisting in accelerated shut-down activities is the IAEA with its broad and general mandate**
- **A revised, realistic schedule for the overall conversion activities and goals should be developed as soon as possible for a renewed international HEU-elimination effort**

