

What Can Forty Years of Red Books Tell Us?

A Red Book Retrospective



Red Book Overview

- ◆ January 1965: OECD European Nuclear Energy Agency establishes study group to review long-term role of nuclear energy in Europe with Working Party to compile information on uranium and thorium resources
- ◆ 1966: collaboration with IAEA begins
- ◆ 1965 and 1982 : 10 resource assessments published with red covers; hence informal name “the Red Book”
- ◆ 1984: Uranium Group formally established (members from OECD/NEA countries, plus IAEA Secretariat)
- ◆ 1992: non-OECD member states join
- ◆ 2006: 21st Red Book published

The Red Book Retrospective

◆ Objectives:

- Collect, collate and publish all information in 20 Red Book editions: 1965 - 2004
- Fill data gaps
- Discern lessons that may apply to the present

◆ Result:

- A detailed historical profile of the world uranium industry in the areas of exploration, resources, production, reactor-related requirements, inventories, price, stocks, policies, etc.

Evolution of Red Book

1965

22 Pages

40 Reactors

16 governments
reporting RAR

1 343 000 tU

2003

288 Pages

435 Reactors

42 governments
reporting RAR

3 169 000 tU

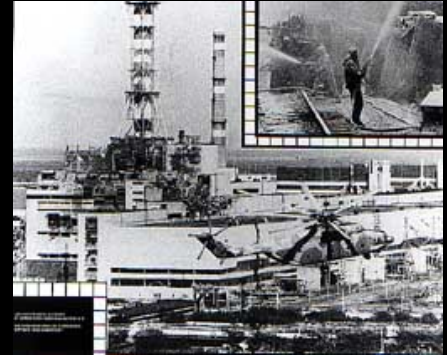
Major events shaping industry

- ◆ 1957 1st commercial nuclear power plant
- ◆ 1968 Unconformity deposit discovery
- ◆ 1973 OPEC oil crisis
- ◆ 1976 Olympic Dam discovery
- ◆ 1979 Three Mile Island

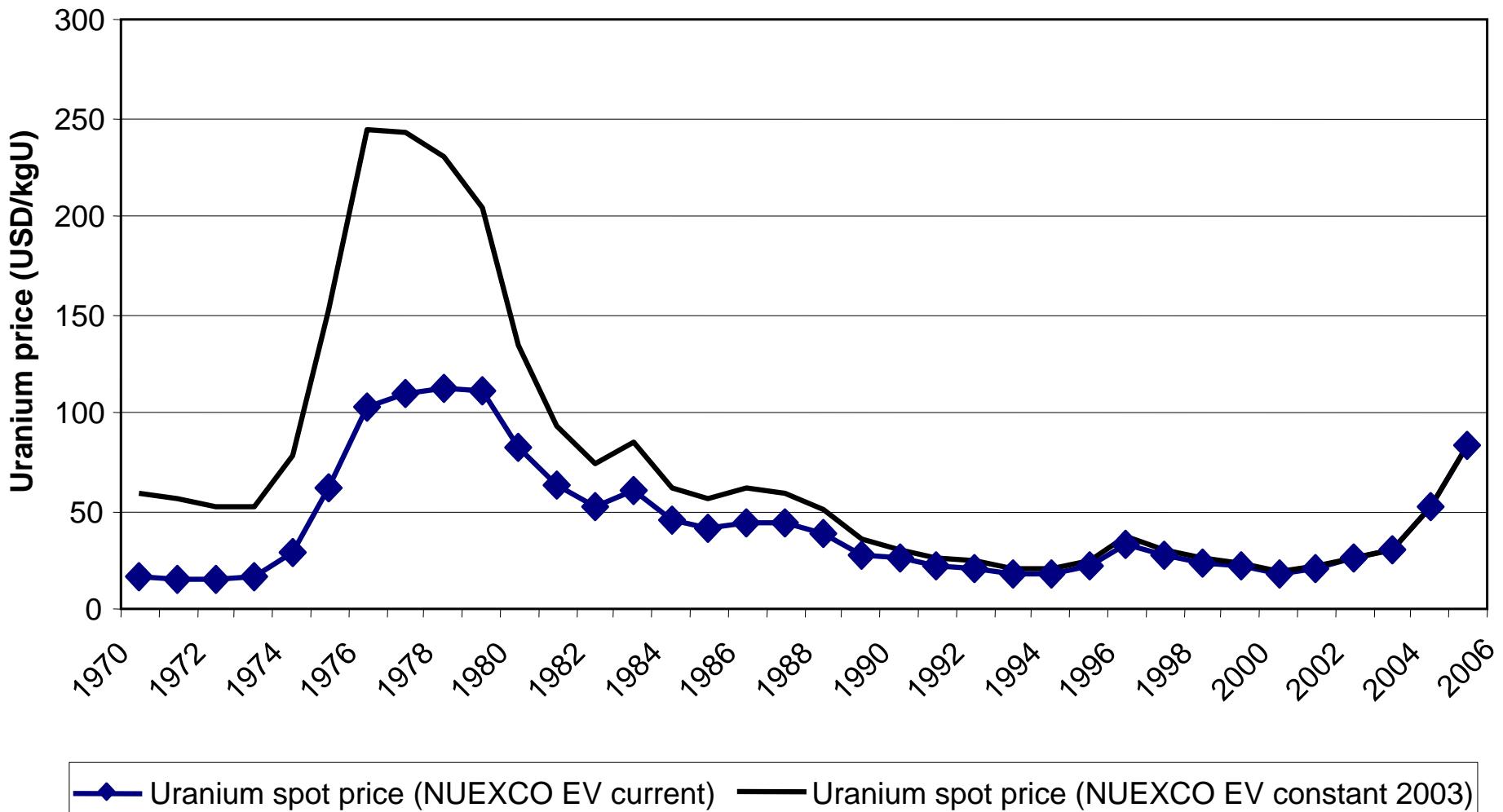


Major events shaping industry

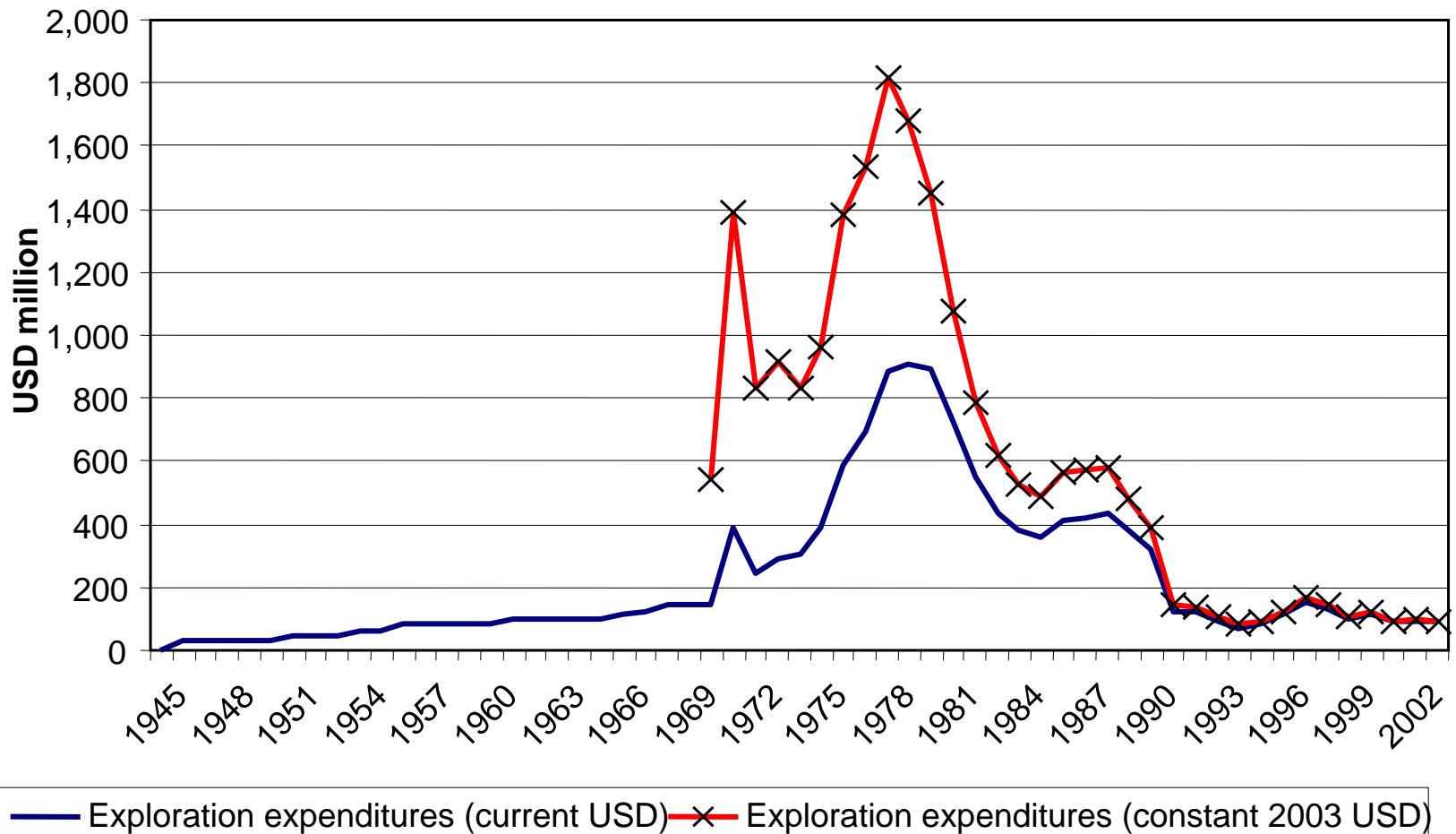
- ◆ 1986 Chernobyl
- ◆ 1989 Cold War ends
- ◆ 1991 Dissolution of Soviet Union
- ◆ 1993 Emergence of secondary supplies



Spot Price (1970-2005)



Exploration Expenditures (1945-2003)



Exploration Expenditures (1945-2003)

- ◆ 81 governments have reported exploration expenditures
- ◆ Total: **\$13 400 M**

1. Since 1991; does not include expenditures by Kazakhstan, the Russian Federation, Ukraine and Uzbekistan.

2. Includes the German Democratic Republic

	Expenditures (USD million)	% of world total
USSR ¹	3 692	27.6
USA	2 507	18.7
Germany ²	2 003	14.9
Canada	1 289	9.6
France	907	6.8
Others (total)	3 002	22.4
World total	13 400	

Known Conventional Resources (KCR)

- ◆ 1965: 16 countries, totalled

3.21 million tU

- ◆ 2003: 56 countries, totalled

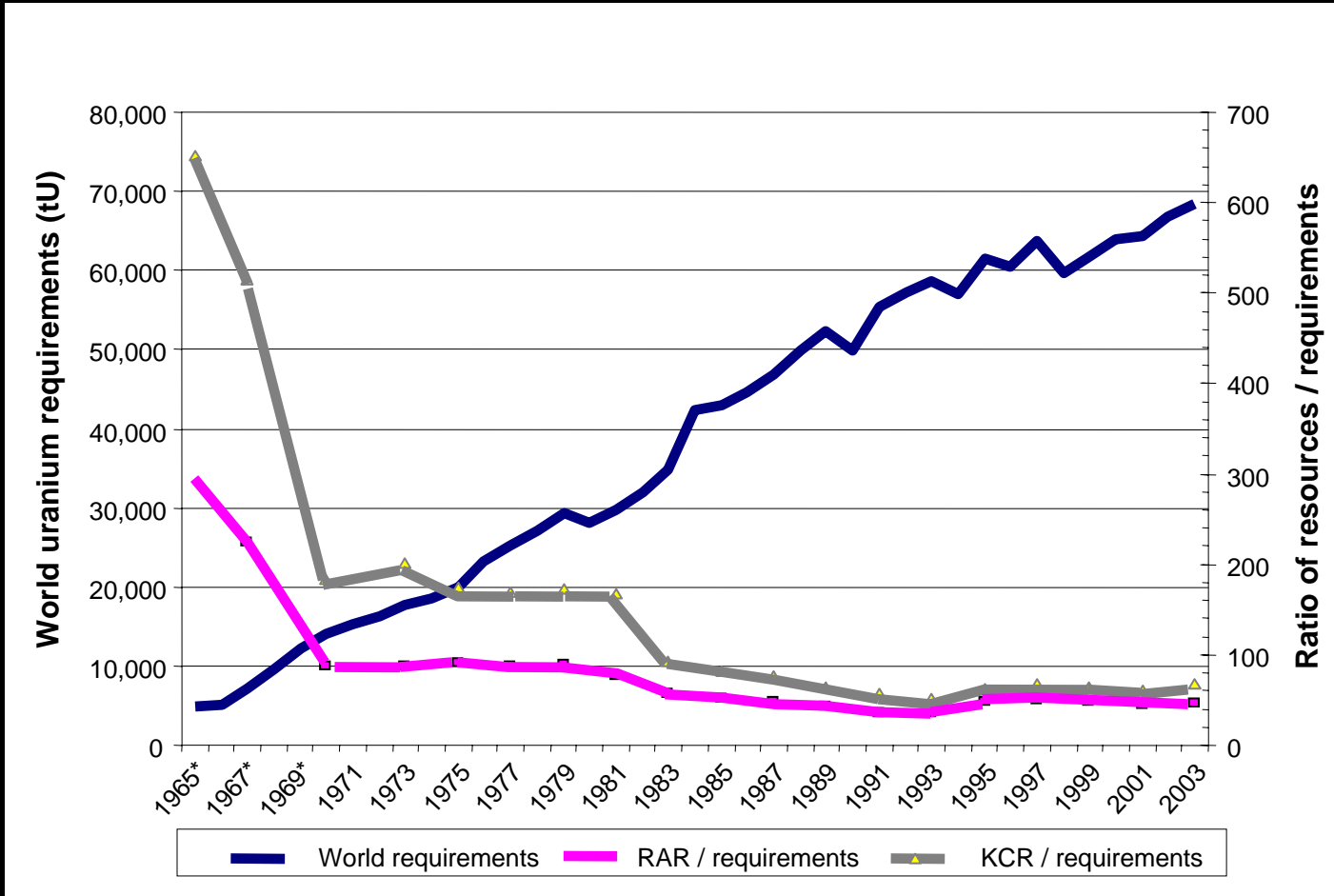
14.38 million tU

Country	KCR ¹ (tU)	% of world total
Australia	1 058 000	23.1
Kazakhstan	847 620	18.5
Canada	438 544	9.6
South Africa	395 670	8.6
United States ²	345 000	7.5
Others (total)	1 503 166	32.7
World total	4 588 000	

1. Includes reasonably assured resources (RAR) and estimated additional resources I (EAR-I) at <USD 130/kgU.

2. The United States does not report resources in the EAR-I category.

Resource/Requirements (1965-2003)



Cumulative Production (1945-2003)

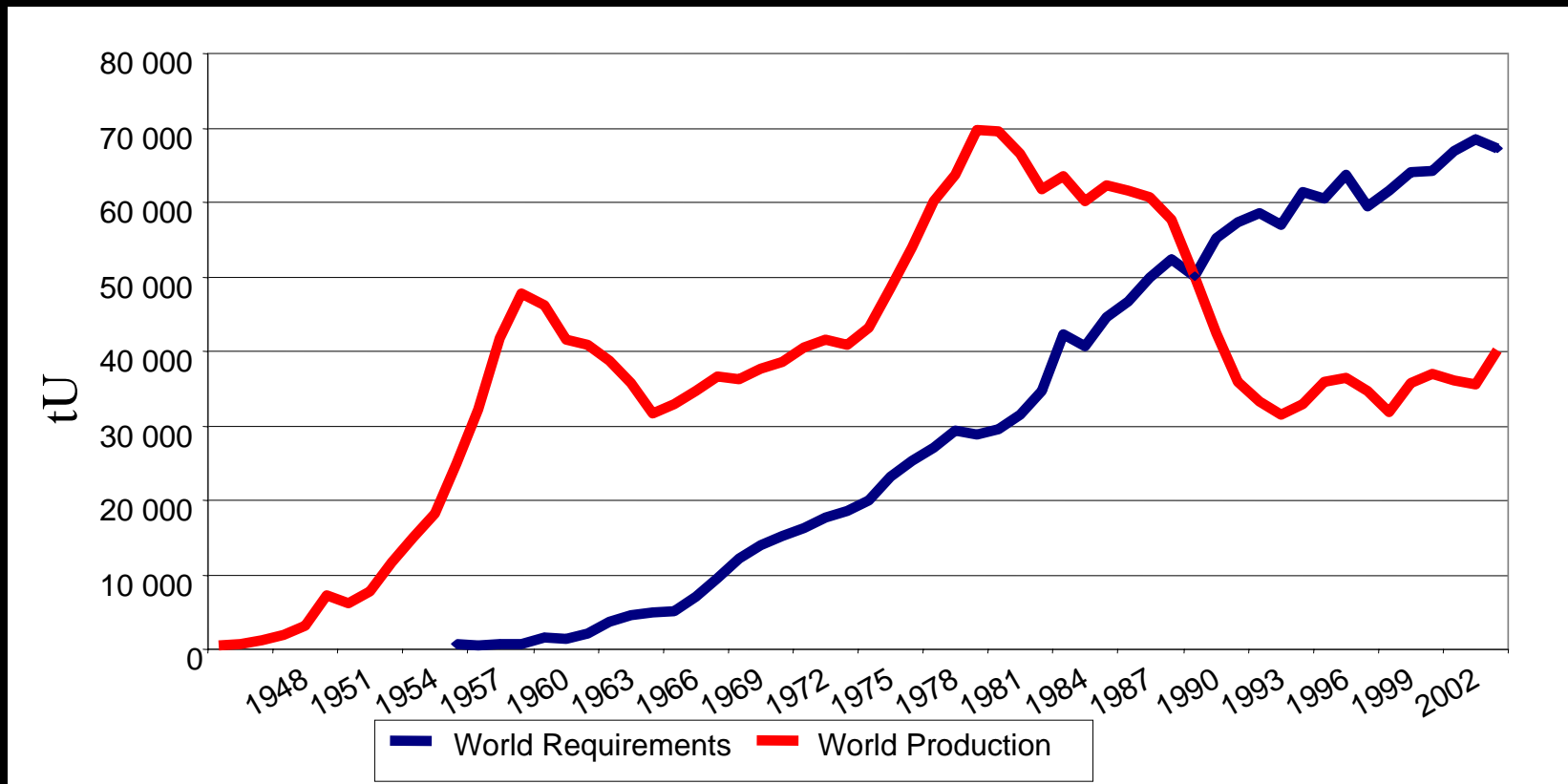
- ◆ 1945: 507 tU (estimate)
- ◆ 1965: 31 630 tU
- ◆ 1980: 69 683 tU from 22 countries (peak)
- ◆ 2003: 35 600 tU from 19 countries
- ◆ Cumulative worldwide production over 2.2 million tU from 35 countries

Country	Cumulative Production (tU)	% of world total
USSR ¹	377 613	17.1
Canada	374 548	17.0
United States	356 845	16.2
Germany ²	219 239	9.9
South Africa	157 618	7.1
Others (total)	719 229	32.7
World total	2 204 732	

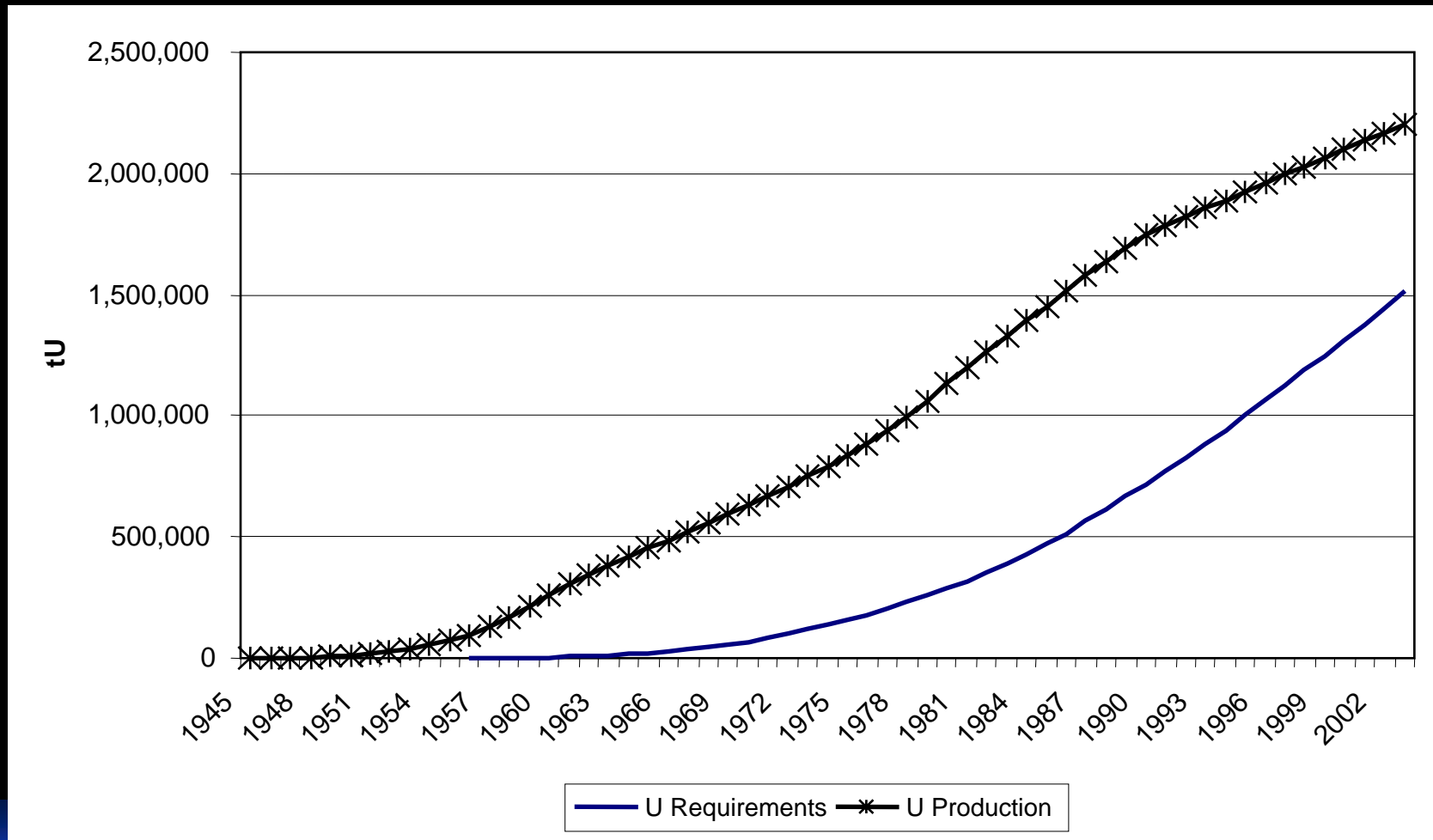
1. Only includes production until 1991.

2. Includes production of the German Democratic Republic (1946-1989) and the Federal Republic of Germany (1961-2003).

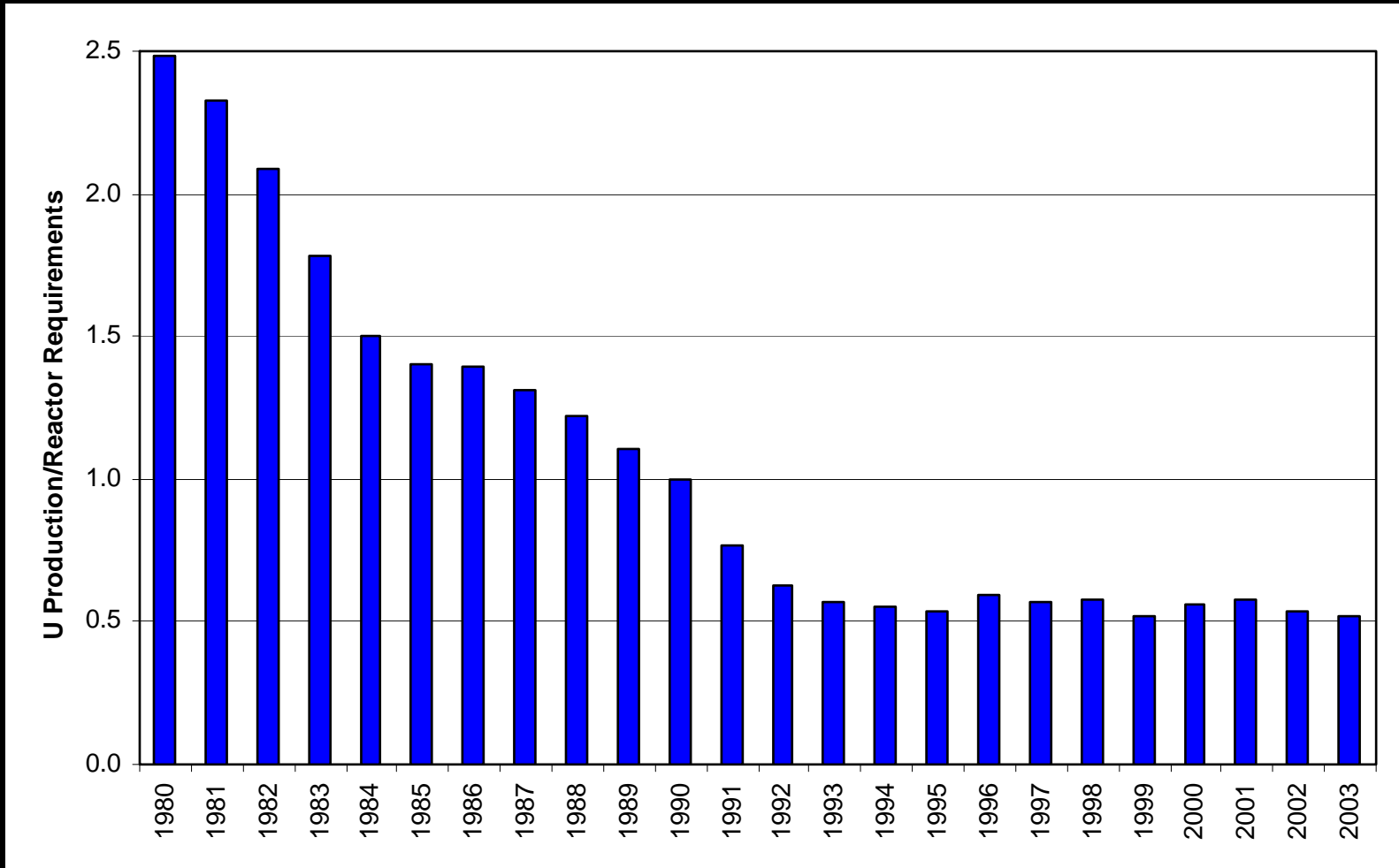
Annual Production v Requirements (1945-2003)



Production – Requirements (1945-003)



Production v Requirements (1980-2003)



Country	RAR + EAR-I (tU)	Prod'n (tU)	KCR + Prod'n (tU)	Exploration Expenditures (USD 1000)	Discovery Cost (USD/kgU)
Australia	1 058 000	113 304	1 171 304	508 949	0.43
Canada	438 544	374 548	813 092	1 288 500	1.58
Czech Rep.¹	920	108 649	109 569	314 013	2.87
France	9 510	75 965	85 475	907 240	10.61
India	59 915	7 963	67 878	315 228	4.64
Niger	227 604	91 186	318 790	216 121	0.68
South Africa	395 670	157 618	553 288	140 919	0.25
United States	345 000	356 485	701 485	2 507 113	3.57
Subtotal non-USSR	2 535 163	1 285 718	3 820 881	6 223 824	1.62
USSR and CIS States²	1 306 390	467 482	1 773 872	4 002 235	2.25
Total	3 841 553	1 753 200	5 594 753	10 200 318	1.82

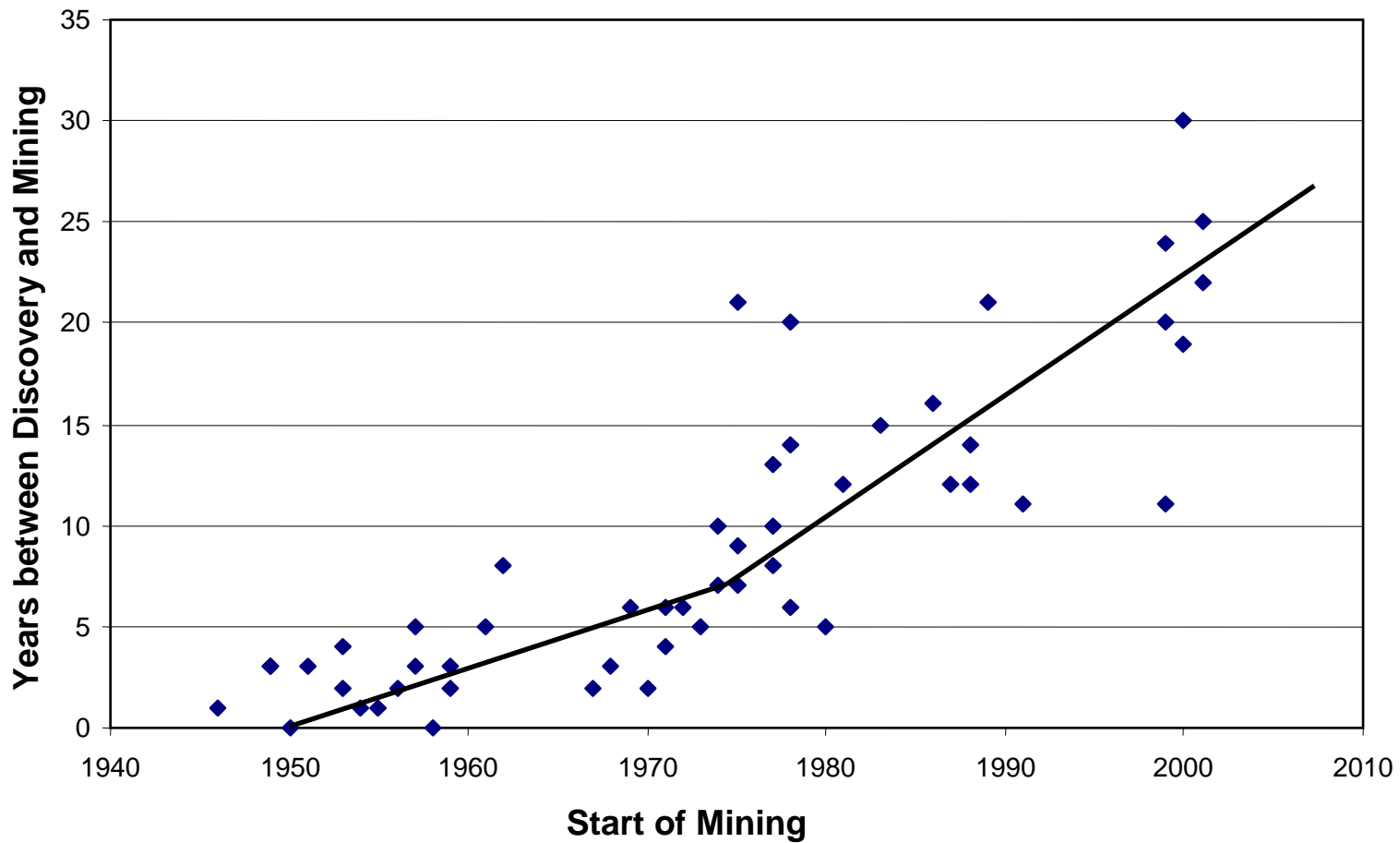
1. Exploration expenditures from 1971 to 2003.

2. Includes totals from Kazakhstan, Russian Federation, Ukraine and Uzbekistan along with USD 3 692 550 000 in exploration expenditures in the USSR from 1945-1990.

Key Messages

- ◆ Past exploration resulted in the discovery of recoverable resources at reasonable cost.
- ◆ Despite low levels of exploration and steadily increasing requirements, resources to requirements ratio has remained relatively constant since the 1980's.
- ◆ Uranium resources will remain adequate to meet projected demand, even with increased demand.

Evolution of mine start up times



The *Red Book Retrospective* provides arguably the most complete record of the uranium industry dating from the birth of the nuclear age through the dawn of the 21st century.

To be published in September 2006

www.oecd.org/bookshop

