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***The uranium production sustainability debate;
current knowledge v.s. uncertainties***

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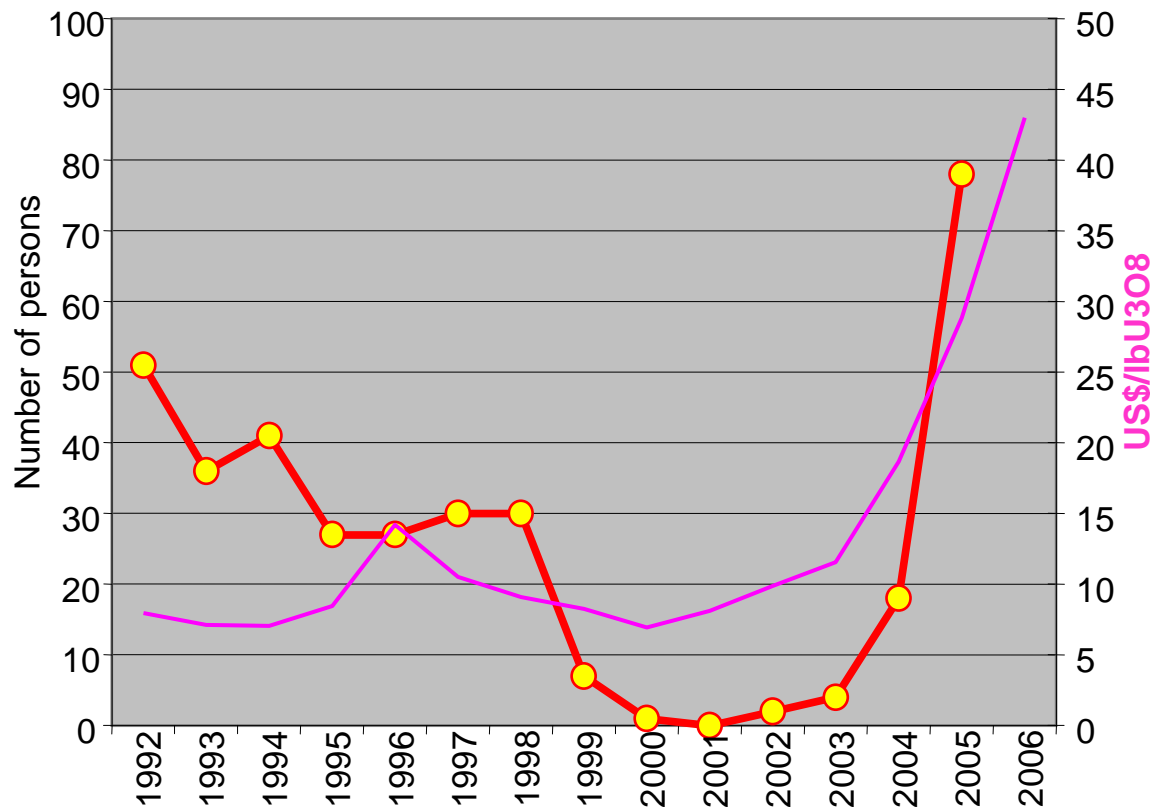
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- ▶ **Uranium perception changes; the « U curve »**
- ▶ **The history of world uranium resources evaluation**
- ▶ **Facts and figures**
- ▶ **Conclusion**

The U curve: until very recently, who cared about uranium sustainability?

- ▶ U.S. government statistics indicate that there was **only one person involved in uranium exploration** in the United States in 2000, at that time, the question was “where he is?”
- ▶ In 2001, he vanished; nobody was seeking for U. Since then, the situation has changed dramatically ...



From current market conditions* to uranium supplies and resources availability

- ▶ **Current price increase attracts a lot of interest in uranium exploration and mining**
- ▶ **But it raises several basic questions, such as**
 - ◆ **1) Does this price increase announce an immediate scarcity of uranium resources, a “peak uranium” like for oil?**
 - ◆ **2) Do we have enough economically recoverable uranium resources to fuel a “nuclear renaissance”?**
 - ◆ **3) What are the ultimately available uranium resources of the planet?**

**** (> US\$ 40/lbU3O8 or >110\$/kgU)***

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The history of world uranium resources evaluation

- ▶ **First commercial nuclear power plant in 1957 (Calder Hall 1 in UK)**
- ▶ **The US evaluations in the 1950's ...**
- ▶ **The OECD-NEA- IAEA “Red-Book”**
 - ◆ **The “Red Book” dates back to January 1965, after the European Nuclear Energy Agency (ENEA) of the OECD established a Study Group on the long-term role of nuclear energy in Western Europe.**
 - ◆ **1965; publication of the first assessment of world uranium resources (W World), titled “World Uranium and Thorium Resources”, under the auspices of the ENEA.**
 - ◆ **That first publication had a red cover, as have all subsequent editions; hence the informal name “the Red Book”**
- ▶ **The Red-Book reports the data for around 50 countries**
- ▶ **In 1976 NEA-IAEA started IUREP to assess LT resources**

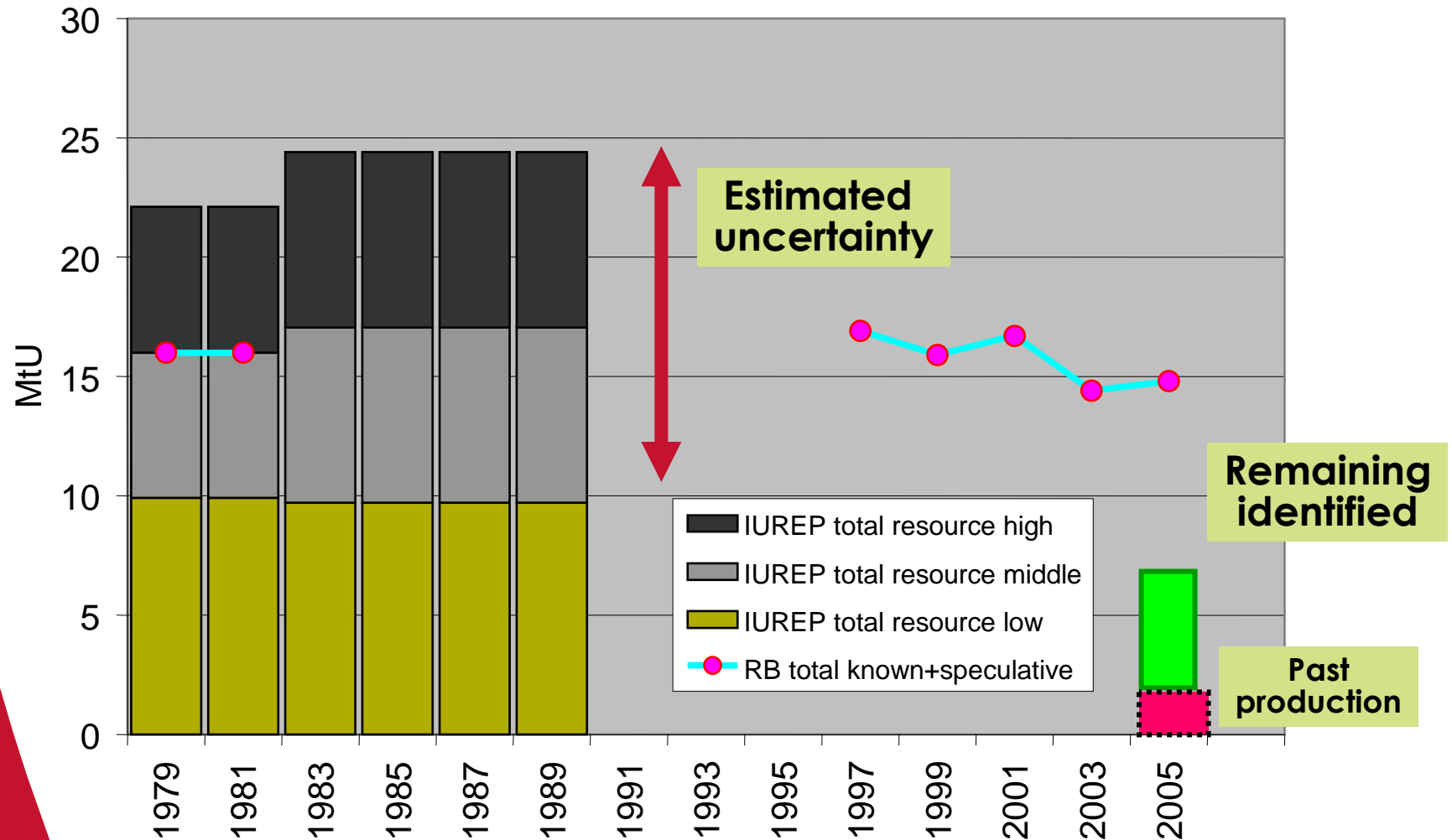


A brief historical of Speculative resources

- ▶ **Same concerns, same questions!**
- ▶ **In 1976 OECD-NEA and IAEA launched the International Uranium Resources Evaluation Project » (IUREP)**
- ▶ **The IUREP evaluation consists in a country by country estimation of a total speculative potential for uranium recoverable at less than 130 US\$/kgU (inclusive of other categories such as RAR & EAR)**
- ▶ **This estimation was basically an expert view (speculation or educated guess?) based upon the then available knowledge (statistics of deposits density in a given geological environment)**

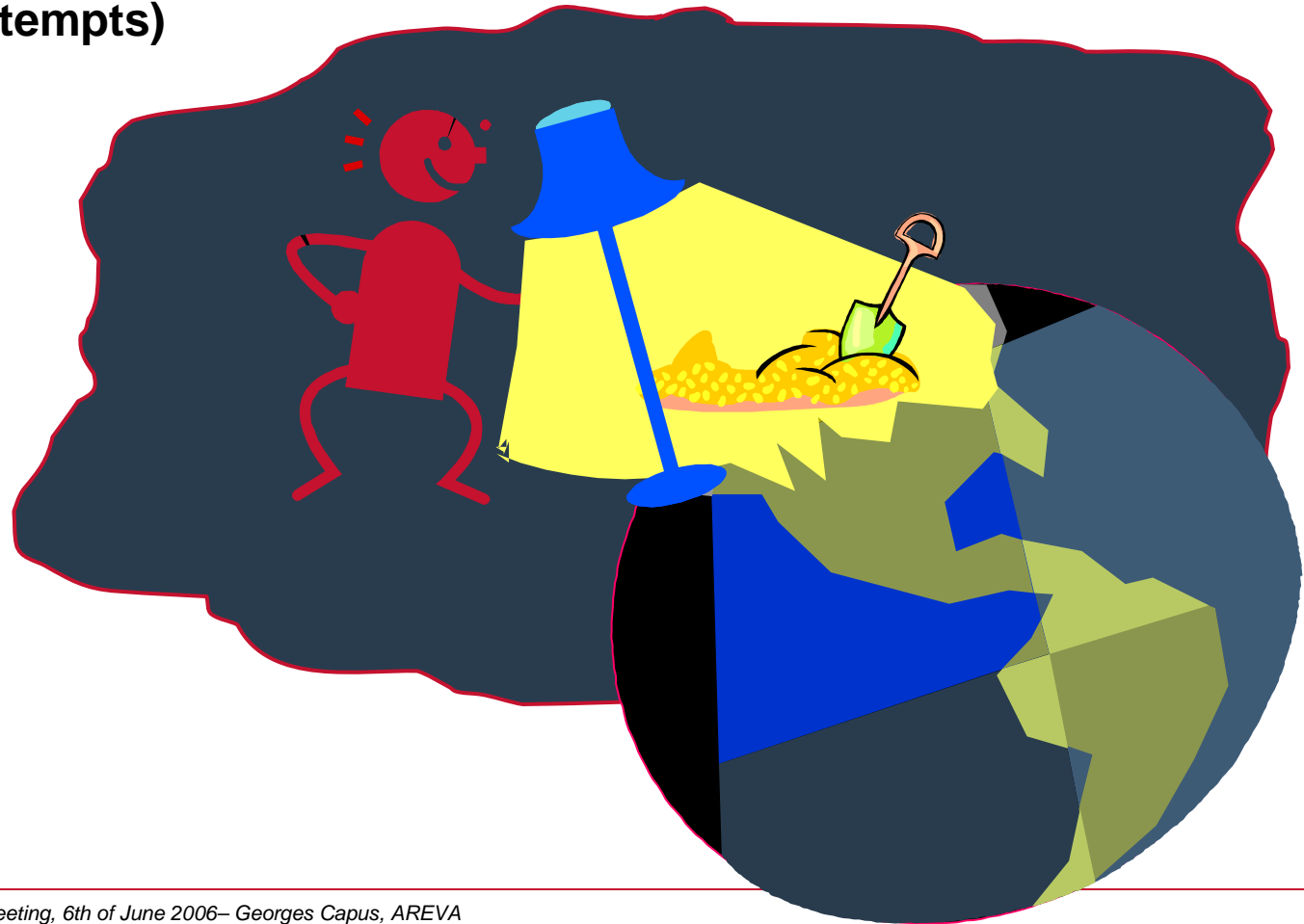
Trend in Uranium World Total Conventional Resources Estimate

- ▶ A stable estimate, not re-stated in many countries + Australia or Niger do not provide any speculative resource figure



Signification of Uranium resources figures

- ▶ 1) The available numbers are just gathering the results of past exploration and surveys, as reported by countries representatives
- ▶ 2) There is no way to get a meaningful “definitive” number for the “ultimate resources” (despite some fancy attempts)



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Indications of Resources Depletion?

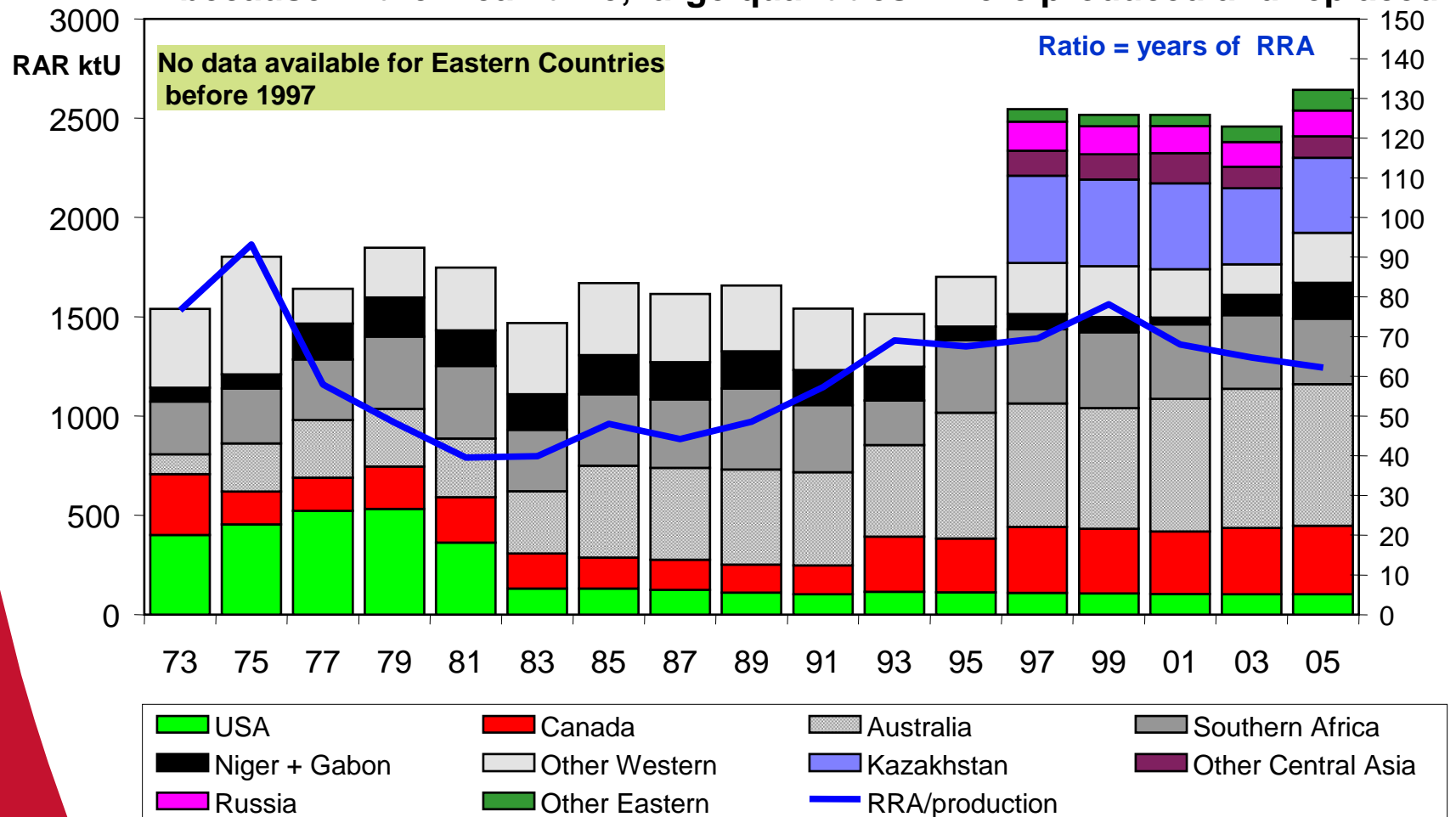
- ▶ Despite a historical cumulative production close to 2.3 million tU through 2005, additions to resource totals have kept pace with production so that **overall resource levels have remained stable or even increased** over time.
- ▶ The ratio between Known Resources <80\$/kgU and reactor related uranium requirements *in 2005 is 60* compared to an average of 47 since 1985.
- ▶ Depletion of resources through production has not yet become a concern.

*Nothing like the « peak oil » in uranium,
the history of this metal is too short*

World uranium resources* evolution

► An apparent stability ... concealing in fact a significant increase

- ◆ because cost category limit is in current dollars
- ◆ because in the mean time, large quantities** were produced and replaced



* RAR <80\$/kgU : source OECD-NEA – IAEA

** about 1 550 ktU from 73 through 2005

Facts: What is available as of today? World Uranium Resources Figures 2005 (millions of tU)

- ▶ Seen from now, there are very large uranium resources already identified and available, plus more “speculative” resources, and finally unconventional, likely to bring significant flows in the LT on a yearly basis, plus potential for further discoveries

40\$

80\$

130\$

M tU	Conventional Resources				Unconventional Resources.
	Identified Resources		Undiscovered Resources		
US\$/kg U \$/lbU308	RAR	Inferred (EAR-1)	Prognosticated (EAR-2)	Speculatives	
< 40 <15	1.9	0.8	1.7	4.6	Around 15 to 25 Costs to be re-assessed Mainly phosphates
40 – 80 15 - 30	0.7	0.4			
80 – 130 30-50	0.7	0.3	0.8		
> 130 > 50	?	?	?	3.0	
<i>subtotal</i>	3.3	1.4	2.5	7.5	
TOTAL	<u>4.7</u>		<u>14.8</u>		15 – 25 or more

* Resources as of 1/01/2005; Source: Red Book OECD-NEA - IAEA; issue 2005 prelim.

Facts: What is available as of today?

World Uranium Resources Figures 2005 (years of 2006 consumption)

- ▶ Seen from now, there are very large uranium resources already

@ 65 ktU/y

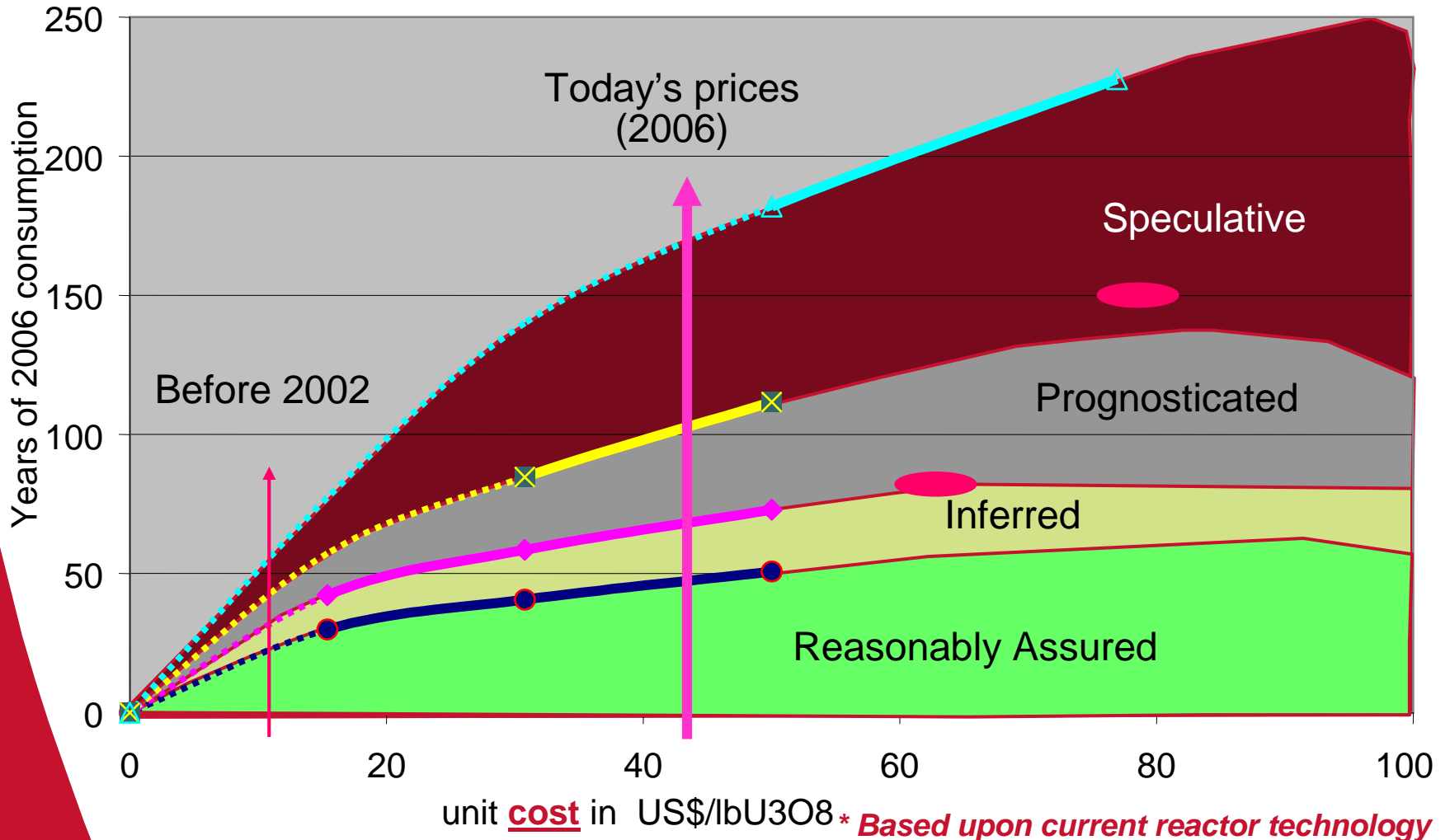
40\$
80\$
130\$

Years*	Conventional Resources				Unconventional Resources.
	Identified Resources		Undiscovered Resources		
US\$/kg U \$/lbU308	RAR	Inferred (EAR-1)	Prognosticated (EAR-2)	Speculatives	
< 40 <15	30	12			Potential to double or more
40 – 80 15 - 30	11	6	26	70	
80 – 130 30-50	10	4	13		
> 130 > 50	?	?	?	46	
subtotal	51	22	39	116	
TOTAL	<u>73</u>		<u>228</u>		

* Resources as of 1/01/2005; Source: Red Book OECD-NEA - IAEA; issue 2005 prelim.

Uranium Resources; Risk appraisal from available figures

- ▶ At current consumption rates* (65 ktU/y or 169 MlbU₃O₈) we are almost certain to have enough for 75 years, and rather confident to more than double that



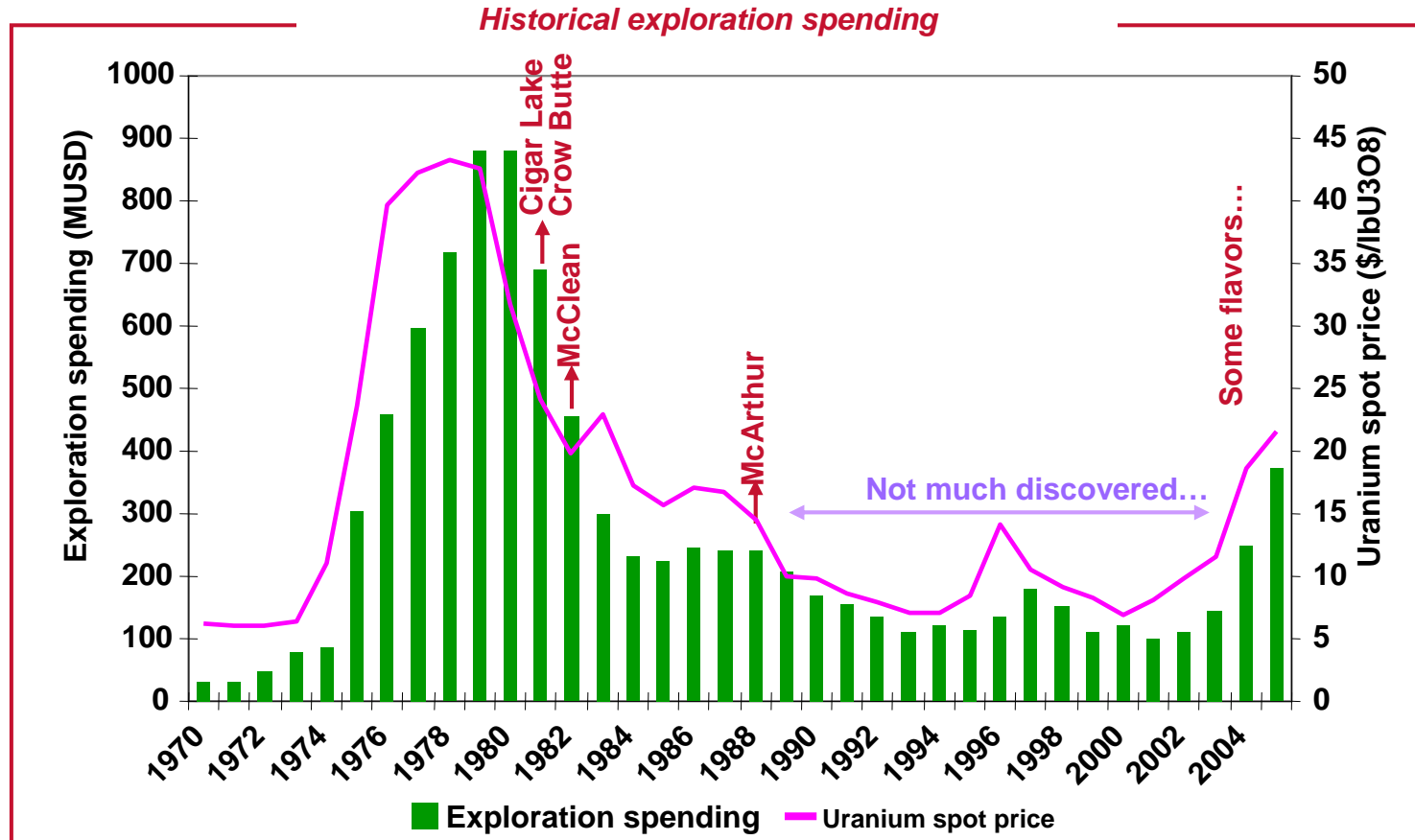
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Uranium exploration history and future...

- ▶ **History, because it explains current knowledge level**
 - ◆ exploration gradually increased from 1945 through 1970. After 1970 there was a sharp increase in exploration, which culminated in an all-time high in 1979.
 - ◆ Then followed a long period of low exploration expenses
- ▶ **Correlation of discoveries with exploration expenses & market price (chart)**
- ▶ **Future?**
- ▶ **It will depend upon**
 - ◆ 1) current exploration results and
 - ◆ 2) actual nuclear reactor fleet growth, the real fundamental factor as a promise of uranium business

To confirm “prognosticated” resources or to discover “undiscovered” resources; no secret, money’s needed!

► **Exploration financing shall be provided by the market**



The discovery of almost 100% of currently identified resources including largest Canadian and Australian deposits occurred in the 70s-80s as a result of well financed exploration

Funding exploration

- ▶ In the past, significant exploration funding came from governments
 - ◆ For local exploration
 - ◆ For abroad exploration
- ▶ Today we can see a similar approach from certain countries (Russia, China...)
- ▶ However exploration funding is coming primarily from mining companies
 - ◆ Established mining companies have in average 20 to 30 years of production as « Reserves » and a similar amount as additional « Resources »
 - ◆ They are funding exploration from the cash from operations to replenish their reserves and resources base.

Extensive national evaluations; the only way to assess « speculative » resources?

▶ **Is it time, is it feasible and is it worth to update the evaluation of world uranium resources?**

Selected past examples

- ▶ **CANADA:** In 1975, the Geological Survey of Canada embarked on a 10-year, CAD 30 million uranium reconnaissance program designed to identify and delineate all areas in Canada which may be favorable for the occurrence of uranium deposits.
- ▶ **USA:** initiated the National Uranium Resource Evaluation program (NURE). This multifaceted program included both basic research on uranium deposit types and a broad range of field exploration work, including extensive airborne geophysical surveys, stream and groundwater sampling and compilations of past exploration activities/results. Results of the NURE program, which were made publicly available, stimulated exploration in areas outside the traditional uranium producing districts, particularly in the eastern United States.
- ▶ **France:** From 1977 to 1981, French exploration activities received government aid (Plan d'Aide à la Prospection d'Uranium), the total being USD 38 million. The purpose of this aid was to provide an incentive for prospecting in France and abroad on technically sound but high-risk projects.

***In exploration, you have to seek for something.
However it's not a shame to find something else!***

- ▶ **The exploration geologist needs a « model »; currently very popular models are**
 - ◆ 1) the unconformity model, especially its Athabasca high grade variety
 - ◆ 2) the Olympic Dam model
 - ◆ 3) the « sandstone type ISL amenable » model
- ▶ **But often in the past when exploring for a model in other places than the original, we discovered something else**
- ▶ **Conclusion; geoscience is needed, at least to bring you to the field, but field expeditions, surveys and drilling are even more needful.**
- ▶ **An unexpected discovery can induce more discoveries on the new model**

There is also a fairly high probability for further discoveries based upon new models

Thank you for your attention!