

URANIUM PRODUCTION CYCLE

Uranium Potential Supply and Exploration Outlook

March 2010 Edition



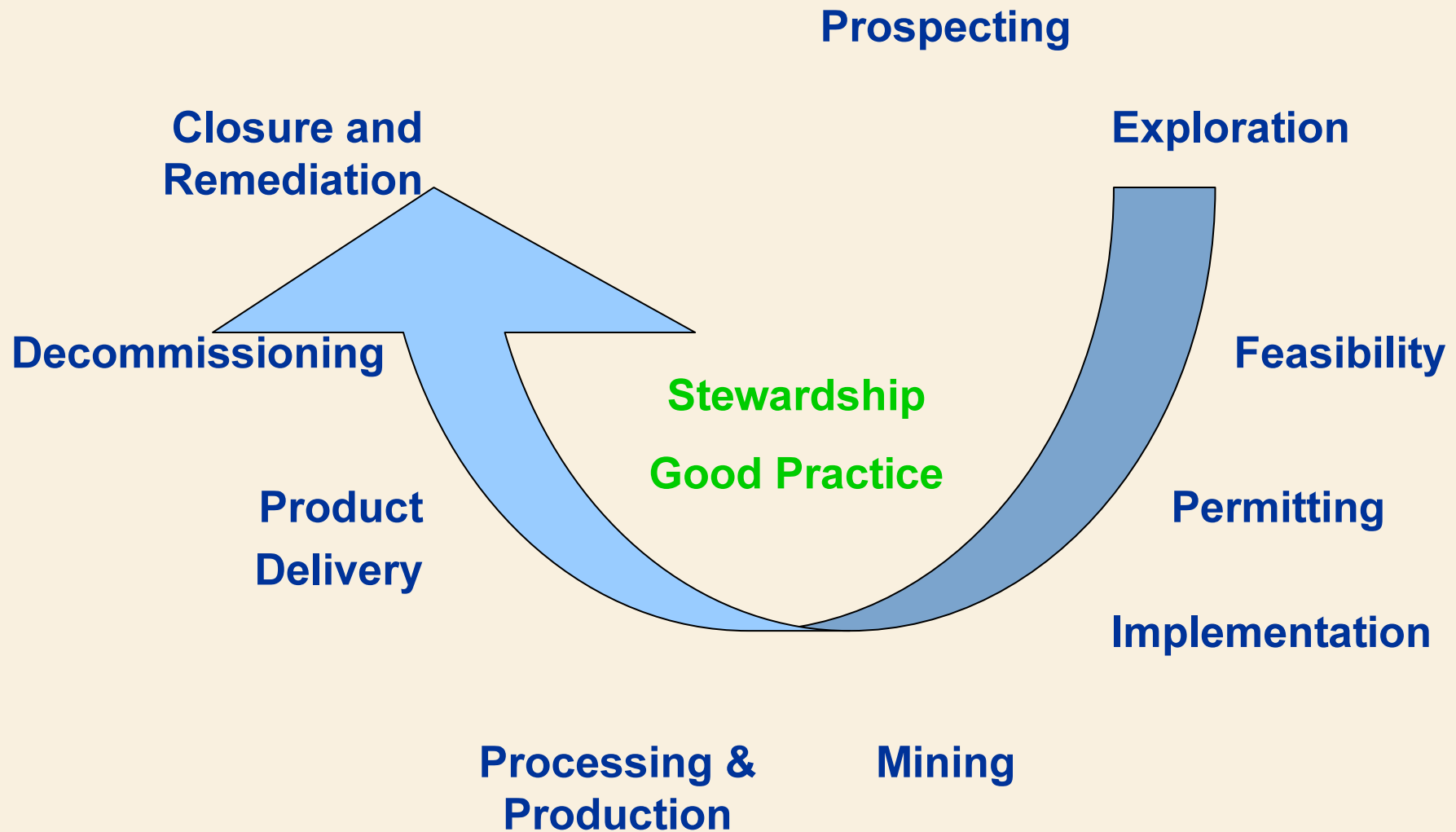
IAEA

International Atomic Energy Agency

Introduction

- Uranium production cycle complexity
- Uranium Resources, Production & Demand
- Uranium Prices, Market, Challenges

Uranium Production Cycle



Uranium Production Cycle

- UPC is a **multi-disciplinary complex** system
- Knowledge on deposits & technology is dated;
no broad development for the last 25 years
UPDATE AND RENEWAL NEEDED
- U exploration comprises many different activities, technologies and procedures
 - **economics are important** (revision of old information, new information gained)
 - New discovery rate determined by spending

Uranium Production Cycle - main stages

- **Feasibility evaluation/estimate**
 - Establish necessary parameters and criteria
 - includes all **economic and risk parameters**
- **Mining & Processing development and operation;**
experienced people needed but limited availability
- **Closedown, decommissioning & remediation**
 - Complexity and difficulty underestimated –
 - **Planning and funding very important for new projects**

**New mines must plan for decommissioning and remediation during studies,
and regularly update these plans during operation**

Uranium Resources (as of 2009)

Identified (Reasonably Assured + Inferred) Resources (in 1000 tonnes)

	< US \$40 / kgU	< US \$80 / kgU	< US \$120 / kgU	< US \$260 / kgU
World				
Australia				
Kazakhstan				
Russia				
South Africa				
Canada				
USA				
Brazil incl PO4				
Namibia				
Niger				
Uzbekistan				
	1983 deposits > 1000 tU	187 deposits > 10,000 tU	17 deposits > 100,000 tU	Olympic Dam ~ 2,400,000 tU

Uranium Production tonnes U

- 2009 estimated 48 510
- 2008 43 853
- 2007 42 463
- 2006 39 603
- 2005 41 943

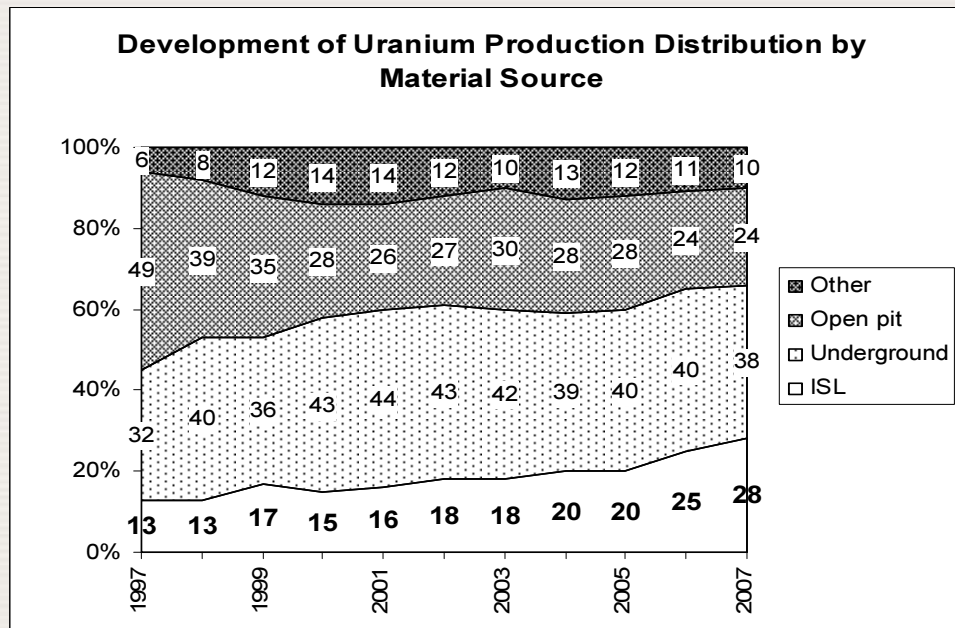
	2008
Canada	9 000
Australia	8 430
Kazakhstan	9 521
Namibia	4366
Russia	3 521
Niger	3 032
Uzbekistan	2 338
USA	1 430

Largest Uranium Producers in 2009

	Tonnes U 2009	
Rio Tinto	8055	
Cameco	7770	
Kazatomprom	7600	
Areva	7500	
ARMZ	4624	
BHP Billiton	2885	
Navoi	2340	
Uranium One	1369	
Paladin Energy	1210	
Others	5157	
Total	48510	

Uranium Production in 2007

conventional underground & open pit 62%
in situ leach (ISL) 29%
by-product 10%



Uranium Production & Demand

2007 production – 42 500 tonnes (62% of demand)

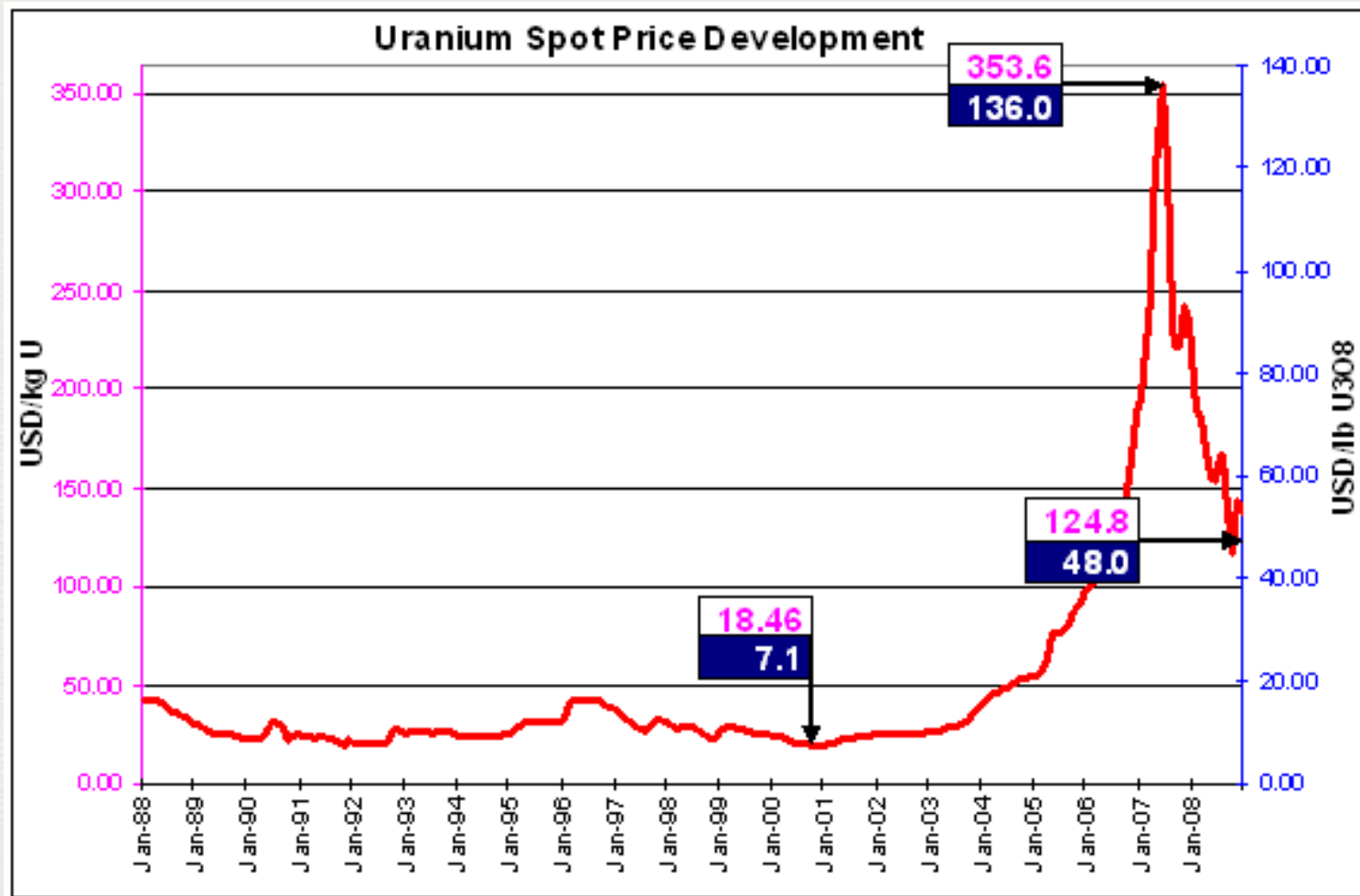
2007 demand - 69 100 tonnes U

**the gap (> 25 000 tU)
is supplied from the so called “secondary supplies”**

Country	2007	% share
Canada	9 500	22.3
Australia	8 600	20.2
Kazakhstan	6 600	15.5
Russia	3 400	8.0
Niger	3 200	7.4
Namibia	2 900	6.8
Uzbekistan	2 300	5.2
USA	1 700	4.0
Ukraine	1 000	2.4

Country	2007	% share
USA	22 825	33.0
France	9 000	13.0
Japan	8 790	12.7
Russia	4 100	5.9
Germany	3 490	5.1
South Korea	3 200	4.6
Ukraine	2 480	3.6
Canada	1 900	2.7
UK	1 900	2.7

Uranium Spot Price Now \$40-45 pp



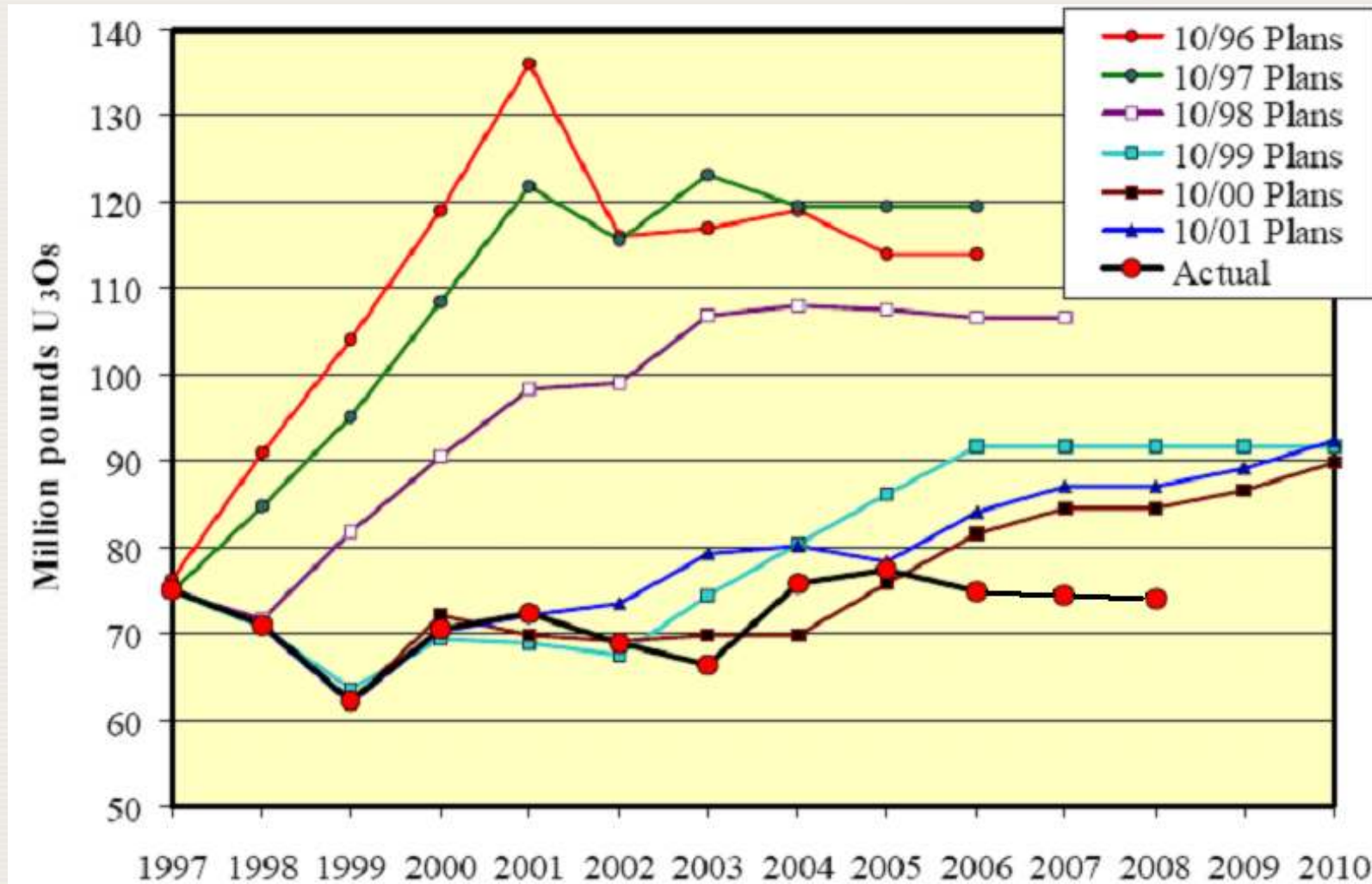
Current U Spot Price Influence

- **Price was low => Supplies are plentiful**
 - an incorrect perception
- **Future price is largely a function of current price**
 - an incorrect perception
- **Price increases can support more production => indicated plentiful future supplies**
 - manifest in the procurement decisions of some utilities which decide not to contract too far into the future
 - Direct equity purchase in mines and exploration prospects by state controlled organizations

Implications

- **Past Ideas**
 - **Future price \Rightarrow a function of recent price**
 - **Production \Rightarrow a function of price**
- **Actual Relationships**
 - **Recent price \Rightarrow function of inventory change**
 - **Production \Rightarrow a function of past price and inventory overhang**
 - **Discovery costs \$4-5 per pound and rising**

Western Production Plans vs. Reality



Observations

- **low prices expectations ~ Under-production and Under-discovery**
- **Few new projects ~ the supply/demand imbalance and higher prices**
- **Effect of lack of production on price is more immediate than the effect of price on production and new project development**
- **Price can go notably higher as production struggles to meet demand**
- **The level to which price overshoots influenced by past price expectations and their effect on exploration and development**
- **Degree of subsequent price decline depends on current exploration and future price expectations**
- **New mines require 10+ years from discovery to reach production**
- **Many new projects will have mined ore grade <0.1% uranium**
- **Current inventory of undeveloped projects has on average only half the ore grade of those deposits that were mined.**

Speculations from CRU analysis

- **Likely level of uranium discoveries to 2030**
- The correlation between uranium prices and uranium exploration will continue.
- For example; at \$40, \$60 or \$80/lb U₃O₈ price, industry projected spend: respectively, \$600m, \$870m and \$1.14bn on uranium exploration worldwide.
- Depending on the prevailing future uranium price at the time, in 2020 the potential amount of uranium discovered is estimated at 55, 79 and 104 ktpa of U₃O₈.
- Assuming future discoveries have similar distribution compared to last 50 years, CRU estimates the likely number of significant new discoveries (>1kt in size) made in 2020 to be in the range of 9, 14 or 18 deposits, depending on the prevailing uranium price.
- In all scenarios, most of the deposits found will be small in size.
 - nine of the deposits found will contain less than 2.5kt of U₃O₈.
- One large deposit, probable size > 100ktU, may be found every 9 years;

UPC Historical Message

- Higher spot prices triggered exploration, which led to new discoveries (with many time delays!!!)
- Over 2.3 Mt U have been mined since 1965
 - But resources are higher than ever
- **Low spot price for >20 years**
 - little incentive to invest
 - Slowed exploration, development, training
- **Stability on the U market is lacking**
 - but it is necessary for the new mine projects

UPC Recent Message

- Enough resources does not necessarily mean enough production; i.e. delays with new mines
- Recent production declined from 2004 to 2006, then 7% increase in 2008 and 11% in 2009
- Production must double to match demand
- Strong and stable market conditions needed to encourage necessary investment

UPC Development Barriers

- Market is not transparent and very volatile
 - Public acceptance is tainted by past events
 - Regulatory requirements are changing
 - Government initiatives are emerging
 - Market uncertainty continues
- => Unpredictable situation, but we hope for future higher stability

- **THANK YOU FOR YOUR ATTENTION**

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