

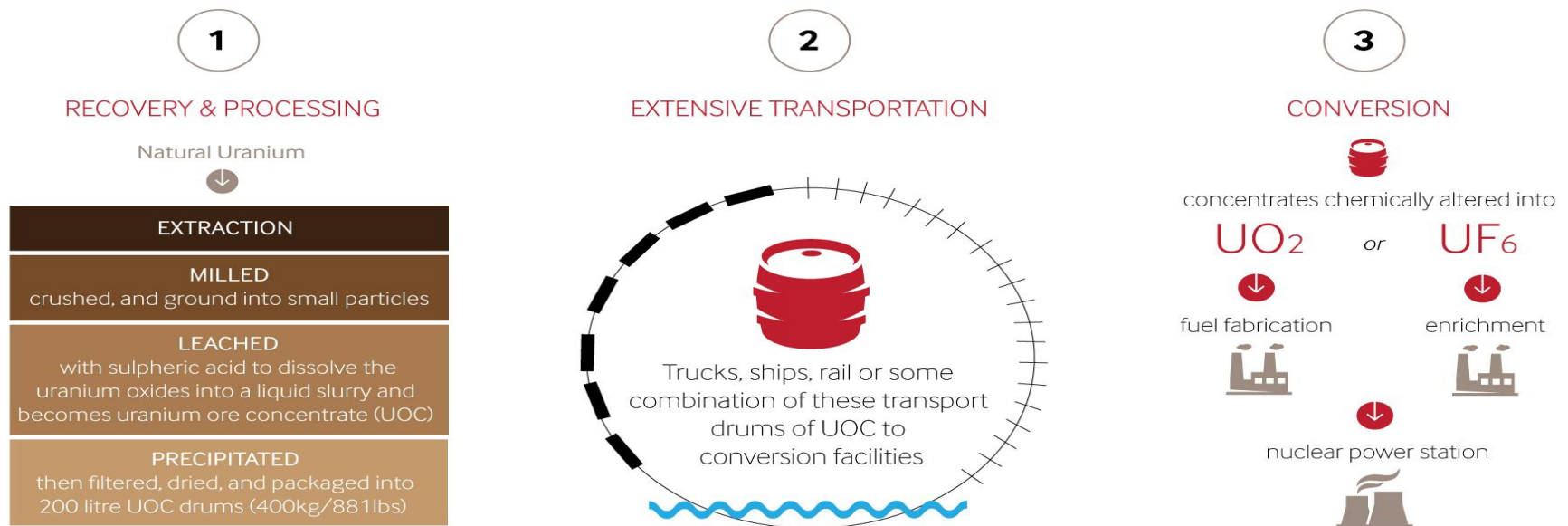


# Governing Uranium Globally

Cindy Vestergaard

# Governing Uranium project

- 2.5 year project - 1 January 2013 to 30 October 2015
- 15 uranium producing/consuming countries
- Up to 25 researchers, from 10 countries involved
- Focus on security, safeguards, & industry practices that govern natural uranium production and trade (up to the point of conversion)



# The Nuclear Fuel Cycle





# Open Pit

(Ranger Mine – Aus)





# Underground



McArthur River Uranium  
Mine Photos: Cameco



# In Situ Leaching (ISL) Muyunkum and Tortkuduk

Uranium Mine, Kazakhstan (Photo courtesy of KATCO)





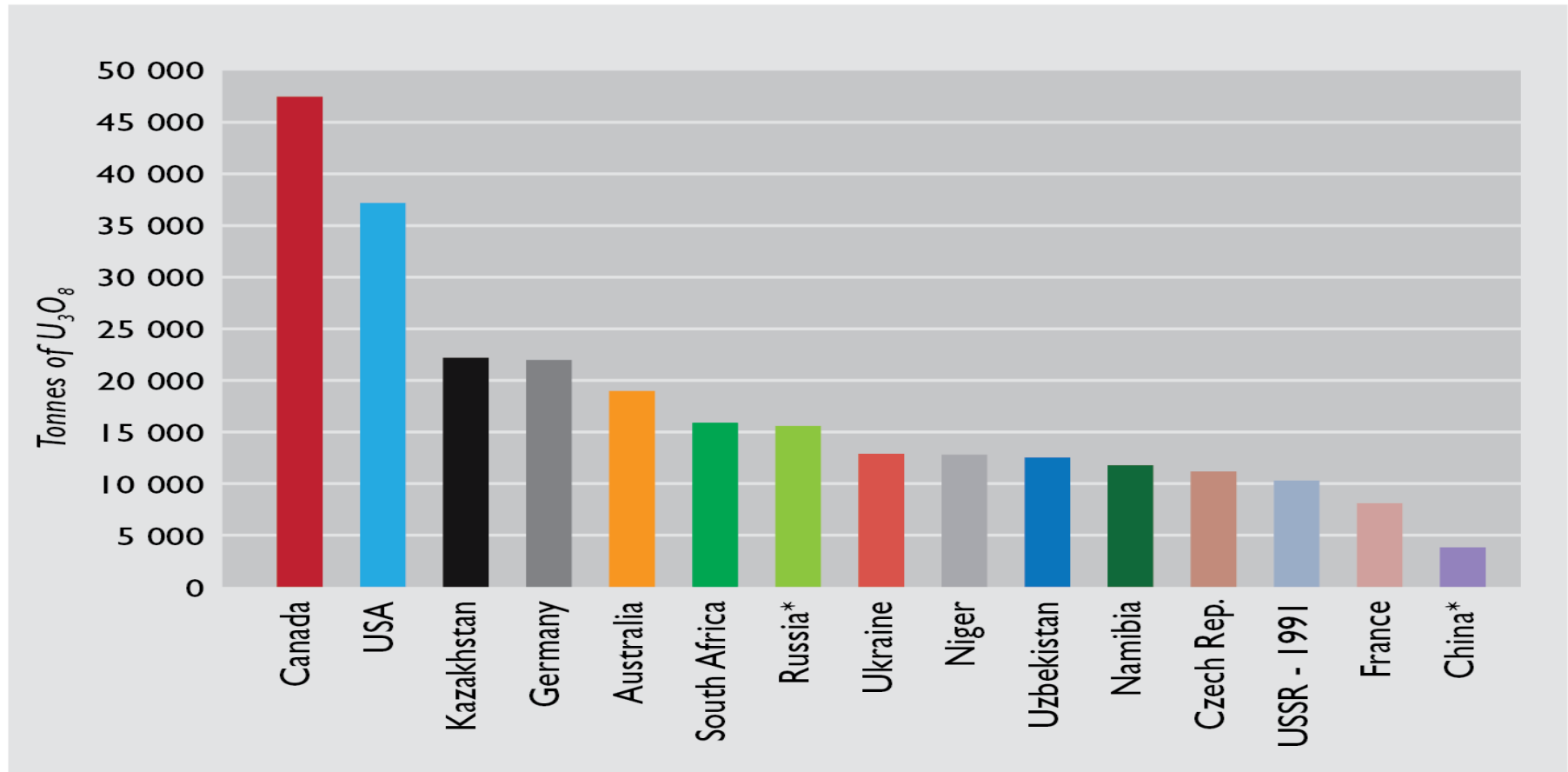
# GovU Country Membership

Country/Membership	NPT	Additional Protocol	CPPNM (and 2005 amendment)	ICSANT	NSG	NWFZ	Regional Safeguards
Australia	√	√	√√	√	√	√	-
Brazil	√	-	√-	√	√	√	ABACC
Canada	√	√	√√	√	√	-	-
China	√	√	√√	√	√	-	-
France	√	√	√√	√	√	-	Euratom
India	-	√	√√	√	-	-	-
Kazakhstan	√	√	√√	√	√	√	-
Malawi	√	√	√-	√	-	√	-
Namibia	√	√	√-	-	-	√	-
Pakistan	-	-	√-	-	-	-	-
Russia	√	√	√√	√	√	-	-
South Africa	√	√	√-	√	√	√	-
Tanzania	√	√	√-	-	-	√	-
United Kingdom	√	√	√√	√	√	-	Euratom
United States	√	√	√-	-	√	-	-





## Total World Production by Country 1945-2013

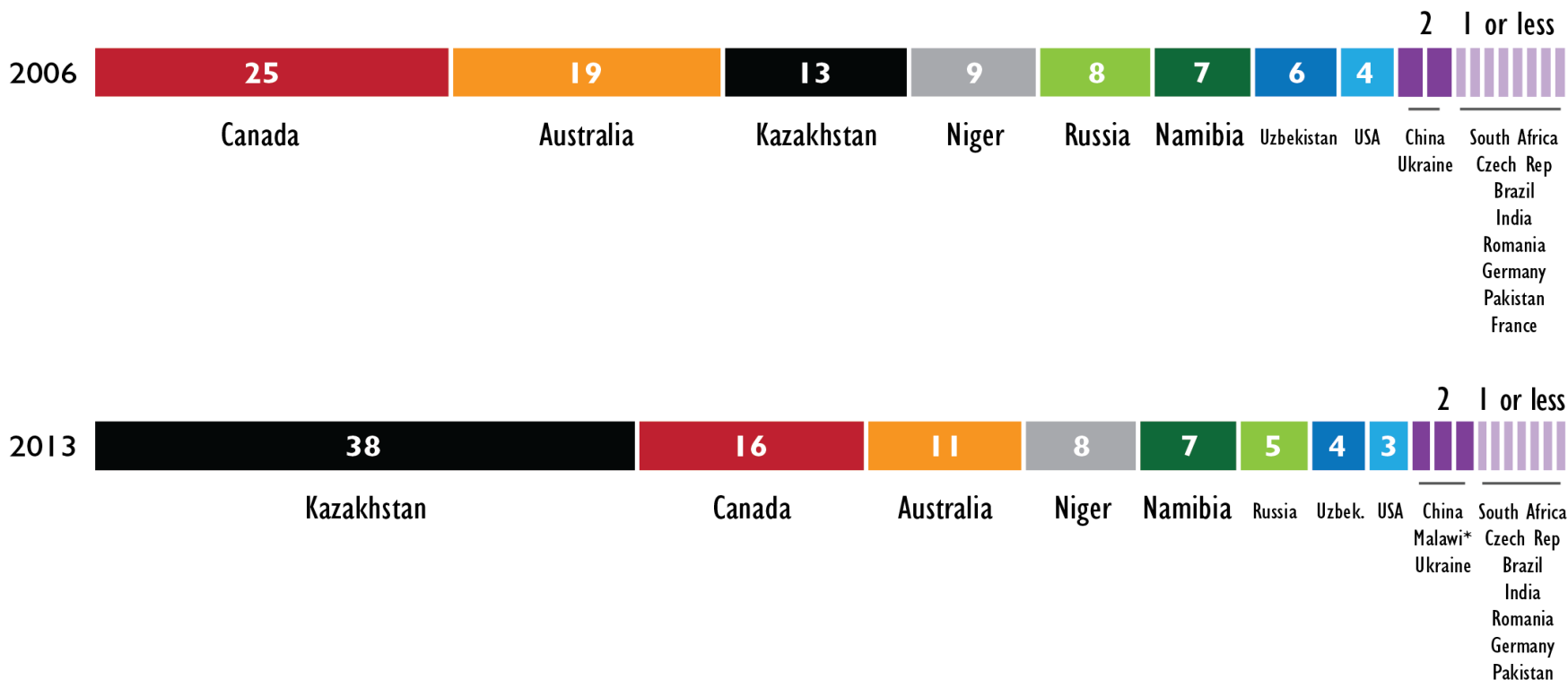


\*Estimated by Secretariat of OECD/WNA.

Source: OECD NEA & IAEA, *Uranium 2014: Resources, Production and Demand* ('Red Book') and WNA *Global Nuclear Fuel Market Report* data.

# Shifting Geographies of Production

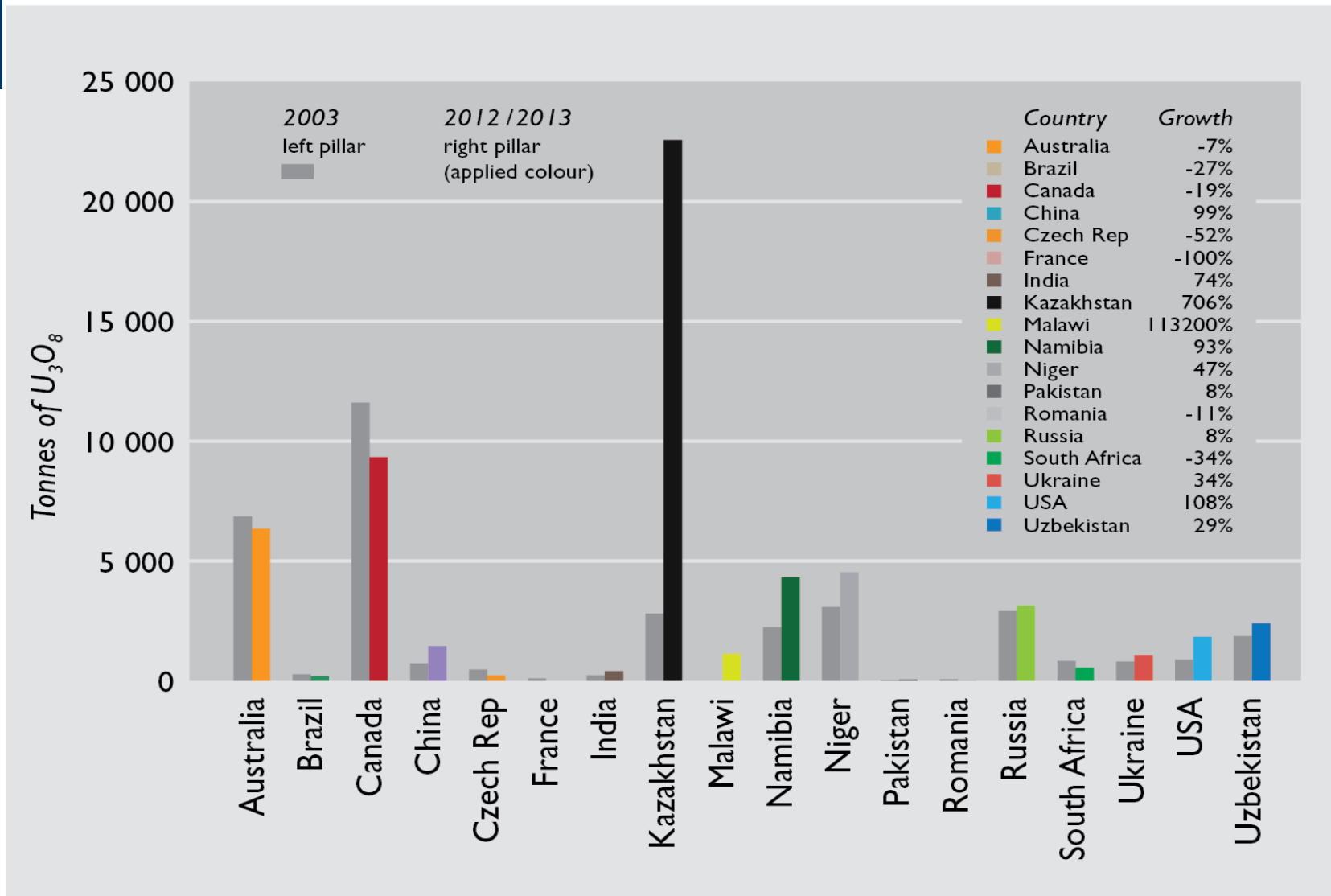
Percentage of World's Uranium Production from Mines, 2006-2013



\* Country did not produce uranium from mines in 2006.

Source: 'Governing Uranium - Production', CSIS and DIIS: <http://uranium.csis.org/production/>

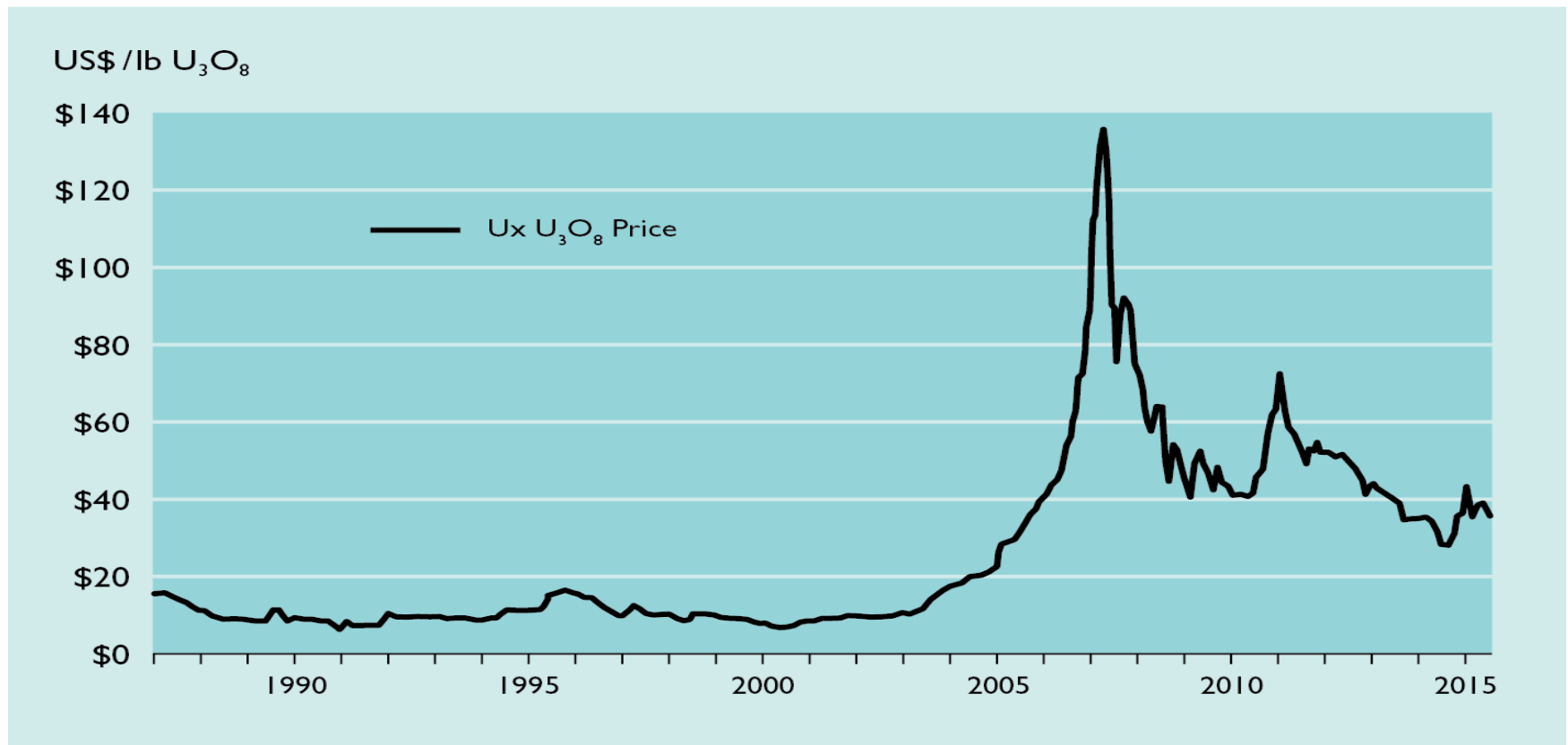
# Change in Uranium Production 2003-2012 / 2013



Source: <http://www.world-nuclear.org/info/Facts-and-Figures/Uranium-production-figures/>

# History of Spot Price of U3O8

## Ux U<sub>3</sub>O<sub>8</sub> Price<sup>®</sup> - Full History (Spot)

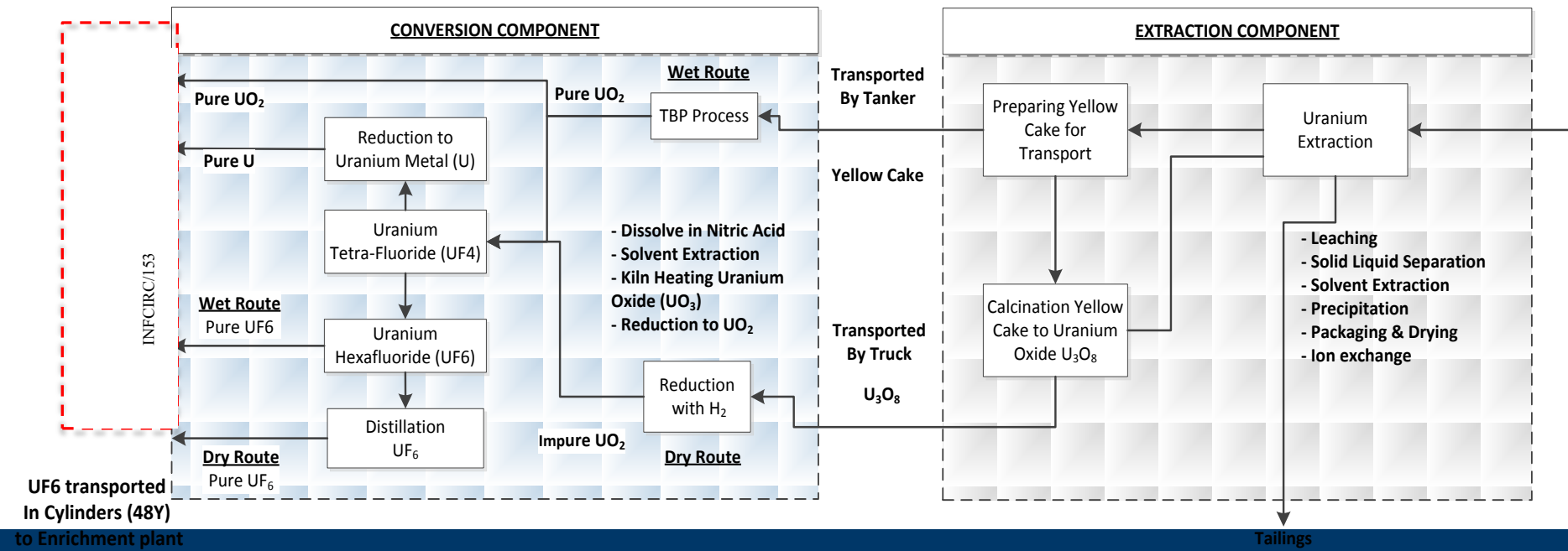
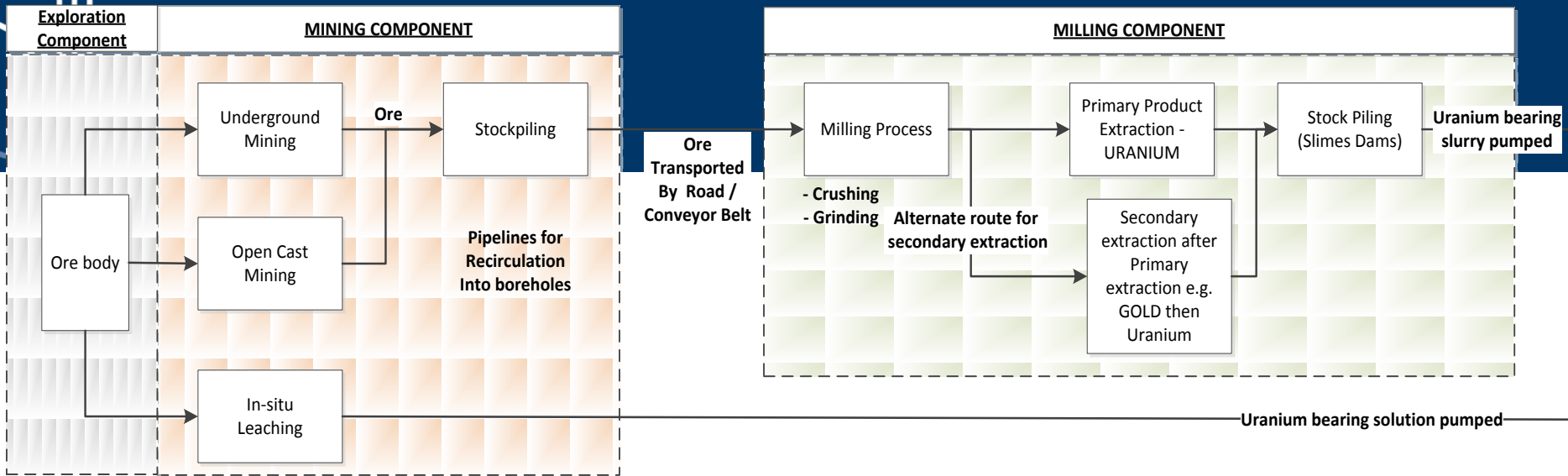


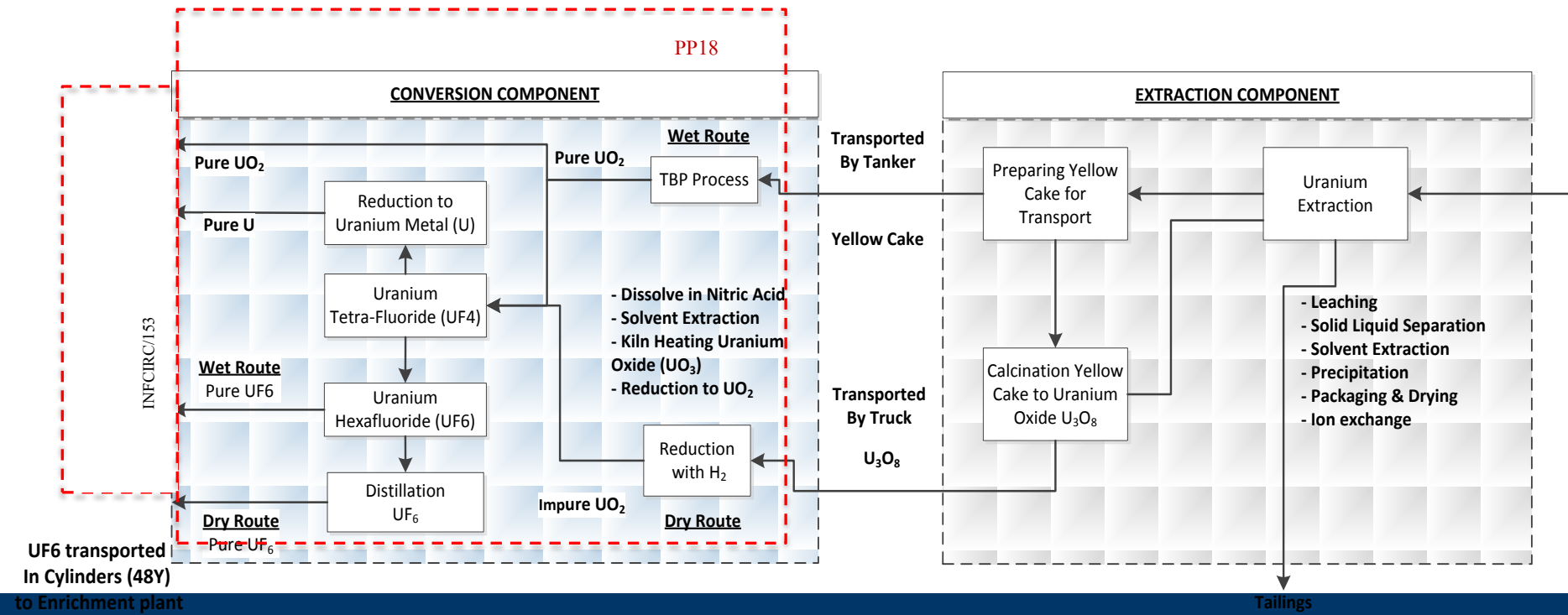
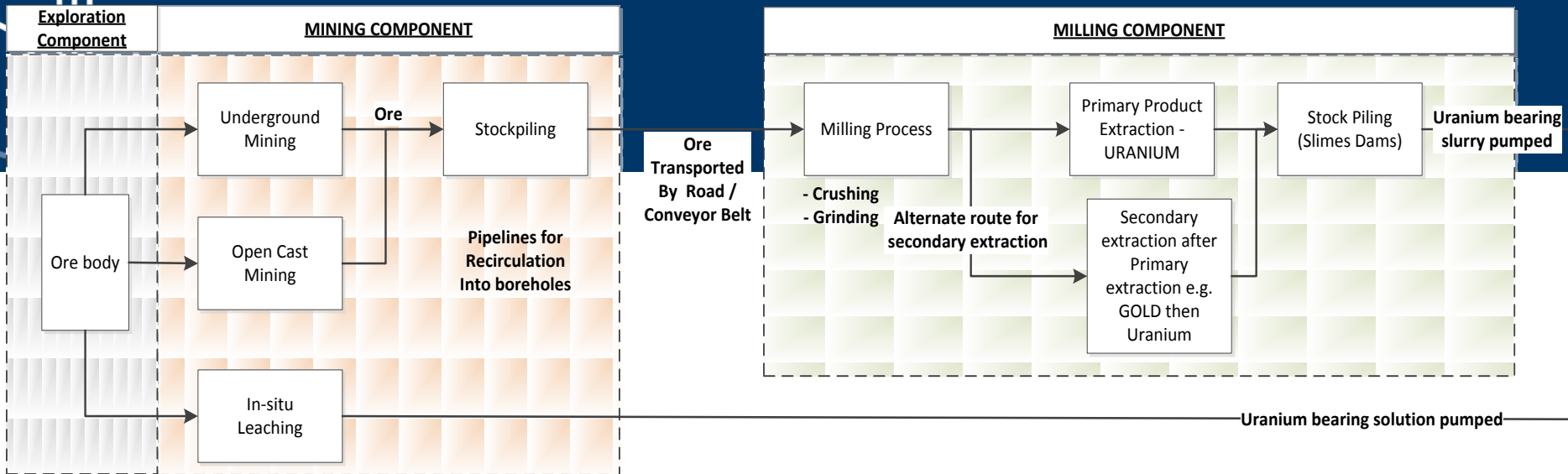
Source: The Ux Consulting Company, LLC: <http://www.uxc.com/>

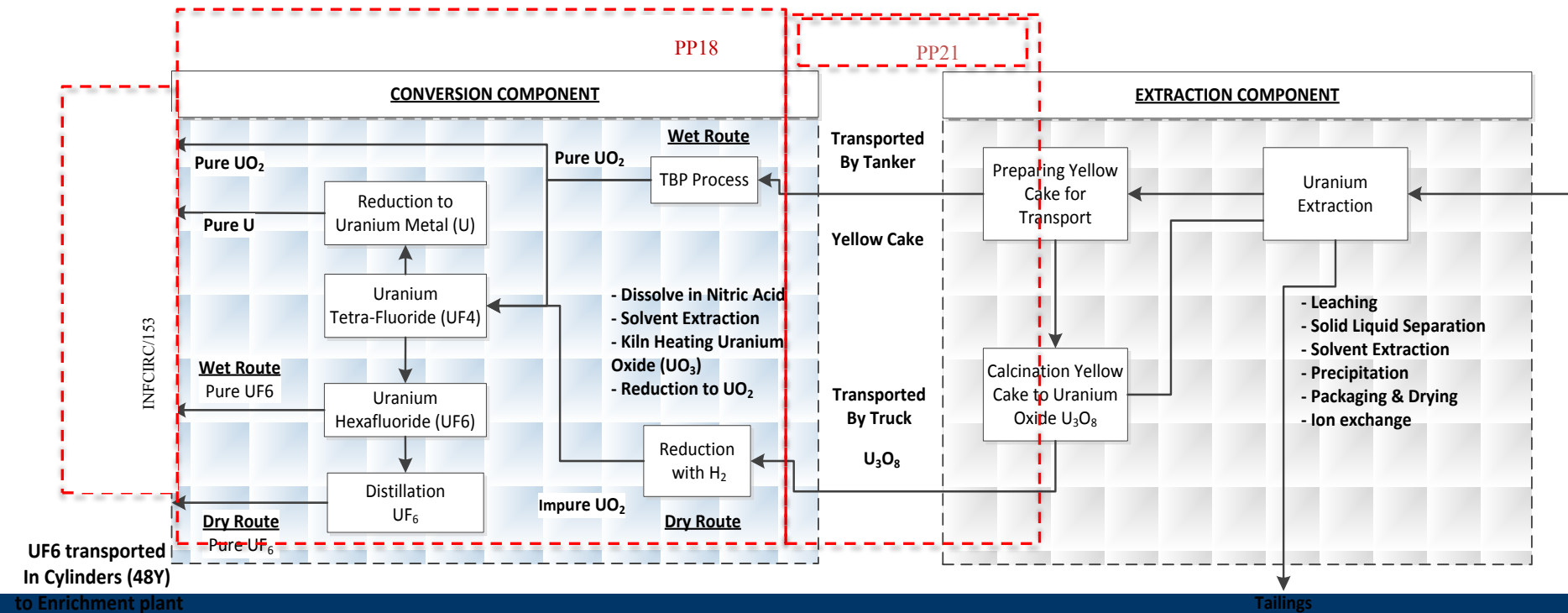
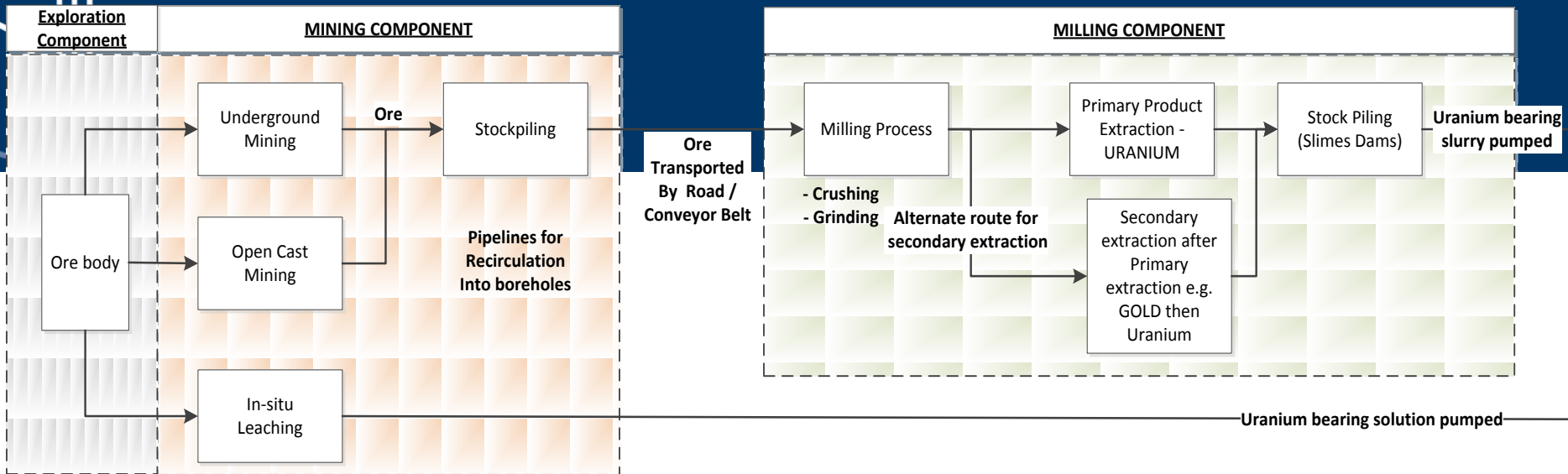


# Intl Reporting Requirements

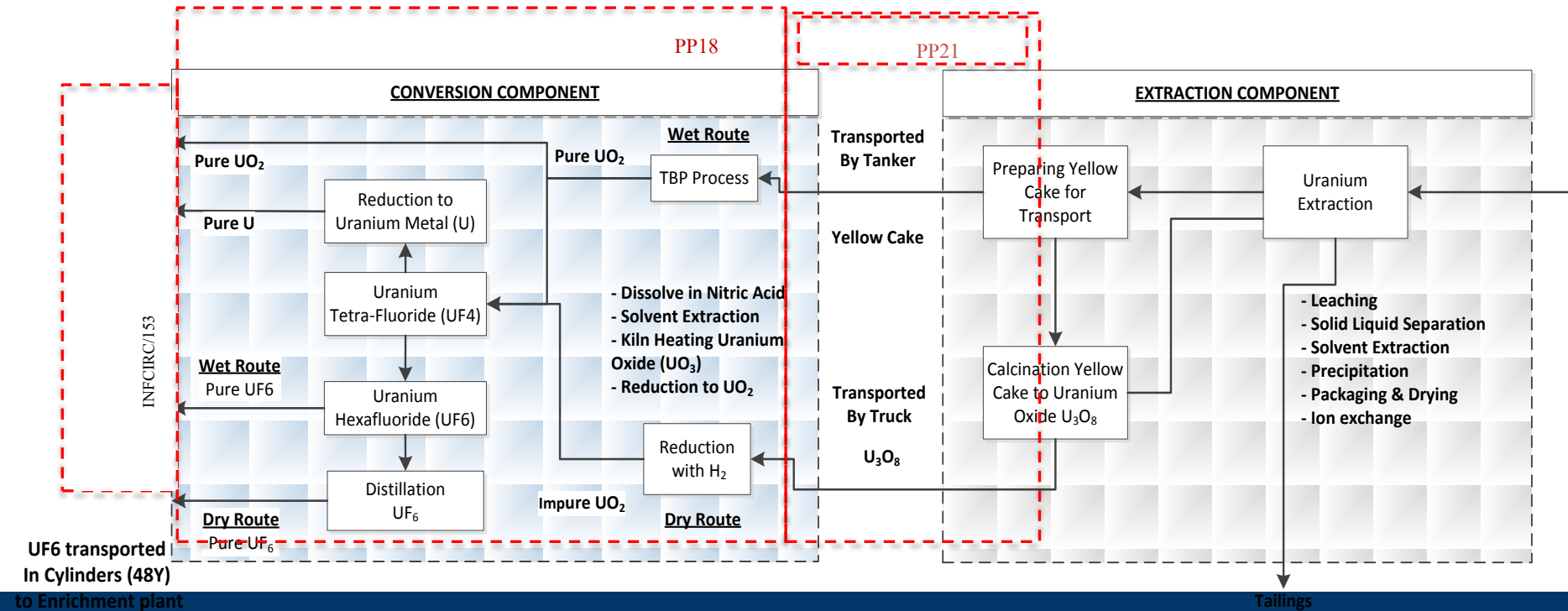
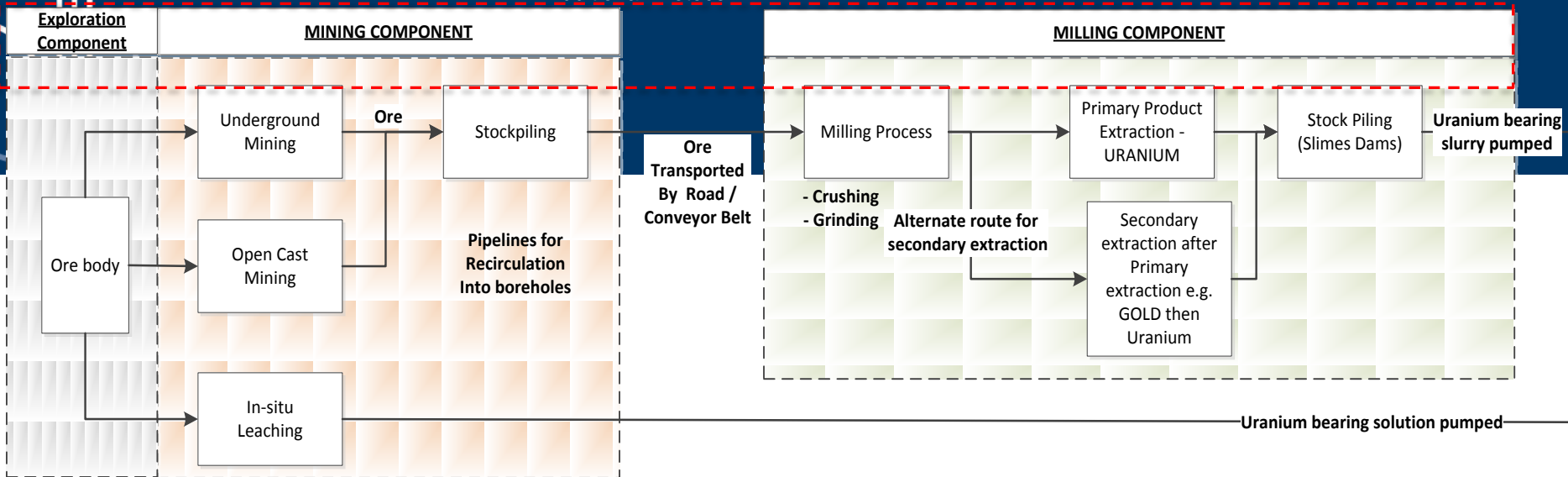
- IAEA Comprehensive Safeguards Agreements – INFCIRC/153
  - Reporting exports/imports of uranium for nuclear purposes (paragraphs 34a and 34b)
  - Full material accountancy and control 34c
  - Policy Paper 18 (2003) clarified 34c to the point of uranyl nitrate
  - PP21 (2013) full scope safeguards on ‘pure’ UOC
- Additional Protocol
  - reporting of # of mines, concentration, production output and potential
  - Unconventional resources for non-nuclear purposes











# Four Tiered Safeguards

## Four Tiered Safeguards Structure

<i>Haves (NWS)</i>	<i>Have-nots (NNWS)</i>	<i>Have-nots that Have (non-NPT)</i>	<i>Exempted Have-nots that Have (India)</i>
VOAs AP	INFCIRC/153 AP JCPOA*	INFCIRC/66-type (no AP)	INFCIRC/754 AP

\* The JCPOA concluded with Iran on 14 July 2015 could be considered as a subgroup under the NNWS safeguards agreements.

# Security



- CPPNM (and 2005 Amendment), ICSANT, UNSCRI 540, and INFCIRC/225 (Rev5)
  - Starting point of security earlier than for SG
- Many producers operate in heightened security environments
- Threat assessments and security plans
- Wide regulatory range, inventory and export controls; need for regional/intl harmonisation
- IAEA tecdoc – graded approach
- -nuclear security culture across fuel cycle

# Inventory Controls/Tracking

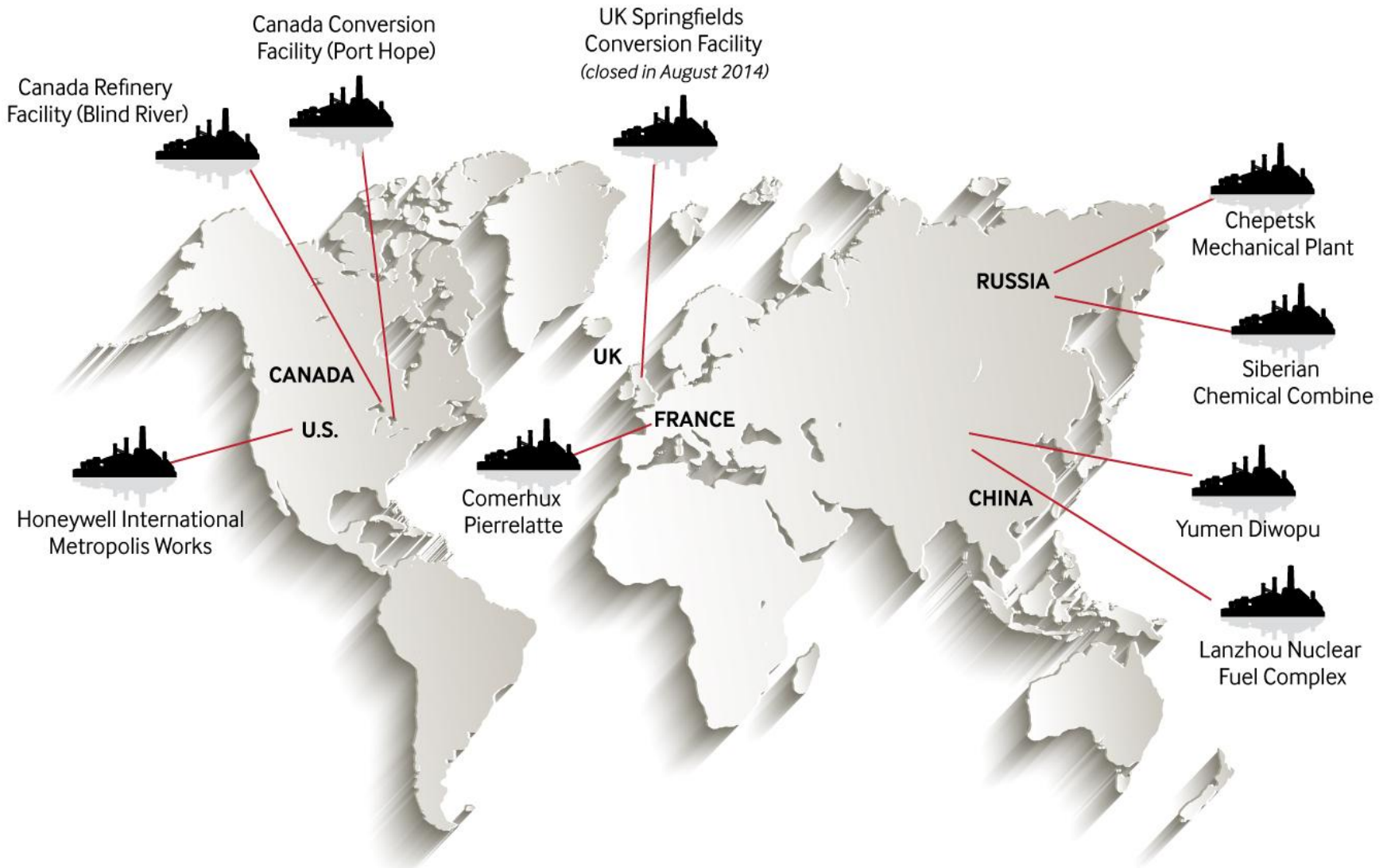
- Ledger system
  - Slowly moving to digital age
- Natl Databases
  - NMMSS (USA)
  - NMAS (Cda)
  - NUMBAT (Aus)
- Standardised forms
- Regulatory & Guidance docs
- Conversion bottlenecks
- Barcoding



# Ready for Transport



# COMMERCIAL CONVERSION FACILITIES WORLDWIDE





# Questions?



# Occupational Safety

- International Commission for Radiological Protection (ICRP)
  - 1mSv/yr for public
  - 20 mSv/yr averaged over 5 years for radiation workers
  - dose limit not to exceed 50 mSv in any single year
  - Rad dose records show average U miner at 1mSv/yr

Occupation/Activity	mSv/yr
7 Hour Airline Flight	0.02
Chest x-ray	0.10
Spine X ray	1.0 - 1.5
Domestic Pilots	2.2
(CT) scan of the whole spine	10