The SA Royal Commission into the Nuclear Fuel Cycle: Has the Nuclear Door Been Opened and What Does it Mean?

By Matthew Moharich and Charles Gregory

South Australian Royal Commission

- Nuclear Fuel Cycle Royal Commission
- Does it means anything for the rest of Australia?
- Political interest: what are the parties saying?
- What is the state of play in other States and Territories?

The nuclear fuel cycle

- SA Royal Commission: looking at all steps in the nuclear fuel cycle
- Australia currently involved in only two: mining and milling
- Conversion, enrichment and fabrication: is an industry viable in Australia?
- Nuclear energy, reprocessing and waste: costs and benefits

Radioactivity and nuclear power

- Fissile nature of uranium
- Emission of radiation by an unstable atom
- Radioactive isotopes and uranium 235
- Enrichment of uranium 235

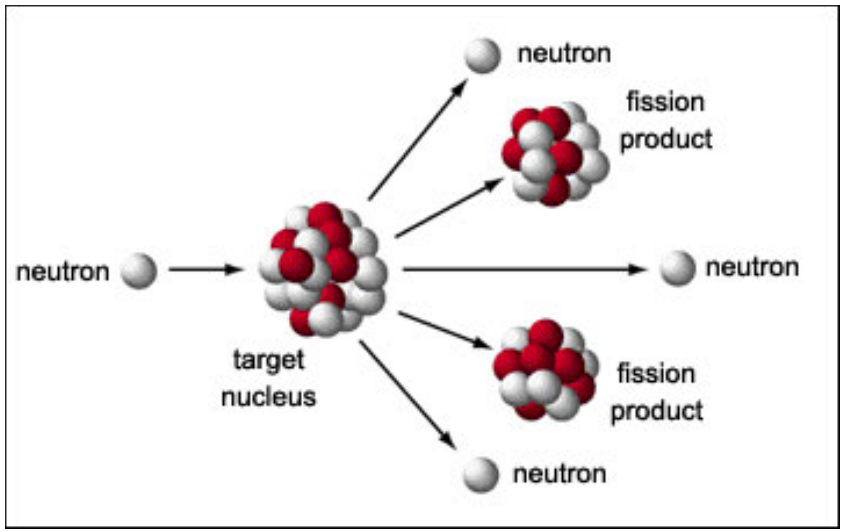
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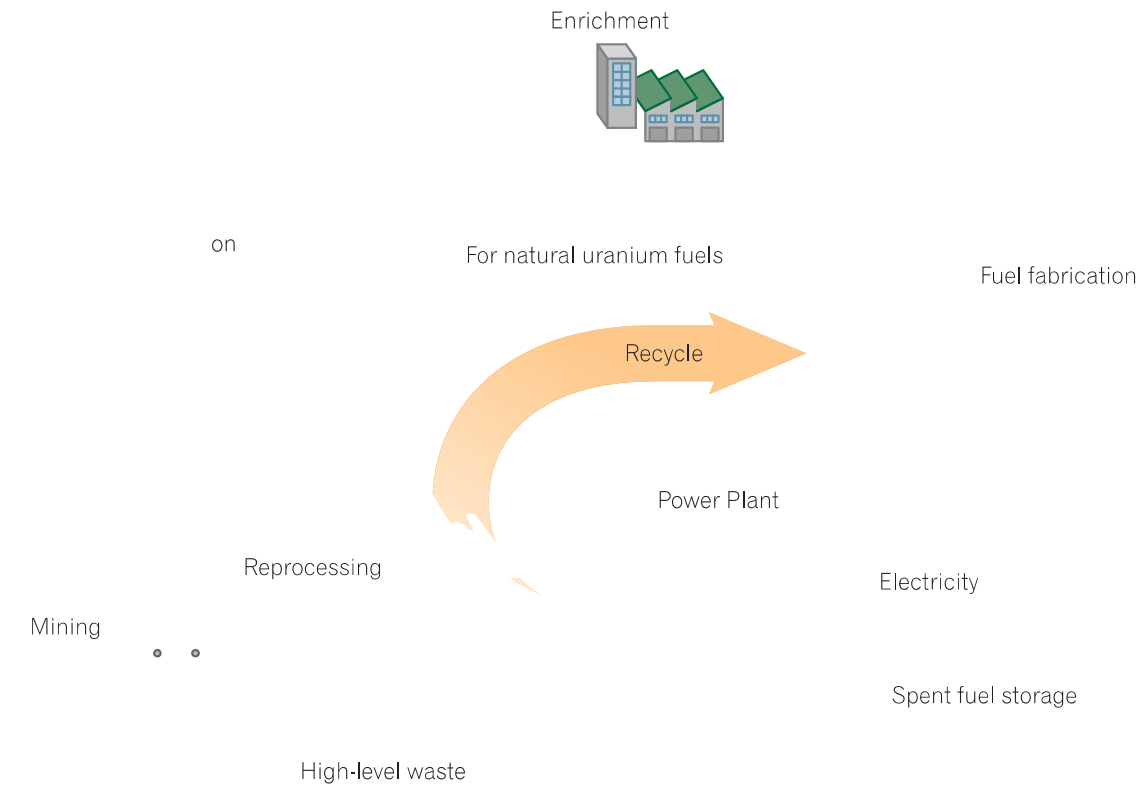
Figure 1.1 Schematic of the nuclear fuel cycle



Mining and milling

- Australia: $573 million exports in 2005
- Olympic Dam (SA), Beverley (SA), and Ranger (NT)
- Conventional mining and in-situ mining
- Possibilities of expansion in Australia?
- Recent news: ERA and the Ranger uranium mine

Fig. 1. Uranium Mines, Deposits & Former Nuclear Test Sites across Australia (see Mudd, 2000a)

Conversion and Enrichment

- ‘Yellowcake’ (uranium oxide, $U_2O_{8)}$ converted in gaseous uranium hexafluoride ($UF_{6)}$
- Tenex, Areva, Cameco and Converdyn supply over 80 per cent of conversion services globally
- Unprofitable in Australia unless connected with enrichment services: transport costs of UF_6 five times greater than natural uranium

Conversion Facility

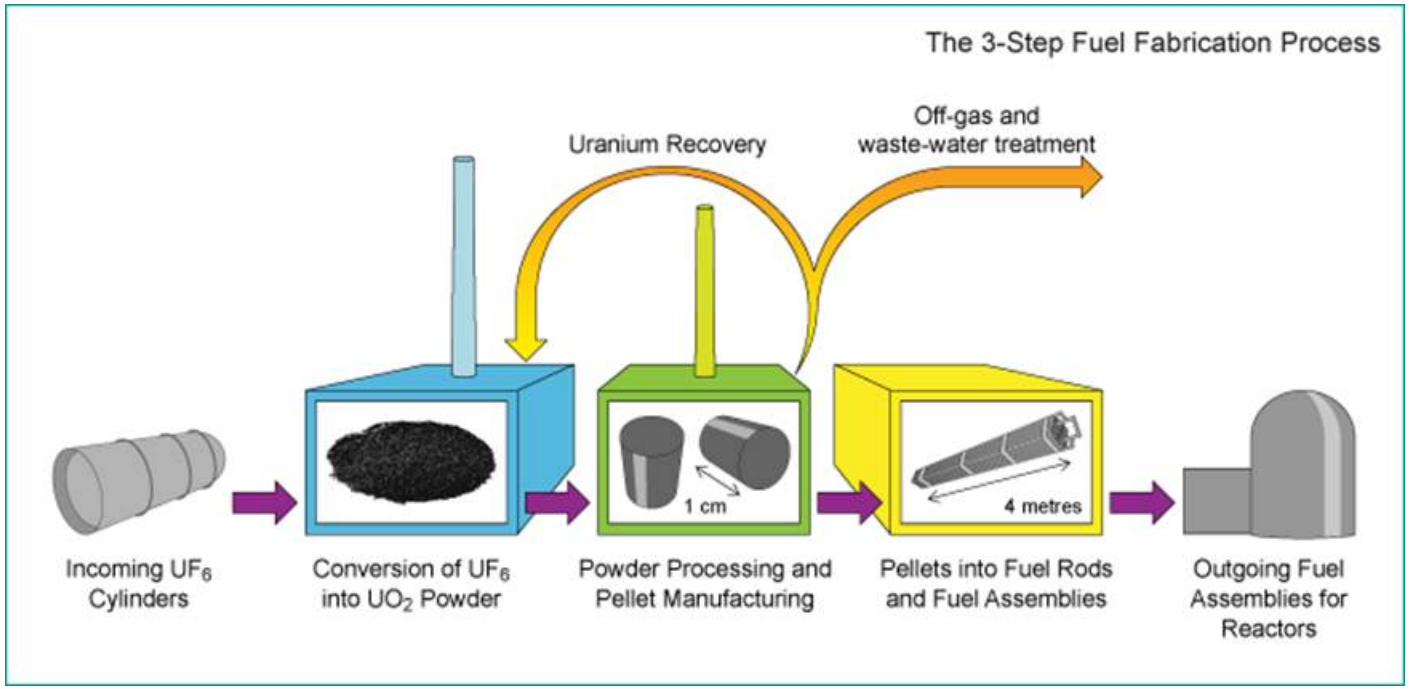
Conversion and enrichment (cont)

- Enrichment: separation of Uranium 235 isotopes from the Uranium 238 isotopes
- Gaseous diffusion or centrifuge
- Most value-adding part of the nuclear fuel cycle
- Also the most monitored: the same technology can be used to enrich to 5% U235 (nuclear power), 20% U235 (research/military), 90% + (weapons grade)
- Modern centrifuge technology is capital intensive ($1 billion + based on 2006 figures), gaseous diffusion is energy intensive (Areva consumes 3-4% of total French electricity)


Paducah, KY

Fabrication

- Enriched uranium made into uranium dioxide fuel pellets
- Pellets inserted into zirconium alloy or stainless steel tubes to form fuel rods
- Rods made into assemblies for reactors: 100+ different varieties of assemblies
- Other manufactured products: apparatuses, medical instruments, medicines, smoke detectors, geophysical tools


The 3-Step Fuel Fabrication Process
Uranium Recovery
Off-gas and
waste-water treatment
1 cm
4 metres
Incoming UF_6
Cylinders
Conversion of UF_6
into UO_2 Powder
Powder Processing and
Pellet Manufacturing
Pellets into Fuel Rods
and Fuel Assemblies
Outgoing Fuel
Assemblies for
Reactors

Nuclear power

- Heat energy created from the fission of uranium atoms
- Steam power cycle to generate electricity
- 438 nuclear power plant units in 31 countries
- Electric net capacity of about 379 GW are in operation
- 67 plants with an installed capacity of 65 GW are under construction in 16 countries
- Australia: Coal (74%), gas (12%) and renewables (14%)

Table 2.2 Nuclear power reactors planned and proposed (on available information)

Country/region	Capacity (MW)	No. reactors	Comments
China	48 800	63	The Chinese Government plans to have 40 GW of additional nuclear capacity by 2020.
Russia	31 200	26	The Russian Government plans to have 40 GW of nuclear capacity by 2030.
United States	26 716	23	The US Government is actively pursuing nuclear power for energy security; expect new reactors to 2020.
Japan	16 045	12	The Japanese Government forecast is to maintain or increase the share of nuclear power in electricity generation (30–40 per cent) beyond 2030.
India	13 160	24	The Nuclear Power Corporation of India plans to have 20 GW by 2020.
Western Europe (other)	12 135	13	Turkey (4500 MW), Romania (1995 MW), Bulgaria (1900 MW), Czech Republic (1900 MW), Lithuania (1000 MW) and Slovakia (840 MW).
Middle East/South Asia (other)	9350	11	Iran (4750 MW), Pakistan (1800 MW), Israel (1200 MW), Armenia (1000 MW) and Egypt (600 MW).
South Korea	8250	7	Seven reactors are planned for existing sites and are expected to be operational by 2015.
Asia (other)	6950	7	Indonesia (4000 MW), Vietnam (2000 MW) and North Korea (950 MW).
North and South America (other)	6245	7	Canada (2000 MW), Mexico (2000 MW), Brazil (1245 MW) and Argentina (1000 MW).
South Africa	4165	25	South Africa is developing pebble bed modular reactor (PBMR) technology. If successful, the plan is to commercialise and build plants in coastal regions.
France	3230	2	–
Eastern Europe other	2200	3	Ukraine (1900 MW) and Kazakhstan (300 MW).
Total	**188 446**	**223**	–

Location for Nuclear power plant

- Primary criteria:
  - proximity to appropriate existing electricity infrastructure
  - proximity to major load centres (i.e. large centres of demand)
  - proximity to transport infrastructure to facilitate the movement of nuclear fuel, waste and other relevant materials
  - access to large quantities of water for cooling

Nuclear waste

- Australian waste: exempt waste, very short-lived waste, very low level waste, low-level waste, and intermediate level waste
- Australia: 3800 m3 of low-level and short-lived intermediate level radioactive waste from over 40 years of research, medical and industrial uses of radioactive materials (size of football field, 1 metre depth)
- Stored at variety of locations around the country
- Commonwealth plans national depository

Regulating the Nuclear Fuel Cycle

- States generally retain constitutional authority to regulate all aspects of the nuclear fuel cycle
- Constrained by conflicting Commonwealth legislation

Procedural Rights of Native Title Holders and Claimants

- Locations of nuclear power plant as compared to a waste repository
- Subdivision K unlikely to apply
- ILUA or compulsory acquisition
- Subdivision M to apply: acts that pass the freehold test, validity subject to Subdivision P (Right to Negotiate)

Procedural Rights of Native Title Holders and Claimants

- Subdivision P, section 26: right to negotiate applies to compulsory acquisitions (s26(1)(c)(iii)
- Two exceptions:
  - Purpose of the acquisition is to confer rights or interests concerned on the Government party (s26(1)(c)(iii)(A)
  - Purpose of the acquisition is to provide an infrastructure facility (s26(1)(c)(iii)(B)

Procedural Rights of Native Title Holders and Claimants

- S26(1)(c)(iii)(A): where government seeks to confer interests on third party
- *South Australia v Slipper* (2004) 136 FCR 259
- Different in circumstances where joint-venture/public-private venture for public purpose of energy generation?

Procedural Rights of Native Title Holders and Claimants

- S26(1)(c)(iii)(B): includes roads, railways, bridges and other transport facilities, jetties and ports, and storage, distribution or gathering or other transmission facilities for oil or gas, or derivative of oil and gas, and dams pipelines and channels and electricity generation and distribution
- *McKenzie v Minister for Lands* [2011] WASC 335
- In McKenzie, Government party did not consider 'gas processing plant' was an infrastructure facility; roads and pipelines were

Procedural Rights of Native Title Holders and Claimants

- If s26(1)(c)(iii)(A) or (B) applies
- Rights equivalent to that which they would hold if they instead held ordinary freehold under the relevant compulsory acquisition legislation by virtue of section 24MD(6) and (6A) of the NTA
- Relevance of rights under State/Territory/Commonwealth acquisition legislation

Compulsory Acquisition in the States and Territories

- NT: ‘any purpose whatsoever’ and objection
- QLD: objection to the constructing authority
- Victoria/NSW/SA: no objection process

Questions?

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