The Importance of Uranium Mining:

What’s all the fuss about?

WA School of Mines Graduates Association
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The Importance of Uranium Mining: what’s all the fuss about?

- Mythbusters: 5 things you should know about uranium
- Why uranium……why Australia………why WA?
- Wiluna Uranium Project
- Uranium and WASM
Myth Busting
Mythbusters:

5 Things to know about Uranium

1. Is Uranium safe?
2. What can Uranium be used for?
3. How is it controlled?
4. What are the benefits?
5. Why should WA have a Uranium mine?
Is Uranium safe?

- Heaviest naturally occurring metal
- Only mildly radioactive in natural form
- 3 isotopic forms – U\textsuperscript{238} U\textsuperscript{235} U\textsuperscript{234}
- Uranium ore =
  - U\textsuperscript{238} = 99.3%
  - U\textsuperscript{235} = 0.7% (fissile)
- To convert U ore to nuclear fuel requires multiple processing steps
  - 1 kg U\textsubscript{3}O\textsubscript{8} = 20,000 t black coal
- Sufficient energy to power an average household for 25 years
Is Uranium safe?

Everyone is exposed to background radiation all the time:

- Rocks, soils, food, air
- Medical imaging
- Even flying!

![Annual Average Dose (mSv)](image)

- Occupational Limit
- Courier Aircrew
- Longhall Aircrew
- Shorthaul Aircrew
- Med (Therapy)
- Med (Nuc)
- Med (Diag)
- U Mill (Surface)
- U Mine (Underground)

DANGEROUS TO HEALTH (Short Term)
High Dose
Moderate Dose
Low Dose
SAFE BUT NEEDS CONTROL
Very Low Dose
SAFE FOR EVERYONE
What can uranium be used for?

Uranium Mining & Milling

Conversion

Enrichment

Fuel Fabrication

Power Generation

Spent Fuel

\( \text{U}_3\text{O}_8 \)
sold to utilities and traders

\( \text{UF}_6 \)
to enable isotopes to be separated

Low enriched \( \text{UF}_6 \)

\( \text{UO}_2 \)
Fuel Rods

BWR
PWR
LWR
Gen III
Gen IV

Spent Fuel

Reprocessing

Depleted \( \text{UF}_6 \)

“Tails”

High level spent fuel product from the electricity consumption of one person’s lifetime.
Australian Government agencies have legislative responsibility to issue various approvals and permits:

**ASNO**
- Overall responsibility and administers Australian compliance with NPT & AP by issuing
  - Permit to Possess Nuclear Material (PN)
  - Permit to Transport Nuclear Material (TN)

**AMSA**
- As the Competent Authority for shipping of Dangerous Goods
  - Verification and approval of container packing methods

**DRET**
- Controls the export of Prohibited Materials such as UOC through:
  - Export permit for nuclear material (usually 10 years)
  - Confirmation of customer countries
  - Approval of individual contracts
  - Project’s compliance with environmental approvals

**Dept of Mines and Petroleum, WA Radiological Council, Fire & Emergency Services**
- Approval of the Transport Plan and incident response for radioactive substances

**SA - Dept of Premier & Cabinet, NT - WorkSafe NT**
- Lodgement of a Transport Plan covering Radioactive Substances endorsed as a Cabinet document
What are the benefits?

Coal produces more than 1 million times the waste (by weight of final product).

High level spent fuel product from the electricity consumption of one person’s lifetime would be encapsulated in a vitrified glass disc of this size.
Why should WA have a Uranium mine?

- Australia has over 30% of the world’s uranium resources but supplies under 12% of world supply

- 28% of world population consumes 77% world energy production

- WA has abundant resources that could help counter climate change effects when combined with renewables
Global Uranium Production

Uranium production by country - tonnes

- Other
- Uzbekistan
- USA
- Russia
- Malawi
- Namibia
- Niger
- Australia
- Canada
- Kazakhstan

Years: 2002 to 2012

Units: Tonnes
Global Uranium Demand

Reference Case Capacity
Net GWe (2013 to 2030)

<table>
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<tr>
<th>Region</th>
<th>2013</th>
<th>2030</th>
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<tr>
<td>US &amp; Canada</td>
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<td>121</td>
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<tr>
<td>Middle East</td>
<td>4</td>
<td>18</td>
</tr>
</tbody>
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US & Canada: 117 (2013) to 121 (2030)
Europe: 126 (2013) to 120 (2030)
Russia: 24 (2013) to 45 (2030)
China: 20 (2013) to 128 (2030)
Asia: 30 (2013) to 86 (2030)
Middle East: 4 (2013) to 18 (2030)
Supply/Demand Forecast

Source: WNA 2013
Wiluna Uranium Mine

The town of Wiluna has supported mining for over 100 years

- Wiluna is located ~950km north-west of Perth
- Commercial aircraft fly regularly
- Access by sealed highways
- 6 surficial deposits calcrete-hosted carnotite mineralisation

- Carbonate leach process, $315M capex
- 1.3Mtpa throughput, 2 mlb per annum production
- 350 construction 170 operations employees
- Up to 25 year mine life
Core Farm at Wiluna
What research is needed to support the emerging industry?

- **Geology:**
  - new technologies to look beneath regolith
  - new technologies to determine grade control

- **Processing:**
  - beneficiation technologies for distant deposits
  - improvement in recovery/efficiency for carbonate leach

- **Environmental:**
  - improved understanding of rehabilitation in harsh arid/semi-arid climates
  - Rehabilitation of overgrazed semi-arid country
  - *Tecticornia* spp research
Graduates?

- Mining
- Engineering – chemical, metallurgy, process
- Geology
- Environment
- Radiation
- Accounts, finance, markets, community etc
Nuclear power in Australia? In WA?

☒ Barriers to Entry:

- Well established national market
- Small population base
- Low energy-intensive manufacturing base
- High capital cost for nuclear new build

☑ Opportunities for Entry:

- Significant resources available for domestic use
- Small Modular Reactors design
The Importance of Uranium

**URANIUM ~ what’s all the fuss?**

- SAFE – Yes
- USED for Power
- CONTROLLED by national and international regulators
- BENEFITS – Clean Energy
- WHY WA – close to market, large resource base
The Importance of Uranium

**WHY WA and Wiluna?**

- Close to growing markets
- Approved, ready to meet emerging supply gap
- Independent, uncontracted uranium supply
- Mining friendly jurisdiction, Wiluna = zero emission site
- New industry capable of creating new jobs
Contact

Dr Vanessa Guthrie
Managing Director

Toro Energy Limited
L3 33 Richardson St
WEST PERTH WA 6005
Telephone: +61 8 9214 2100

Email: info@toroenergy.com.au
Website: www.toroenergy.com.au