Are Special Safety Measures Required for Uranium?

Nick Tsurikov

CALYTRIX
CONSULTING PTY LTD

Radioactivity:

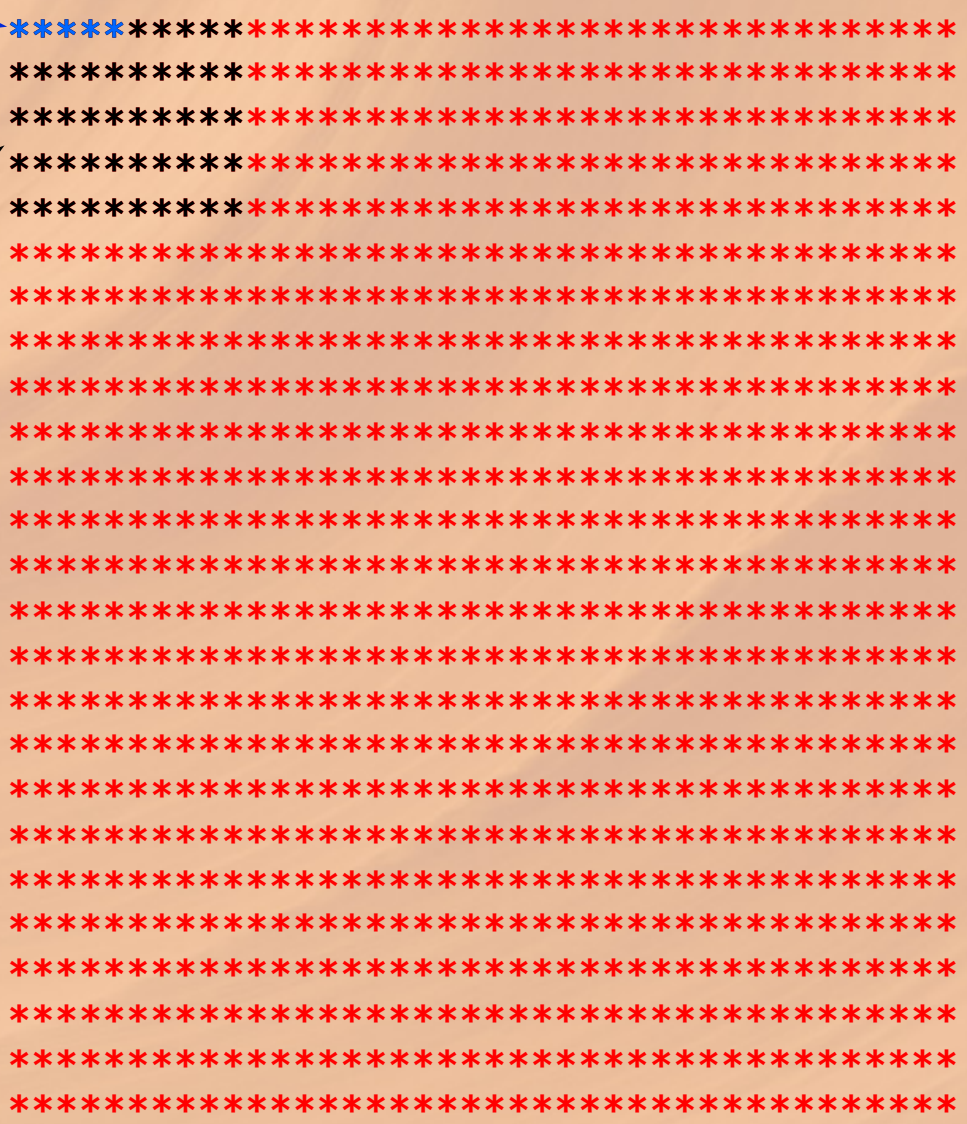
1. What is so special about radiation?
2. How dangerous is it?
3. Where is it?

1. What is so special about radiation?

- ***Human senses cannot detect it***
- ***Historical association with nuclear activities***
- ***Most importantly:***
  It is impossible to determine if there is an exposure level below which there is no effect

2. So, how dangerous is it then…?

And this is the typical radiation dose that a worker could receive at a uranium mine (5 mSv/year)



This is the radiation exposure limit in one year (50 mSv)

This amount of radiation (1000 mSv) may cause you serious harm

2. How dangerous is radiation?

← Many different opinions…

- Radiation protection professionals
- Potentially affected workers
- Members of the general public
- The Government
- The Industry
- Scientific Institutions
- Environmental groups
- The media

Illustration →

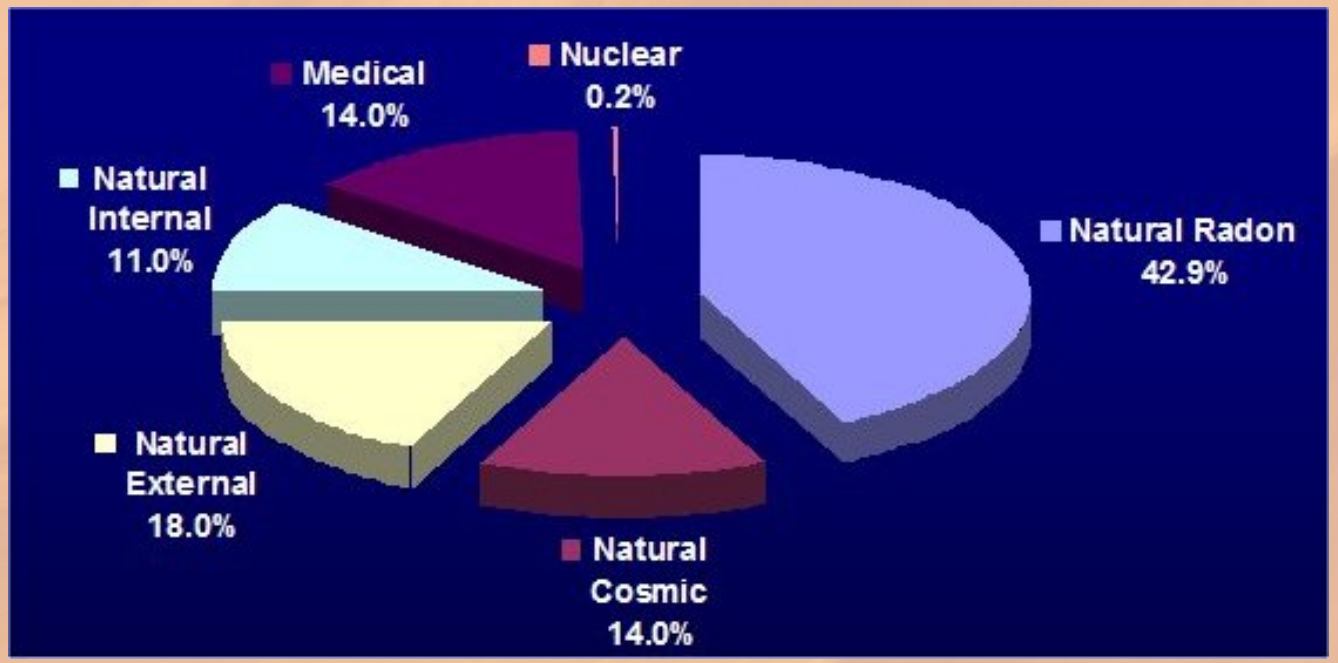
2009 Safety and Health Conference

'Raising the Bar'

9-10 March 2009
Hyatt Regency Perth

3. Is the radiation only exists around uranium?

Natural radiation is the greatest source of human exposure:



We are all exposed to radiation (average annual dose = 2.0 – 2.4 mSv):

- Cosmic rays from space
- Gamma rays from soil and building materials
- Radon gas emitted from soil and rock (buildings, tunnels, cellars, etc)
- Higher exposure at higher altitudes
- Traces of radioactive materials in food and drink

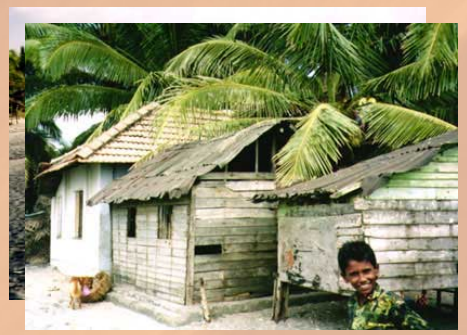
There are some areas in the world (Brazil, India, China), where the 'background' radiation exposure can be much higher, between 10 and 200 mSv per year.

Exposure to natural radiation varies widely, from 2-3 mSv/year in Australia to about 35 mSv/year in certain areas of Iran, China and Brazil.

Ramsar, Iran

Radiation doses may reach 50 mSv/year

Kerala, India



Houses built on “black” beaches, containing monazite
Radiation dose ~ 17 mSv/year

Guarapari, Brazil

“Radioactive” beaches in Brazil
Radiation dose ~ 35 mSv/year

Yangjiang, China

Bricks are made of clay containing radium
Radiation dose ~ 10 mSv/year

3. Is the radiation only exists around uranium?

If we take a typical gamma radiation level per hour in Western Australia as **1**, the following comparative values can be derived:

1 – natural background in Western Australia
3 – typical for an exploration site with U mineralisation of 0.05 – 0.06% (Lake Maitland, Centipede)
4 – natural background in some areas of Perth Hills
4 – some cement
5 – typical for an exploration site with U mineralisation of 0.10% (Lake Way)
5 – certain phosphate fertilisers
6 – some ceramic tiles
7 – typical for an exploration site with U mineralisation of 0.14 – 0.15% (Mulga Rock, Yeelirrie)
7 – coal burning slag
10 – on board of a local WA flight
14 – a phosphate mine
16 – titanium minerals
20 – typical for an exploration site with U mineralisation of 0.40% (Kintyre)
22 – zirconium minerals
25 – geothermal energy generation waste
30 – water treatment sludge
40 – heavy mineral sands concentrate
60 – on board of an international flight
80 – tin concentrate
120 – uranium mine/processing plant
250 – rare earth processing plant
400 – coal mine (underground water discharge points on the surface)
500 – some areas of titanium dioxide pigment plant
1000 – contaminated equipment from oil and gas industry
2500 – rare earth mineral (monazite)

Radiation is only one of many hazards at a mine site and should be treated as a part of an overall occupational health and safety program

Other parts of health and safety that require specific attention and should be addressed simultaneously:

- Noise and vibration
- Ventilation
- Working at heights
- High voltage electricity
- Heat stress
- etc.

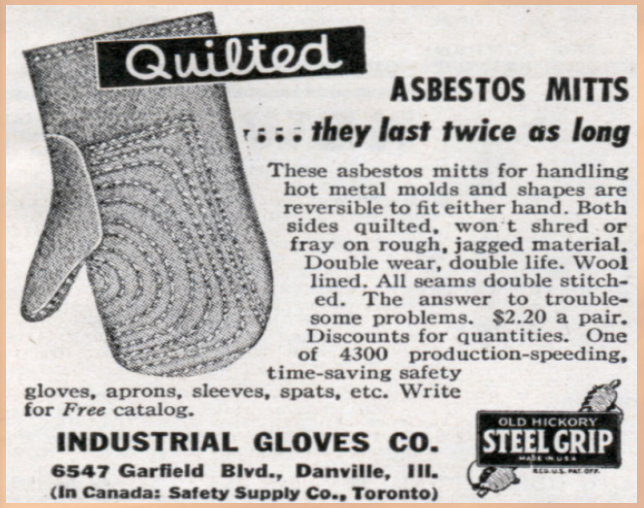
Radiation protection principles:

Due to the scientific uncertainty in regard to the effects of low level radiation, the main principle:

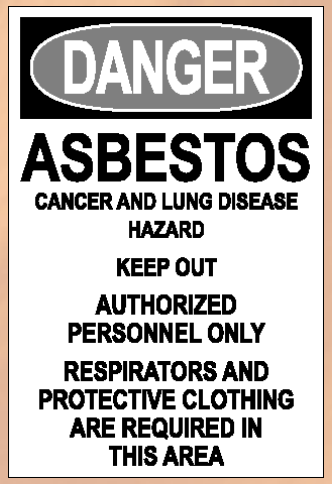
To keep the exposure to radiation
As **L**ow **A**s **R**easonably **A**chievable (ALARA),
social and economic factors taken into account

Some relatively recent examples:

1946



2009



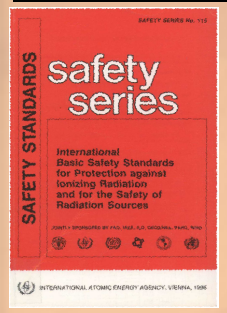
1947

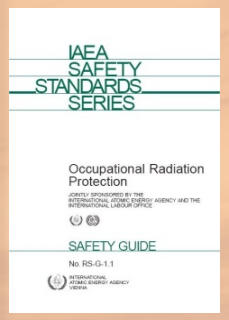
2009

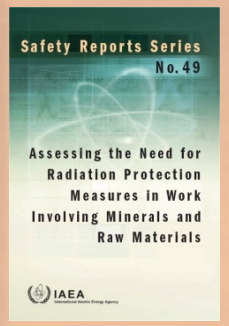
1953

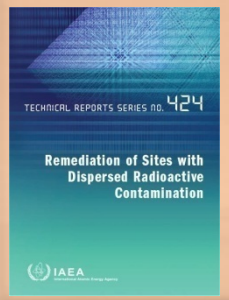
2008

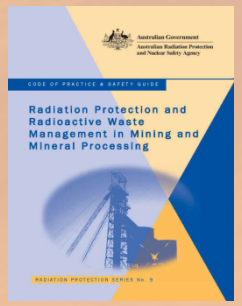
How does the system of radiation protection work?

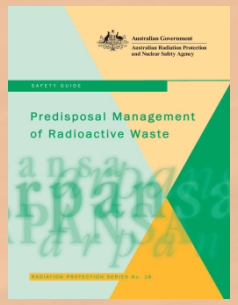










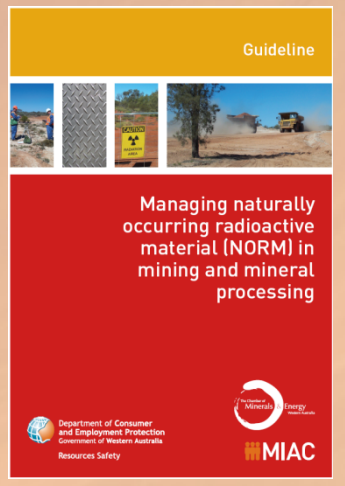


Western Australia

Radiation Safety (General) Regulations 1983

Radiation Safety (Transport of Radioactive Substances) Regulations 2002

Mines Safety and Inspection Regulations 1995



WA Guidelines:

Most important and complex:

→ Avoiding over-regulation whilst complying with latest national and international recommendations

- Set performance standards in the form of radiation exposure and 'release/clearance' limits and leave it to the industry to develop systems to meet these standards in specific circumstances.

  WA 2008 Guidelines were developed with active participation of the members of 'Radiation Protection Industry Group' of the Chamber of Minerals and Energy of WA

- The industry systems must be the subject to the approval by an Appropriate Authority and commonly accepted procedures on, for example, dose calculations should be developed.

  WA 2008 Guidelines were jointly developed by the industry and the WA Government, and are currently undergoing small adjustments to ensure full applicability to uranium exploration and mining

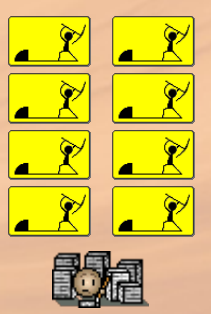
  The main reason for cooperation:

  If industry is provided with detailed and compulsory specifications on how to meet the performance standards, the system of radiation protection would degenerate into a continuing effort to comply with ever more complicated regulations, procedures and guidelines – completely losing sight of the basic goal of safe operation.

Illustration →

Current situation

INDUSTRY



GOVERNMENT

PUBLIC

Possible outcome

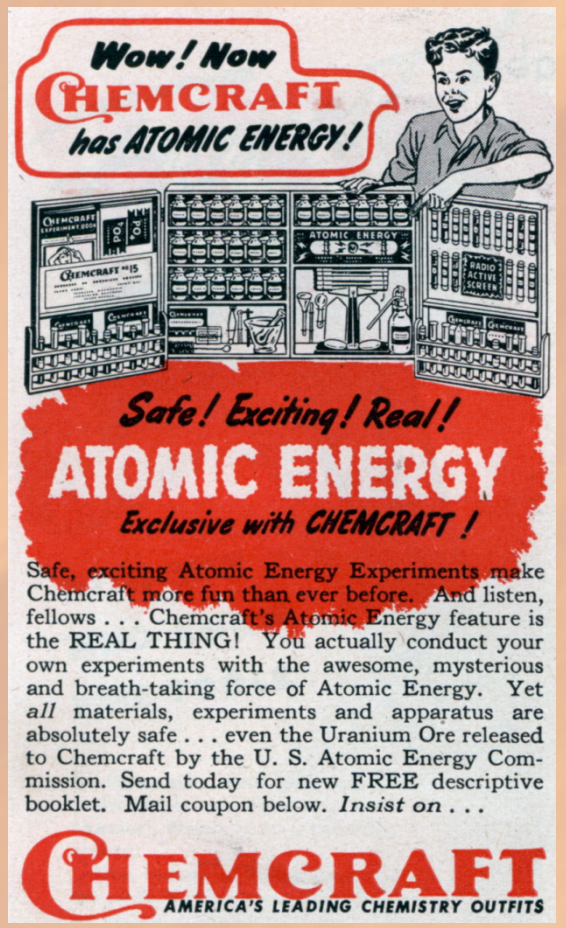
INDUSTRY

GOVERNMENT

PUBLIC

It is also very important for the industry and the government to ensure that the following does not happen in Western Australia with uranium mining:

Issues of importance – 1. QUALIFIED PERSONNEL & APPROPRIATE EQUIPMENT



No person should be employed as a Radiation Safety Officer and no 'contract' person, consultant or a company should be engaged unless it is clearly demonstrated that their qualifications and experience are relevant and sufficient to carry out the tasks *in the mining and mineral processing industry* to the standard required *in Western Australia*.

Training courses (particularly for radiation safety personnel) must be government–approved, and all monitoring must be undertaken in accordance with all relevant Australian Standards and using properly calibrated equipment – to guarantee that the results of this monitoring are technically and legally valid and, therefore, acceptable for the purpose of statutory reporting.

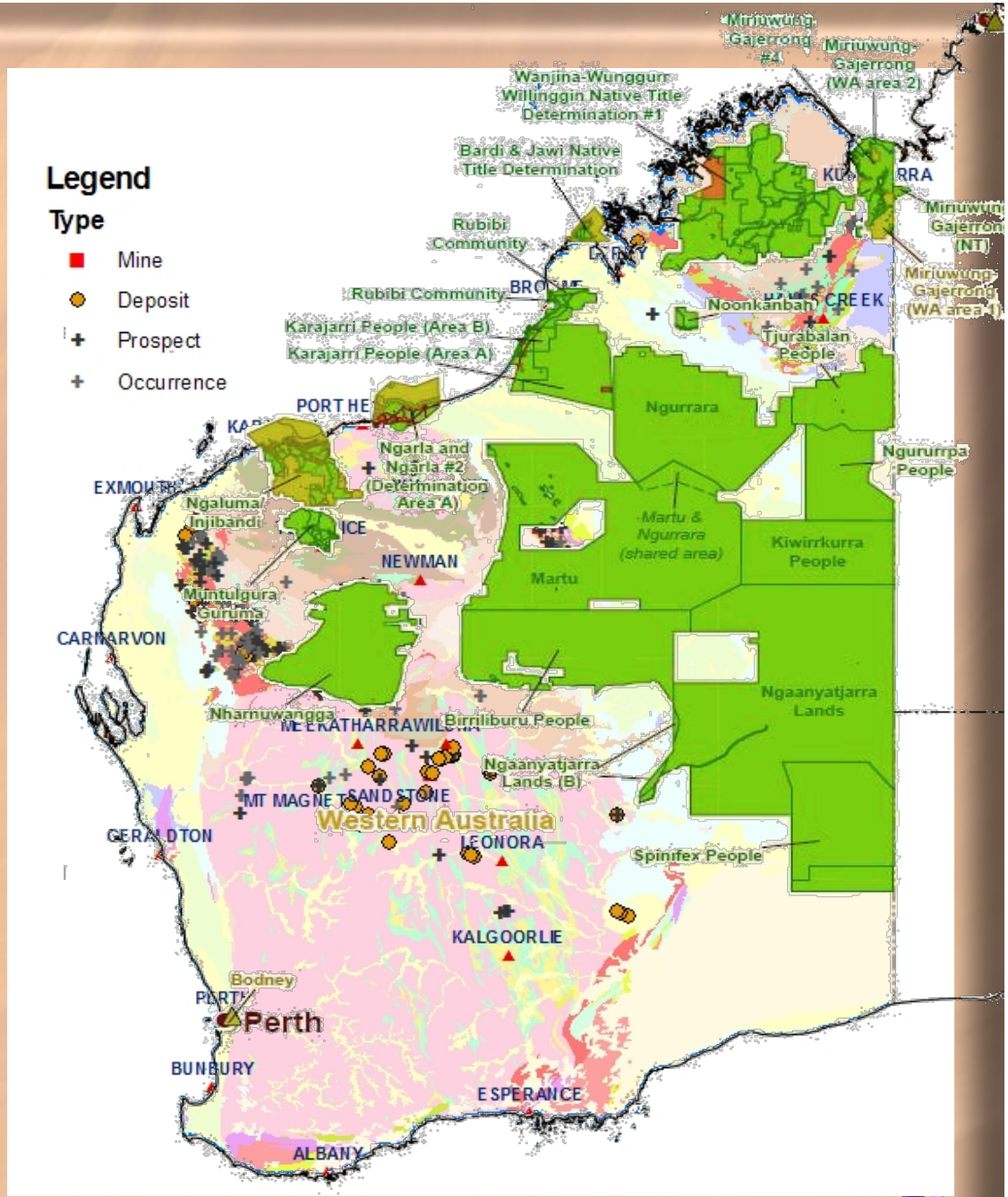
Issues of importance
2. NATIVE TITLE

International Atomic Energy Agency, 1999:
Aboriginal groups are in some countries an integral part of dynamic ecosystems, for whom to separate 'man' from 'nature' is a convention with little meaning when dealing with environmental impact.

The assessment of the impact of uranium mining and exploration needs to take this into account.

Having particular regard to Aboriginal practices and lifestyle, the exposure to radiation may be a result of not only direct pathways of radiation exposure such as external gamma-radiation, inhalation of dust/radon, and ingestion of drinking water, but also several indirect ones, such as:

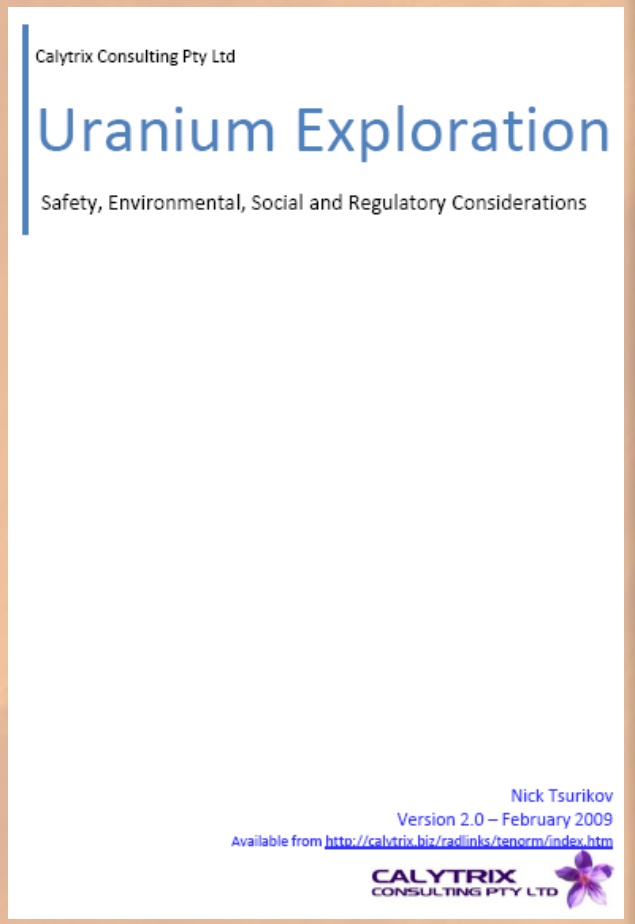
1.Ingestion of potentially contaminated flora (both surface and aquatic),
2.Ingestion of potentially contaminated fauna (both surface, air and aquatic),
3.Incidental ingestion of dust and soil (particularly for children).



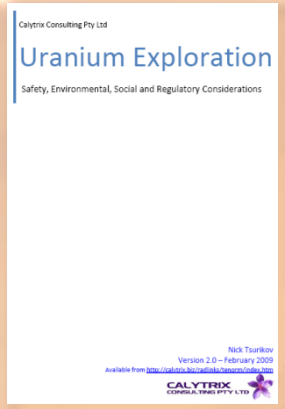
All issues relevant to uranium exploration and subsequent mining in Western Australia have been summarised in the following document:

The report:

- Provides background information on uranium and radioactivity, possible pathways of radiation exposure, and methods of radiation measurements;
- Explains the current scientific uncertainty in regard to the effects of low level radiation;
- Describes the stages of mineral exploration, drilling techniques and methods for the minimisation of the generation of dust;
- Details the general legislative framework of radiation protection and its applicability to the exploration of uranium;
- Examines the possible effects of uranium exploration on human health and the environment, and the applicability of the WA Contaminated Sites Act 2003;
- Provides comments on the relationship between exploration and mining companies and members of the general public, particularly the Aboriginal population,
- Analyses the legal requirements for an exploration/mining company to successfully demonstrate the statutory compliance in regard to uranium exploration in Western Australia.



Available at http://calytrix.biz/



Conclusions:

Uranium exploration and subsequent mining are acceptable activities, provided that:

- Each exploration and mining company complies in full with the standards of radiation protection and relevant guidance documents – both in regards to the protection of human health and the protection of the environment. No special exemptions should be available to exploration and mining companies from any State or Federal Law or Regulation.
  It should be noted that the word 'acceptable' must not be misinterpreted and does not imply in any way that, in contrast with other branches of mining and mineral processing industry, should one uranium exploration company fail to meet any obligation, the whole uranium industry would become 'unacceptable'.

- Effective control over the management of radiation protection at exploration and mining sites is exercised by the relevant government departments.

- A system of inspections and monitoring of uranium exploration sites (and, in the future, mining sites) is introduced as soon as possible. It is suggested that the system be based on the model used in the Australia's Northern Territory where such inspections are carried out with the involvement of both representatives from government departments and representatives of the interests of Traditional Owners; with appropriate modifications to reflect the differences between NT and WA regulatory systems.

- Education programs dealing with uranium exploration and mining and aimed at the general public (both in population centres and in remote areas) are developed and presented jointly by the industry, government and non-government organisations. It is noted that a high degree of cooperation between all stakeholders will be required for any education program to succeed.