

Are Special Safety Measures Required for Uranium?

Nick Tsurikov



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 →

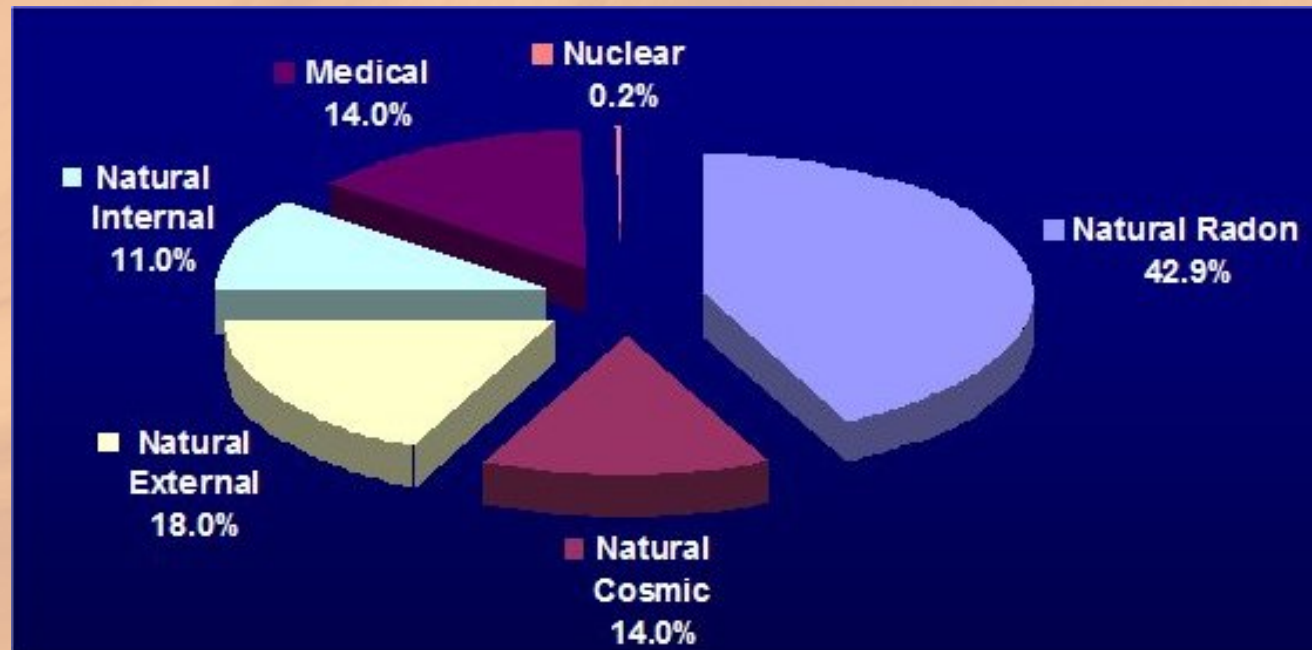


2009 Safety
and Health
Conference
'Raising the Bar'
9-10 March 2009
Hyatt Regency Perth



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.



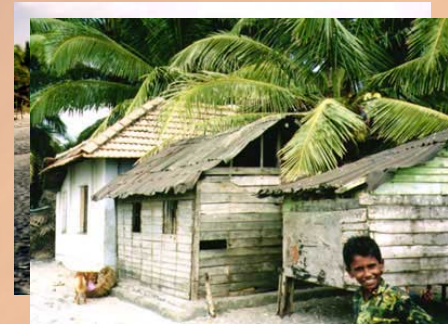
Exposure to natural radiation varies widely, from 2-3 mSv/year in Australia to about 35 mSv/year in certain areas of Iran, China and Brazil.

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 Low As Reasonably Achievable (ALARA),
social and economic factors taken into account



Some relatively recent examples:

1946



Quilted
ASBESTOS MITTS
... they last twice as long

These asbestos mitts for handling hot metal molds and shapes are reversible to fit either hand. Both sides quilted, won't shred or fray on rough, jagged material. Double wear, double life. Wool lined. All seams double stitched. The answer to troublesome problems. \$2.20 a pair. Discounts for quantities. One of 4300 production-speeding, time-saving safety gloves, aprons, sleeves, spats, etc. Write for Free catalog.

INDUSTRIAL GLOVES CO.
6547 Garfield Blvd., Danville, Ill.
(In Canada: Safety Supply Co., Toronto)

OLD HICKORY STEEL GRIP
MADE IN U.S.A.

1947

113,597 DOCTORS FROM COAST TO COAST WERE ASKED:



Family doctors, surgeons, nose and throat specialists . . . doctors in every branch of medicine were asked: "What cigarette do you smoke?"

Three nationally known independent research groups did the asking.

The answers came in by the thousands. Actual statements from doctors themselves. The results? Camels . . . convincingly!

According to this recent Nationwide survey:

MORE DOCTORS SMOKE CAMELS THAN ANY OTHER CIGARETTE!

R. J. Reynolds Tobacco Co., Winston-Salem, N. C.

2009

DANGER

ASBESTOS
CANCER AND LUNG DISEASE HAZARD

KEEP OUT
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

2009

BENSON & HEDGES
GOLD

Smoking kills

1953




Promise of a golden future

Yellow uranium ore from the Colorado Plateau is helping to bring atomic wonders to you

2008

CAUTION



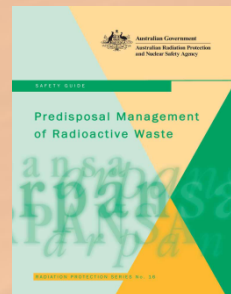
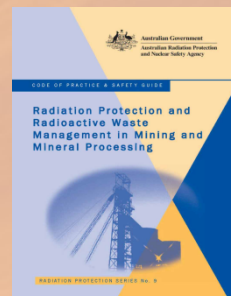
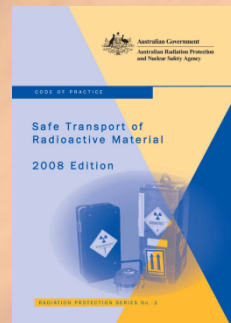
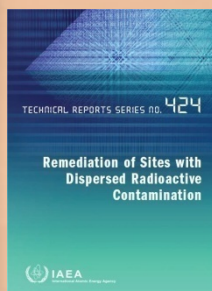
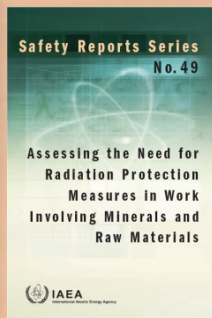
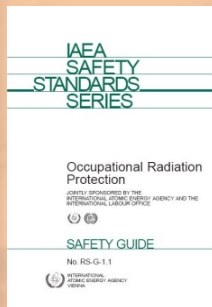
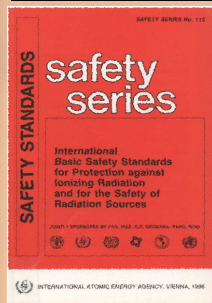
RADIATION AREA

RADIATION LEVELS IN THIS AREA ARE ELEVATED DUE TO URANIUM MINING. A MAXIMUM OF ONE DAY SHOULD BE SPENT IN THE AREA. WATER IN THE VICINITY IS HIGHLY CONTAMINATED AND SHOULD NOT BE INGESTED.

NO CAMPING
DO NOT DRINK THE WATER



How does the system of radiation protection work?

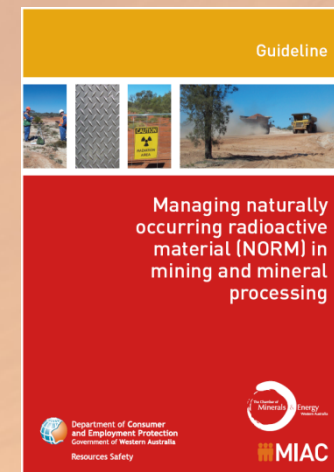


Western Australia

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

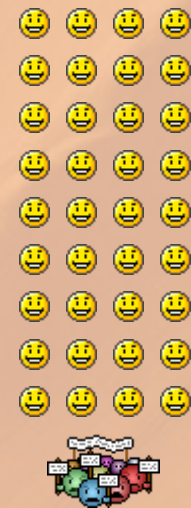
INDUSTRY



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



BUILD A URANIUM LOCATOR!
(GEIGER COUNTER)

GOVERNMENT NEEDS URANIUM!
Valuable undiscovered deposits may be at your finger tips! Find them with a Geiger Counter. Send \$1.00 for Big How-To-Build Plan . . . Describes easy, inexpensive construction and operation. No technical experience needed. This little locator may show you the way to wealth. Uranium and other needed metals are being discovered daily!

Send \$1.00 Today For Your Big Plan!
LEJAY MANUFACTURING CO.
247 LeJay Bldg., Minneapolis 8, Minnesota

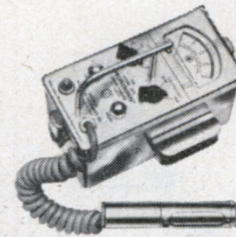



Here's your chance to "cash in!" Over \$3,750,000 in Government Bonuses have been paid for URANIUM discoveries in the past 2 years. Currently \$175,000 a month is paid to people like you.

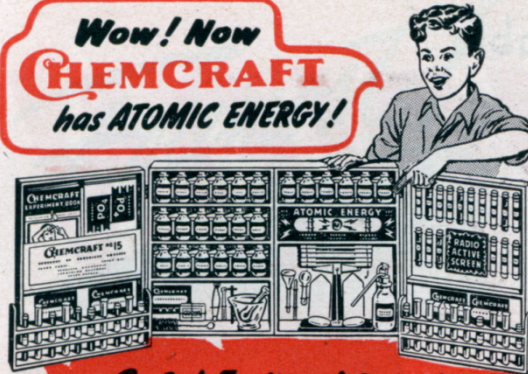
Precision Geiger Counters and Scintillators are the finest instruments made for URANIUM prospecting. These highly sensitive instruments are compact, lightweight and ruggedly built for field use. Prices start at \$29.95.

CONTACT YOUR NEAREST DEALER
or write direct to factory for
FREE 12-PAGE CATALOG and
our 24-PAGE BOOKLET with
"64 QUESTIONS AND ANSWERS
ON GEIGER COUNTERS
AND SCINTILLATORS."

PROSPECTORS
RELY ON . . .



Wow! Now CHEMCRAFT has ATOMIC ENERGY!



Safe! Exciting! Real!
ATOMIC ENERGY
Exclusive with CHEMCRAFT!

Safe, exciting Atomic Energy Experiments make Chemcraft more fun than ever before. And listen, fellows . . . Chemcraft's Atomic Energy feature is the **REAL THING!** You actually conduct your own experiments with the awesome, mysterious and breath-taking force of Atomic Energy. Yet *all* materials, experiments and apparatus are absolutely safe . . . even the Uranium Ore released to Chemcraft by the U. S. Atomic Energy Commission. Send today for new **FREE** descriptive booklet. Mail coupon below. *Insist on . . .*

CHEMCRAFT
AMERICA'S LEADING CHEMISTRY OUTFITS

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

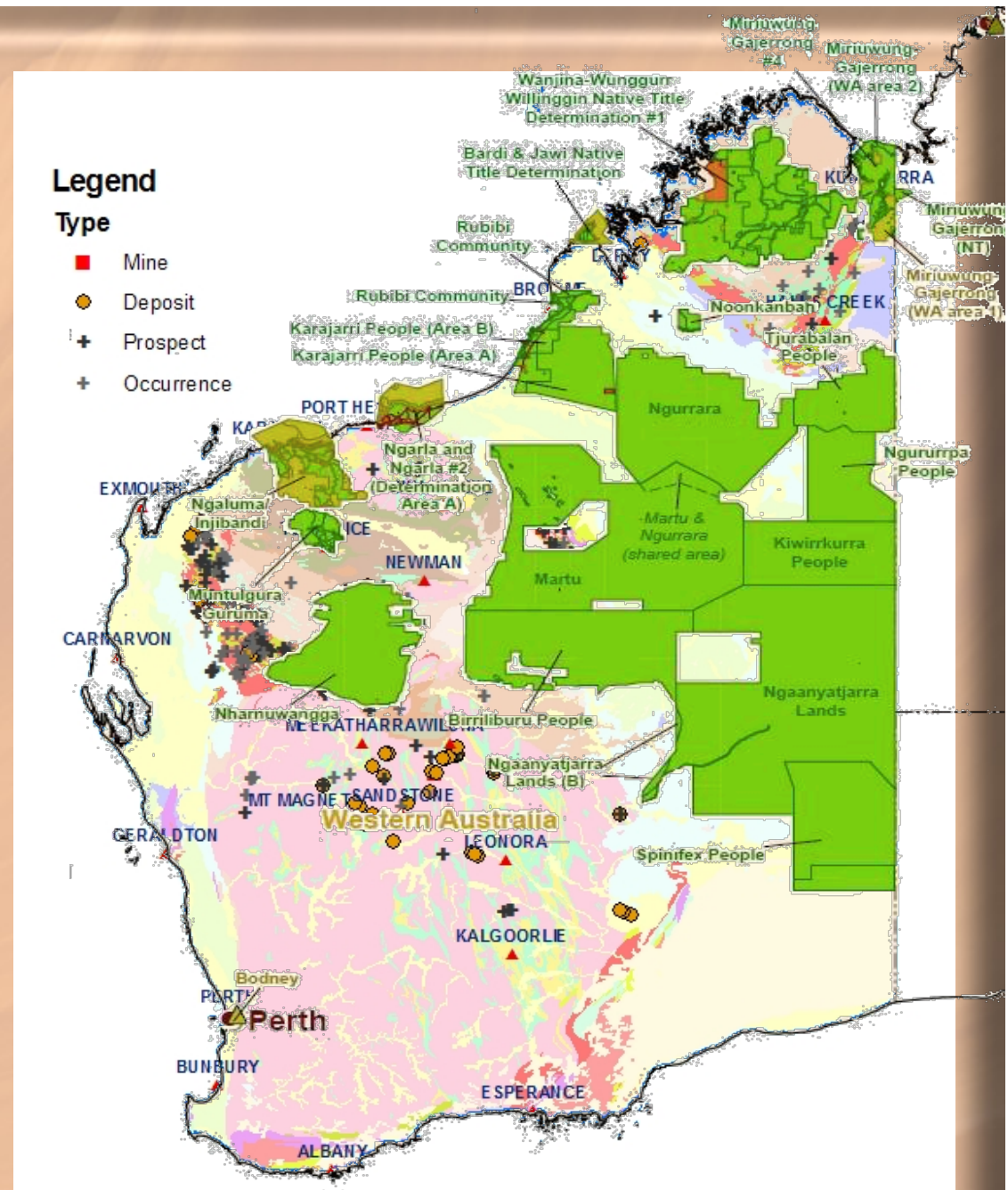
2. NATIVE TITLE

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.

Calytrix Consulting Pty Ltd

Uranium Exploration

Safety, Environmental, Social and Regulatory Considerations

Nick Tsurikov

Version 2.0 – February 2009

Available from <http://calytrix.biz/radlinks/tenorm/index.htm>

CALYTRIX
CONSULTING PTY LTD



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.

