VHM Limited

Naturally Occurring Radiation and Mineral Sands

What is radiation?

Radiation is energy emitted or transmitted as waves or particles travelling through space. Naturally occurring and all around us, radiation can also be man-made and comes in many forms including light, heat, microwaves, and wireless communication.

Understanding radiation exposure

Radiation cannot be fully eliminated from the environment. Carbon-14 is radioactive and is found in all living organisms. Plants absorb carbon dioxide from the atmosphere and animals eat plants.

This means all living things have radioactive carbon-14 in them.

However, by having a good understanding of radiation and how to control our exposure, we can reduce our risk.

Radiation can seem scary because you cannot see it or feel it (although you can feel sunburn), even though it is all around us – but it is easy to measure with a Geiger counter or scintillometer.

Exposure to radiation is reported as a dose, in units of millisievert (mSv). The average Australian dose from natural sources is 1.7 mSv per year.

NORM

Naturally Occurring Radioactive Material (NORM) is associated with most, if not all, mineral sands deposits in Australia, including the Goschen Project orebody. NORM is due to the presence of naturally occurring uranium and thorium contained in the grains of orebody sands containing monazite, xenotime, zircon, and some ilmenites.

NORM management at Goschen

Monitoring of background radiation at the Goschen mine site area has been ongoing since 2018. This monitoring will continue throughout the life of the Project. Gamma levels, radon, and radionuclides in dust and groundwater are being measured.

All Australian jurisdictions have uniform annual limits for public and occupational exposure to ionising radiation: 1 mSv for the public and 20 mSv for workers who are occupationally exposed. Occupational exposures in the mining and milling of mineral sands in Australia are low. Data from the Australian mineral sands industry (2000 – 2008) shows average exposures for workers in dry separation plants to range 1.3 – 3.1 mSv (milliseiverts) per year during that period. Exposure to mining operators is much lower (<0.1 mSv per year) due to vehicle shielding, cabin ventilation and lower concentrations of radionuclides in the ore compared with processed materials. (ARPANSA)

In comparison average background radiation exposure in Australia is 1.5 mSv per year from natural sources and currently Australians are exposed to an average of 1.7 mSv per year from medical exposures.

Management of radiation is detailed in the following plans for the Goschen Project and all will require government approval and be monitored by government agencies:

- Radiation Management Plan
- Radiation Environmental Plan
- Radioactive Waste Management Plan
- Transport Management Plan

sourced from our Radiation Impact Assessment poster and this illustration is also on the ARPANSA website - *Ionising radiation and health | ARPANSA*

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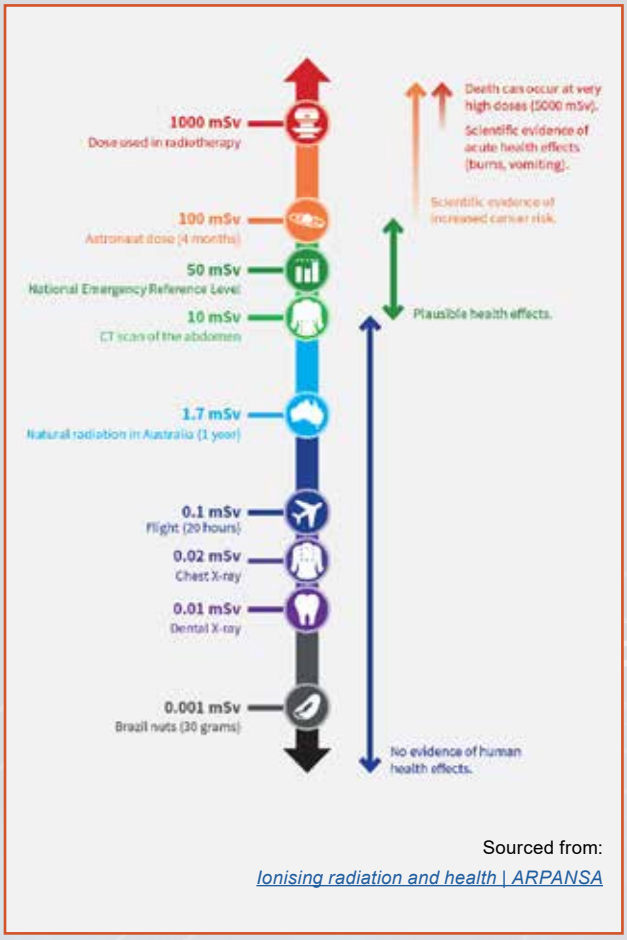
RADIATION FACTS

- Radiation occurs naturally and is all around us in the natural world – in rocks and soil, in the air we breathe, in cosmic rays from the sun, in the food we eat, and in our bodies.
- Naturally-occurring, or background radiation, varies in different places – it largely depends on local geology (uranium and thorium content in soils and rocks).
- Radiation is well understood – it's easily measured and easily controlled.
- Exposure to radiation is reported as a dose, in units of millisievert (mSv). The average Australian dose from natural sources is 1.7 mSv per year. This is about the same amount of radiation received from 75 chest x-rays.
- The effects of radiation have been studied for over a century and reported in scientifically robust publications. The information is continually assessed by the International Commission on Radiological Protection (ICRP) and incorporated into their publications which are used by the International Atomic Energy Agency (IAEA) to produce International Standards and Guidance on radiation protection.
- The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) develops codes, standards, guides and provides advice to support radiation protection and nuclear safety throughout Australia based on ICRP and IAEA documents.
- Victoria manages radiation under the Radiation Act 2005.



Sourced from:
Ionising radiation and health | ARPANSA

Useful references:

- Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) - Home | ARPANSA
- Victorian Department of Health Radiation (health.vic.gov.au)

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