14.1 Existing conditions

The uranium and thorium levels of the mineral sands at the deposits are very low, compared with most mineral sands deposits elsewhere in Australia. Assays of concentrate have given levels for Uranium of 160 - 217 ppm, and for Thorium of 135 - 195 ppm (Radiation Wise Pty Ltd., 2005a and b).

Based on these Uranium and Thorium assays, the mineral sands would not be regarded as 'Radioactive Ores', as defined by the Code of Practice on Radiation Protection in the Mining and Milling of Radioactive Ores (1987), and Matilda has been advised that there is no requirement to obtain approval from the Commonwealth to export the mineral sands concentrate from Andranangoo or Lethbridge.

A radon and gamma survey was conducted on the 12th and 13th of October 2005 by John Waters of On Site Technology Pty Ltd (On Site) at Andranangoo. The objective of this survey was to:

- Establish pre-operational baseline radon measurements, for use as a baseline when comparing against post-operational measurements;
- Facilitate the estimation of probable occupational exposure during the mining and transport of minerals and the disposal of waste materials; and
- Train Matilda staff to implement the atmospheric radon and gamma dose monitoring program.

Initial radon and gamma surveys have not been undertaken at Lethbridge. However the background dose rates at Andranangoo are probably typical of general coastal areas on the island (Waters 2005). Baseline measurements at Lethbridge will be undertaken by Matilda personnel prior to commencement of mining activities at that site.

Survey methodologies and results are presented in Appendix G. A diagram showing the sites surveyed at Andranangoo is presented in Figure 14.1. Samples were taken in the following locations:

- In costeans within the mineralised zones;
- On the soil surface adjacent to the costeans within the mineralised zones
- On the Quaternary strand plain; and
- On the tertiary plateau.

The results for the radon and gamma surveys for Andranangoo are summarised below.

Soil Radon Flux

Soil radon flux at Andranangoo is generally low, ranging from <0.01 to 0.04 $Bq/m^2/s$. There is no statistically significant difference between the radon flux in the costeans, in the surface soil adjacent to the costeans or in the Quaternary strand plain (Waters 2005).

There is a statistically significant difference between the locations on the tertiary plateau and all other locations. There is greater than 95% confidence that the tertiary plateau locations have a higher soil radon flux than at all other locations in the sand plain area. The results (at 95% confidence interval) indicated soil radon flux levels of 0.01 to 0.04 $Bq/m^2/s$ on the plateau, compared with 0.00 to 0.01 $Bq/m^2/s$ in the sand plain area (Waters 2005).

The dominant regional source of radon is the tertiary plateau, irrespective of the mineralisation being exposed or not. It can therefore also be concluded that the proposed mining operation at Andranangoo will not significantly impact on regional or local atmospheric radon levels (Waters 2005).

Gamma Survey

There is no significant difference in gamma measurements between areas that have been identified as mineralised and those identified as non-mineralised. There are some mineralised areas with higher gamma activity (Figure 14.1), however there is little statistical basis to treat these as a separate data sub-set (Waters 2005).

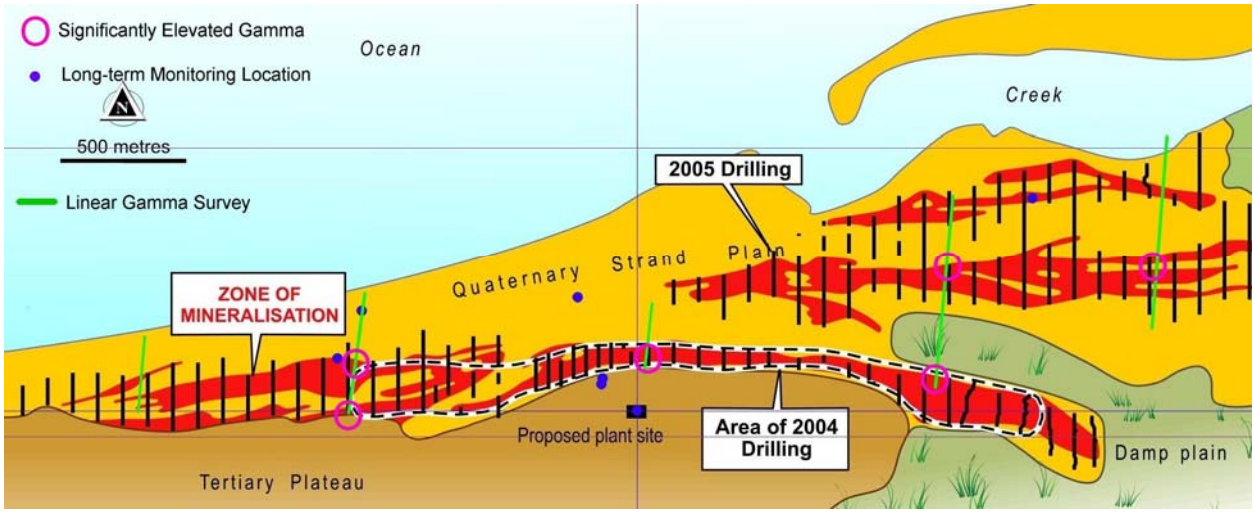

Figure 14.1: Long-term Monitoring Locations and Sites of Elevated Gamma Activity

There is an elevated gamma dose rate (compared to background) in the costeans, where the mineral bearing sand has been exposed. This elevation is also evident at the coast in locations where black sand has been concentrated and exposed by wind and wave action (Waters 2005).

For the local population, permanent habitation of the mineral lease area is considered unlikely, however the background dose rates in the Andranangoo area are probably typical of other coastal areas on the Tiwi Islands. Based on the data for all undisturbed areas of the lease, the average background dose is estimated to be 0.53 mSv per year (95% upper confidence limit 1.4 mSv per year) (Waters 2005).

14.2 Objectives and standards

In the Northern Territory licensing is required under the *Radiation (Safety Control) Act 1999* to mine radioactive ores, excluding Uranium. (Uranium mining is managed under the *Mine Management Act 2001*.)

Based on advise received from the Northern Territory Department of Health and Community Services (DHCS), Matilda will apply for a license to possess, sell and handle radioactive material and appoint a Safety Officer. Conditions of this license are likely to include a requirement for operations to be undertaken in accordance with the Code of Practice for the Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing (2005) which means that a Radiation Management Plan will be required.

Permission is also required from the Commonwealth Department of Industry Tourism and Resources to export Uranium and Thorium. Matilda submitted an application for permission to export the HM concentrate to the Commonwealth Department of Industry, Tourism and Resources and was informed that approval was no longer required under Commonwealth regulations for export of mineral sands, due to their low Uranium and Thorium content.

Matilda has also been advised by WorkSafe NT that licensing is not required under the Northern Territory *Radioactive Ores and Concentrates (Packaging and Transport) Act 2002.*

Matilda has developed a Draft Radiation Management Plan and has commissioned Western Radiation Services to prepare a more detailed Radiation Management Plan that meets Matildas license and regulatory requirements, prior to commencement of operations.

Relevant legislation, standards and policies

The relevant legislation, standards and policy are:

- Matilda's Safety and Health Policy.
- Matilda's Environmental Policy
- *Radiation (Safety Control) Act 1999*
- *Radioactive Ores and Concentrates (Packaging and Transport) Act 2000*
- *Public Health Act 1952*
- *Work Health Act 1986*
- Code of Practice on Radiation Protection in the Mining and Milling of Radioactive Ores 1987
- Code of Practice for the Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing (2005).

14.3 Definition of issues and impacts

It is possible that mineral processing activities may impact on local atmospheric radon levels because of the separation of the Uranium and Thorium-bearing minerals in the processing plant. The possibility of radon build-up in the processing area is considered to be unlikely, because the proposed HM Concentrate Separator will be operated in a well-ventilated open environment.

In addition radon is generally not an environmental or occupational concern in other Australian mineral sand operations, and the Uranium and Thorium levels are low in comparison with typical levels in other mineral sands deposits. However, it is proposed that the radon flux from stockpiled HM concentrate, and in the sand tailings will be measured as part of the operational monitoring program (Waters 2005).

As stated earlier, the concentrate assays indicate that the HM concentrate to be produced at the proposed operation will contain between 160 - 217 ppm Uranium and 135 - 195 ppm Thorium. Based on typical mineral sand industry operations with concentrates having higher Uranium and Thorium content, it is considered unlikely that occupational exposure at the proposed operation will exceed 5 mSv per year for any worker (Waters 2005).

For personnel currently engaged in exploration and other pre-mining activities the occupational dose is estimated to be 0.44 mSv per year (95% upper confidence limit 0.73 mSv per year). This estimate is based on a 2 week on 1 week off roster, with a 12 hour working day and includes a dose rate of 0.06 mSv per hour while working and a 0.09 mSv per hour while at the camp. While these estimated doses are considered occupational because they would not be received except for the working environment, they are comparable to the normal background dose that would be received anywhere in Australia (Waters 2005).

For mining operations, where the mineralised sand will be exposed, the occupational exposure is estimated to be slightly higher with an average of 0.70 mSv per year (95% upper confidence limit 0.96 mSv per year). These estimates are based on the same working regime discussed above and assume the worker spends all working hours in close proximity to the exposed mineral bearing sand (Waters 2005).

The occupational exposure estimates of gamma doses, discussed above, are considered over-estimates because they include exposure while at the mining camp. Even considering this over-estimation, the dose rate received by current employees, and expected to be received by future employees engaged in mining activities, are low compared to the 1 mSv maximum permitted for members of the public. The levels are in fact considered typical of the normal background dose received in Australia (Waters 2005).

14.4 Management

Matilda has developed a Draft Radiation Management Plan and has commissioned Western Radiation Services to prepare a more detailed Radiation Management Plan that meets the requirements of the *Radiation (Safety Control Act)* and appoint a Radiation Safety Officer. Where required it will also

comply with the Code of Practice for the Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing (2005).

The Draft Radiation Management Plan presented in this Draft EIS specifies requirements for monitoring radon gas flux and gamma radiation levels. The monitoring would be undertaken at each stage of the process for the first year, in order to ensure that doses are kept below harmful limits and to provide a baseline for future comparison. After the first year of operation at Andranango, Matilda will evaluate the need to continue the program based on the data gathered. Matilda would also implement the monitoring program at Lethbridge for the entire production period, estimated to be six months.

Matilda has trained staff to implement the gamma and radon monitoring program. Long-term passive gamma monitors were deployed on 12th October 2005 and will be collected for analysis at the end of February 2006. Long-term passive radon monitors will be deployed at the end of October 2005 and will be collected for analysis at the end of February 2006. Both sets of monitors will be replaced in February 2006, with the next set due for collection at the end of May 2006.

The estimated annual gamma dose rates [0.70 mSv per year (95% upper confidence limit 0.96 mSv per year)] are comparable with normal background radiation exposure in the Australian environment. For example, typical backgrounds in Adelaide vary from 0.80 to 1.3 mSv per year. The typical backgrounds in Darwin based on measurements taken on 14th October 2005 range from 0.50 to 1.0 mSv per year.

Under these conditions, the exposure of personnel and members of the public to radon and radon daughters from current operations and proposed mining activity will not be higher than natural exposure in the region (Waters 2005).

14.5 Commitments

Matilda will develop a Radiation Management Plan that meets the requirements of the Radiation (Safety Control Act) 1999 and appoint a Radiation Safety Officer.

Matilda commits to and trained staff to undertake a long term gamma and radon monitoring program in order to ensure that doses are kept below harmful limits and to ascertain baseline data (Section 12.4).