



Summary Report -

Results of monitoring on North Stradbroke Island

3 July 2012

Outcome of Investigation

The results of the investigation do not reveal any evidence to suggest that activities associated with the mining, processing and transport (both to and from the island) of mineral sand on North Stradbroke Island are adversely affecting occupational or public health, from a radiological perspective.

Introduction

The mineral sand mined by Sibelco on North Stradbroke Island contains small amounts of the radioactive elements uranium and thorium. The monazite in the mineral sands is the predominant source of the radioactivity in the sands extracted from the island.

The mineral sand undergoes a separation process resulting in products (ilmenite, rutile, and zircon) with varying concentrations of uranium and thorium. The first part of the separation process is done on North Stradbroke Island and the final separation of the components occurs at the Pinkenba mill.

During processing at the Pinkenba mill, a concentrated material known as “zircon mags” is collected and, due to its elevated levels of radioactivity, this material is classified as a radioactive substance and is regulated under the *Radiation Safety Act 1999*. The zircon mags in addition to other tailings are transported back to North Stradbroke Island by truck.

The Radiation Health Unit, Environmental Health Branch conducted a series of tests and inspections to determine the nature of the mineral sands at certain locations on North Stradbroke Island (both on and off mining leases). These tests and inspections were prompted by the concerns of a citizens group, Stradbroke Island Management Organisation (SIMO), about the safe storage and transport of mineral sands to and from the island.

The types of radiation monitoring activities conducted in and near Dunwich included:

- gamma radiation surveys of some sites known to have been, or suspected of having been, affected by elevated levels of radioactive material
- sampling and radio-assays of stockpiles of mineral sands, material spilled from trucks, and of soil and sand from various locations
- sampling and radio-assays of water from selected locations
- sampling to test for particulates in air.

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The investigations were carried out over a period from September 2008 to November 2010. This report has been prepared so that a summary of findings may be available to the public and is based on the collated data contained in the main internal Queensland Health report of May 2011.

Results

The following is a summary of the investigations and results.

External gamma radiation surveys

An initial walk-over of selected sites of interest to SIMO was conducted in September 2008. Gamma radiation levels were measured at these sites. While some areas of slightly elevated radiation levels were found, they were similar to natural background levels and should therefore be considered safe. The results were consistent with radiation levels measured during previous surveys conducted by the Radiation Health Unit from the late 1980s to the early 1990s - no unexpected radiation levels were found

Gamma radiation levels in the parks at Banksia Street and to the north of the Junner Street jetty were at natural background radiation levels.

Radiation levels were measured at the following locations known to be places where mineral sand residues had been deposited many years ago:

- the park between Ballow Road and Mallon Street
- the forest at the corner of Mallon Street and Mitchell Crescent
- the waste sand piles north-east of the Dunwich water treatment plant.

Though the radiation levels at these locations were slightly elevated above natural background, the levels are still low and therefore considered safe.

Sand / soil sampling

The naturally occurring sand on North Stradbroke Island from which minerals are extracted contains uranium and thorium at concentrations that are at the lower end of the range of typical worldwide levels of these radionuclides in soil. Separation of the heavy mineral sands from the original natural sand results in products or tailings that have increased concentrations of these radionuclides.

Samples collected were of two types:

- mineral sands from various stages in the processing cycle (including naturally occurring source sand, product and tailings) located on premises controlled by Sibelco at Dunwich and Pinkenba
- soil and sand from publicly accessible areas around Dunwich.

The samples were analysed by gamma spectroscopy which is able to measure the activity concentrations of the radionuclides uranium-238 (^{238}U) and thorium-232 (^{232}Th).

Processed mineral sand tailings

There is a very wide range of uranium and thorium content in the tailings returned to North Stradbroke Island. The concentrations of ^{238}U and ^{232}Th in the tailings described as 'zircon mags' range from 1,000 to 5,000 times the levels in the natural sand; and in the other tailings the concentrations range from being equal to, up to 1,000 times those in the natural sand.

Additionally, the results show that only the tailings material described as 'zircon mags' have a high enough concentration of ^{238}U and ^{232}Th to be classified as a radioactive substance and therefore subject to regulation through licensing under the *Radiation Safety Act 1999*.

Rehabilitated mining areas

On areas where rehabilitation is taking place, the tailings returned to North Stradbroke Island are covered by approximately 10 metres of clean soil/sand. Soil samples collected from the surface of rehabilitated areas contained material with ^{238}U and ^{232}Th concentrations similar to, or slightly less than, those in the existing naturally occurring sand.

Public areas

Soil and sand samples were collected from various locations around Dunwich that are accessible to the public:

- Junner Street and surrounds (footpath and road edge, ferry terminal, parkland)
- Adams Beach
- Ballow Road park
- Water treatment plant and surrounds

In order to obtain some indication of the highest radiation levels that are likely to be found, most of the samples chosen were those that appeared to show an obvious mineral sand content.

In these samples the radionuclide content of the material was elevated but at safe levels.

The sampled material had a wide range of uranium and thorium content which would in part be of natural occurrence and in part due to the extracted mineral sands being deposited on the ground.

In some locations, samples of soil and sand were collected in conjunction with the external gamma radiation survey described above. The samples with the highest uranium and thorium content were from areas showing an elevated, but localised gamma radiation dose rate.

Water sampling

Samples of water were collected from the following locations:

- the creek running through Adam's Beach
- a stream adjacent to the Ballow Road park
- Brown Lake
- a tap in the park at Junner Street and Ballow Road.

Gross alpha and beta concentrations in each of these samples demonstrated an acceptable water quality when compared with criteria in the Australian Drinking Water Guidelines.

These results show the radiation levels in natural watercourses and the drinking water supply to be at safe levels.

Air sampling

Testing for particulates in air at the Junner Street jetty and surrounds was conducted in December 2008 and April 2009 using personal air samplers and a high volume sampler. On these occasions the weather was fine with a very mild breeze.

No measurable amount of radioactive material was detected in the samples.

Leachability of mineral sand

The toxicity characteristics leaching procedure (TCLP) is a procedure used to assess the potential for radionuclides in a material to contaminate groundwater. The Radiation Safety Regulation 2010 specifies the leachability criteria for acceptable disposal of mineral substances without requiring an approval.

The previously mentioned samples of mineral sands from various stages in the processing cycle (naturally occurring source sand, partly processed material, product, and tailings) were subjected to testing using the TCLP. As expected from these chemically unaltered mineral sands, the amount of radioactive material leached from these samples was negligible.

These results show no potential for deposited mineral sand products and tailings to contaminate groundwater.

Personal radiation dose assessment

The most significant pathway by which a member of the public on North Stradbroke Island may be exposed to radiation related to mineral sands is through external gamma exposure.

An assessment based on an individual spending 10 hours per week at the Ballow Road park (where the most elevated radiation levels were found) shows that their additional radiation dose due to the deposited mineral sand residues in the soil would be equivalent to approximately one-quarter of the naturally occurring background dose. Therefore normal unhindered use of the park would not result in any adverse health outcomes.

Conclusion

The outcomes of these tests are consistent with previous monitoring and testing and do not reveal any evidence to suggest that activities associated with the mining, processing and transport (both to and from the island) of mineral sand on North Stradbroke Island are adversely affecting, or likely to adversely effect, occupational or public health, from a radiological perspective.