CNNC
Rössing Uranium
Working for Namibia

Rössing Uranium Health Study

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Overview

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The Rössing Uranium Mine

Uranium was discovered in the Namib Desert in 1928, but it was not until intensive exploration in the late 1950s that much interest was shown in the area. After discovering numerous uranium occurrences, Rio Tinto secured the rights to the low-grade Rössing deposit in 1966. Ten years later, in 1976, Rössing Uranium, Namibia's first commercial uranium mine, began operating, celebrating its 43rd year of production in 2019.

Today, Namibia has two significant uranium mines, which together provide for roughly 11 per cent of the world's uranium oxide mining output; Rössing Uranium produces about 3.9 per cent of the world's output. The mine has a nameplate capacity of 4,500 tonnes of uranium per year and, by the end of 2019 had supplied a total of 137,587onnes of uranium oxide to the world.

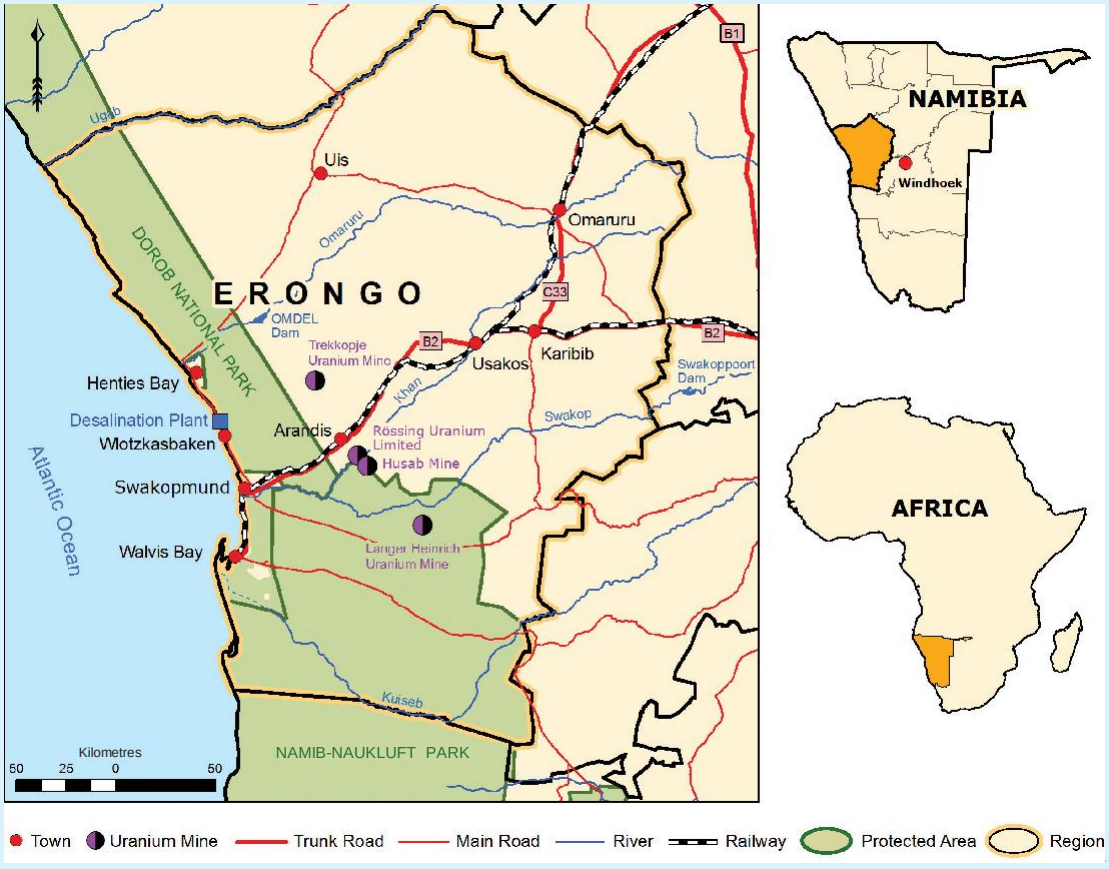
The mine is located 12 km from the town of Arandis, which lies 70 km inland from the coastal town of Swakopmund in Namibia's Erongo Region. Walvis Bay,

Namibia's only deep-water harbour, is located 30 km south of Swakopmund.

The mining operation is located in an arid environment. Exposure at Rössing Uranium is high, and as a result, daytime ranges of temperatures are wide, especially during May and September, when the difference between minimum and maximum temperatures exceeds 20ºC daily. The lowest temperatures are normally recorded during August, but frost is rare. The highest temperatures are recorded in the late summer, particularly March.

The mine site encompasses a mining licence and accessory works areas of about 129.79 km^2, of which 25 km^2 is used for mining, waste disposal and processing.

Mining is done by blasting, loading and hauling from the main open pit, referred to as the SJ Pit, before the uranium-bearing rock is processed to produce uranium oxide. The open pit currently measures 3 km by 1.5 km, and is 390 m deep.



1. Background and Purpose

Rössing Uranium started operations in 1976. In 2021 we mark a milestone — 45 years of production at the mine. Over the years the well-being and safety of our employees have been our priority and we continuously place renewed focus on improving our health, safety and environmental (HSE) systems and performance.

To ensure that our safety initiatives are on the right track we have in the past attempted on several occasions to carry out a comprehensive health study that would be able to demonstrate that occupational exposures on site are not resulting in any excess health risk to workers. While several studies have been performed by external consultants, only one was published as the other studies lacked scientific rigor.

From 2011, Rössing Uranium began preparing for a scientific study designed to stand up to scrutiny. The first requirement for a successful study of this nature is a scope or project design that adequately addresses all the study parameters, such as quantity and quality of available data for the workforce, the available information on the population from which this workforce is recruited, and the study design that would produce the optimal outcome.

The scoping study was awarded to SENES (Specialists in Energy Nuclear and Environmental Sciences) in March 2014, and was completed in August 2014. SENES Consultants is a Canadian-based environmental consultancy firm.

Then the search for a suitable consultant for completing the study was undertaken and the project was awarded to the University of Manchester (United Kingdom) in August 2015. The choice was based on the research team's exceptional academic standing and experience in occupational and radiation epidemiology.

The key outcome from the health study is a completed case-cohort study of worker health, with a focus on radiation-induced health effects (primarily cancer).

The research team carried out statistical analyses to determine whether there are any relationships between occupational exposures (radiation, silica, acid mist, diesel engine exhaust) and the selected cancers of interest. These analyses showed that there is no strong evidence that total radiation exposure, or other exposures at the Rössing mine, have caused an increased risk of cancers in the workforce.

Additionally, the International Commission on Radiological Protection maintains that the risk of excess cancers due to exposure of low level radiation follows a linear relationship between exposure and risk [4]. Considering the extremely low average radiation exposure doses to Rössing Uranium employees [1], [2], it is unlikely that any excess cancers have resulted as a result of the work at the mine.

2. This is how the project was carried out

Scoping study

The scoping study carried out by SENES suggested the following design for the planned study:

- A case cohort study design was recommended. This means that 'cases' (people who have been diagnosed with cancer) have been matched with 'controls' (people who have not been diagnosed with cancer) within the same group of people.
- Both 'cases' and 'controls' have been selected from the Rössing Uranium workforce, including all workers who have worked at the site consecutively for more than one year. For each case, five to ten controls have been selected.
- The radiation exposure dose, obtained from historical dose records at Rössing Uranium, for controls and cases has been compared, in order to obtain a statistical analysis of the question whether a link between radiation exposure and excess cancers exists in the workforce.

Epidemiological study

Epidemiology is the study and analysis of the patterns, causes, and effects of health and disease conditions in defined populations.

The epidemiological case cohort study can be summarised as follows:

[1] Perform an epidemiological case-cohort study of worker health at Rössing Uranium. The scoping study [3] presents the basis for understanding the quality and quantity of available data, and provides recommendation about the study design.

[2] The study focused on radiation exposure as principal occupational risk.

[3] The potential outcomes of radiation exposure to have been studied are cancers that could be linked to radiation exposure or the chemical toxicity of uranium. Relevant cancer types include those of the lung, kidney, and blood-forming organs. In addition, brain cancers have been included because several of these are known to have occurred in the workforce, although no link to radiation was associated.

- Confounding factors, ie factors not related to occupational radiation exposure that can contribute to cancer incidence in the workforce have been considered. These would include other occupational hazards (silica dust, acid mists, asbestos, manganese and welding fumes), as well as lifestyle factors such as smoking, diet and socioeconomic background.
- Relevant objectives have been met, such as ethics review by a suitably appointed ethics committee, agreement of relevant Government stakeholders with the project scope and implementation, suitable information of all affected stakeholders such as the workforce and affected communities.

3. Results

- The study focussed on lung cancer, cancers of other parts of the airways, leukaemia (cancer of the blood), kidney cancer and brain cancer.
- Using records held at the Rössing mine, the University of Manchester research team identified 7901 people who had worked at least one year at the mine between 1976 and 2010. A representative sample of 1121 people from the whole workforce was selected. The records of those identified who had developed cancer by 2015, where taken from the Namibia National Cancer Registry, the South African National Cancer Registry and information from the records of the mine's occupational health service provider. These worker records were carefully linked to cancer registry records, maintaining strict confidentiality.
- Statistical analyses, to identify if the risk of developing cancer was higher in workers with higher radiation exposures, showed that total radiation exposure in the Rössing mine was not associated with a higher risk of any of the cancers studied.
- Radiation exposures for workers at the Rössing mine appear to be low, based on the data studied. At these radiation levels and from what is known about radiation risks an increase in cancer incidence in the Rössing workforce is not to be expected.
- Moreover, for many workers the assessed radiation levels at work are similar to the exposure from naturally occurring background radiation in their everyday lives, such as exposure to radon in their homes.
- This study does not provide strong evidence that radiation or other exposures at the Rössing mine cause an increased risk of cancers in the workforce.

4. References

[1] *Von Oertzen G. et al, Rössing Uranium Radiation Management Plan, 2016*

[2] *Rössing Uranium, Report to Radiation Protection Authority on Implementation of Radiation Management Plan, 2013, 2014 and 2015, www.rossing.com*

[3] *SENES Consultants, Scoping Study to Recommend Possible Health Studies of Workers Employed at the Rössing Uranium Mine, 2014*

[4] *ICRP, Low-dose Extrapolation of Radiation-related Cancer Risk, ICRP Publication 99, Ann. ICRP 35 (4), 2005*