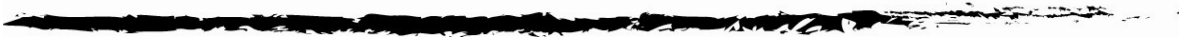


Guidance for Licensing of Mineral-sand Mining that Generates Radioactive Residues



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1. Introduction

Radioactive isotopes, or radioisotopes, occur naturally in the earth's crust. They are chemical elements that give off radiation. Mineral sands contain small amounts of naturally occurring radioactive material (NORM) which is mainly uranium and thorium and their natural decay products. The radioisotope impurities in what are collectively known as heavy minerals are bound within the crystal structure of the grains of the mineral sands monazite (a mix of various rare-earth phosphate minerals), zircon (zirconium silicate), xenotime (yttrium phosphate) and leucosene (altered iron-titanium dioxide).

When mineral sands are mined and processed, they result in residues of reject or unmarketable heavy minerals that contain radioactivity. These residues are normally highly insoluble and are generally associated with either the mineral monazite, which is a thorium and rare-earth phosphate, or the dense mineral zircon and other dense minerals such as rutile (titanium dioxide). When mining licensees are planning to undertake new mineral-sand mining and separation operations, they need to address the issue of whether the residues contain radioactivity.

2. What is the purpose of this document?

The guidance in this document is related to new proposals for mineral-sand mining rather than to mining on legacy sites.

The purpose of the document is to:

- set out guidance for an appropriate way to manage the residues that contain insoluble, radioisotope-bearing minerals as a result of physical separation of mineral sands
- prevent creation of a site on which radioactivity would have an impact that would have to be managed into the future.

The guidance is not applicable to heavy minerals that are extracted by way of chemical means, because in that case, the mobility of the residues can be affected. You must assess those heavy minerals and any other residues according to the specifications set out in the Waste Guidelines¹.

3. How are radioactive residues managed?

Heavy minerals that result when mineral sands are physically separated are chemically unaltered and have existed for thousands of years. Although heavy-mineral residues are chemically unaltered, they often contain an elevated level of radioactivity due to the removal of the non-radioactive portion of the mineral sand. Because the residues are naturally immobilised, an appropriate treatment is to blend or mix them with clean, non-radioactive material in order to return the concentration of radioactive elements to its original, pre-separation, level.

To comply with generic 'protection of the environment' licence conditions when this type of residue is being dealt with:

- a survey of the mine site's background-radiation level should be conducted
- the residue from the physical-separation process should be blended with other, non-radioactive solid material such as the original light sands from the initial separation process, mine spoil, soil or sand so the resulting material has the same radioactivity as the radioactivity of the background-survey material

- the blended material should be sent back to the mine site for backfilling
- the mine licence should be amended so the mine can receive the material for 'waste disposal by application to land'
- the Mining and Milling Code of Practice² should be complied with.

Anyone who handles residues that contain radioactivity must handle them so as not to generate or inhale airborne dust.

Anyone who transports material defined as a *radioactive substance* under the *Radiation Control Act 1990* must comply with the Transport Code³.

You must conduct an approved sampling and analysis program in order to validate your compliance with the background-radiation survey.

4. How do you assess contamination?

Planning authorities have to be sure that levels of chemicals and radioactivity in the environment are within acceptable limits for the proposed land use. Site owners or developers employ consultants to:

- undertake site management, assessment and remediation
- advise them about how to mitigate processes through which land would be rendered unsuitable for the future proposed use
- validate the approved sampling and analysis program.

When an owner, a developer or a local council lacks the necessary expertise to evaluate a consultant's work, DECC advises that the individual or entity undertake an independent review of the work. The individual or entity can engage either an appropriately qualified and experienced consultant or a DECC-accredited site auditor to provide an authoritative opinion about whether the consultant has undertaken the work satisfactorily.

A local authority might require the opinion of either a DECC-accredited site auditor or an appropriately qualified expert if the land is subject to a proposal to change the land use. By involving another expert at the time of the assessment, the site owner or developer will more easily avoid suffering delays and/or having to pay reworking costs.

If you require help in undertaking a statutory or non-statutory site audit, please refer to the Auditor Guidelines⁴.

References

¹ Department of Environment and Climate Change NSW, 2008. *Waste Classification Guidelines*.

² Australian Radiation Protection and Nuclear Safety Agency, 2005. *Code of Practice for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing*.

³ Australian Radiation Protection and Nuclear Safety Agency, 2008. *Code of Practice for the Safe Transport of Radioactive Material*.

⁴ NSW Department of Environment and Conservation, 2006. *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme*.