

Naturally occurring radioactive materials

Handling, storing and preparing potentially hazardous samples at the British Geological Survey

by John Davis

With the vast array of geological samples held in the BGS collections¹ it is no surprise that a number of items will contain naturally occurring radioactive material (NORM). Uranium and thorium are the forty-eighth and thirty-ninth most abundant elements in the Earth's crust, and it is these elements and their radioactive decay products ('daughters') that form the NORM in geological collections. Uranium is found in pitchblende, uraninite, carnotite and autunite, as well as in phosphatic rocks, lignite and monazite. Thorium is found in thorite, thorianite and monazite.

Working with NORM at the BGS is controlled under the provisions of a number of pieces of legislation, predominantly:

- Radioactive Substances Act, 1993.
- Ionising Radiation Regulations, 1999.
- Euratom Directive / Basic Safety Standards, 1996.
- Management of Health and Safety at Work Act, 1999.
- Radioactive Materials (Road Transport) Act, 2002.

There are a number of 'geological exemptions', but these govern collections of small size and personal collections. Given the large amount of ore-containing samples at the BGS, and the fact that about 50 staff come into fairly regular contact with NORM, it is the role of the Radiation Protection Supervisor (RPS) to ensure safe practices are followed and regulations are adhered to. The overriding constraint is to keep exposure to NORM 'as low as reasonably practicable' (ALARP). This ensures that any radiation exposure, or dose, is kept to

a minimum. For many people, the word 'radioactivity' is inherently associated with danger. While the hazard is sometimes overstated, this can be helpful, if it promotes caution.

What are the common issues the Survey encounters?

The large amounts of material handled

Even if the NORM content is low, if a great amount is handled, the potential dose rate is increased. Collections are often bought on large scale from other institutes or, on occasion, bequeathed. Field geologists often collect bulk samples and this can also increase the potential dose rate. It is often, but not always, readily apparent that a collection will have a NORM content.

Existence of archived material

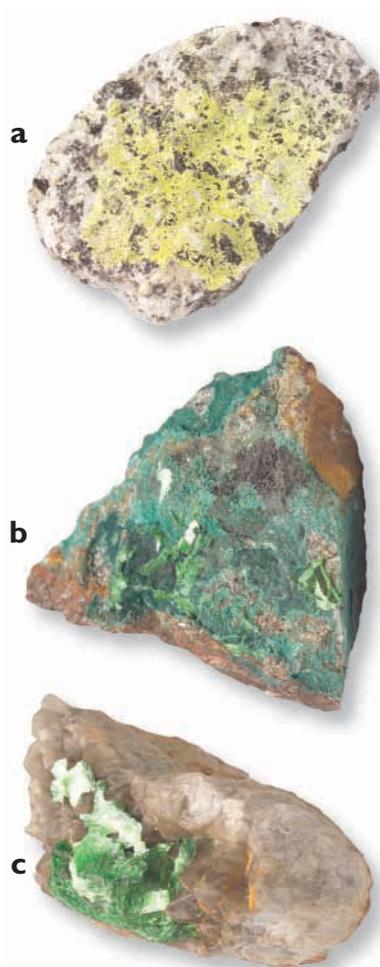
Large collections of archived, and often redundant, materials are commonly a legacy of projects carried out decades before any regulations existed, such as uranium exploration in the 1950s and 1960s. Staff also enthusiastically collect material for their own personal collections, for office décor, and as curios and paperweights. When staff retire, large amounts of material can appear, often with a lineage that is difficult to trace.

Transport of material

Very strict legal regulations for road transportation exist, but if NORM is not suspected, or checked for, staff or third parties may send samples without completing the proper paperwork.

Handling, examination and processing

Samples are often very closely handled and examined by eye, small particles



Some naturally occurring materials, such as these uranium-bearing minerals from south-west England, have high levels of radioactivity and require measures to ensure safe handling. (A) autunite and (B) metatorbernite with cornwallite, Merrivale Quarry, Tavistock; (C) meta-torbernite, Old Gunnislake Mine, Cornwall. (Thorman collection.)

¹See Earthwise issue 20, page 32.

can be inadvertently removed by cleaning causing contamination. Further preparation may involve comminution processes, where samples are cut, ground or milled and by other dust-creating hazards.

Radon in the workplace

When very large amounts of ore are kept, radioactive radon gas may emanate, and accumulate in confined storage areas.

Disposal and waste

NORM can often be disposed off via normal waste routes, but higher content materials may need specialist disposal. As each decade passes, regulations get tighter, so what starts as a project sample, and is then archived, can in time become a liability and its disposal cost may outweigh any initial research benefit. A recent extreme case in point being a drum of mineral sands that cost almost £40 000 for disposal.

Sales of materials in shop

It is inevitable that some items for sale in geological shops will have a NORM content. As the use of these materials is unknown once they leave the premises, caution should prevail.

How do we ensure safe working practices?

Training

All staff at the BGS working with NORM have access to training. More specialist radiation protection training is taken by relevant staff. The BGS has four trained Radiation Protection Supervisors, one of whom is dedicated to Core Store areas and sample preparation.



Equipment used by staff working with radioactive materials for scanning new samples and for monitoring personal radiation doses.

Monitoring and record keeping

All samples arriving for corporate collections are scanned by radio-monitors on arrival and treated under written procedures depending on the activity. These values determine what further processing can occur with the samples. At the BGS the same written systems of work and local rules are used on all the sample receipt routes on site.

Area designation

For very active samples, dedicated areas are available for storage and preparation. The restrictions on these areas vary with the dose levels of the materials and engineering controls are used to restrict access. These areas are routinely monitored and local rules and designations updated as holdings increase and decrease.

Dose monitoring

Personal real-time dose alarms and long term 'film badges' are available if engineering controls and access restriction cannot guarantee dose controls.

Robust health and safety channels

The BGS has a well established health and safety structure, and management are kept aware of, and respond well to, changes in situations and to new needs given the uniqueness of the issues. Good communication exists between the RPS and curators and processors. A solution for one problem can often be the basis for a solution in another area of the site.

Radon monitoring

The Radon Protection Supervisors on site routinely monitor the workplace environment for radon gas levels. At the BGS they are rarely above ten per cent of working limits.

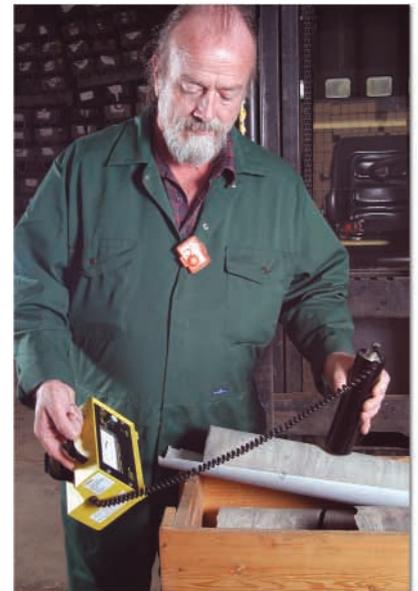
External advice

The BGS is obliged to seek external advice from a Radiation Protection Adviser, and also from the Environment Agency for waste streams.

The legislation is strictly enforced and working with NORM presents a challenge to any RPS. However, it is only through the adoption of good practice that we can continue to protect our own staff, our customers and the local environment. ■



Dedicated areas with restricted access are available for storing radioactive samples.



All geological samples arriving on site are scanned for radioactivity before processing and curation.

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