Understanding the scale and needs of a Geological Disposal Facility

By Clare Bond

Understanding the need and scale of the UK's radioactive waste is an important part of ensuring the effective and timely delivery of a geological disposal facility. This includes consideration of the current storage solutions and the lengths of time these will be needed for, as well as innovative solutions to minimise the volume of waste that requires to be disposed of. With this in mind six CoRWM members travelled to Sellafield in July to get an overview of the task in hand.

It was July 19, the hottest day on record in Britain, when the CoRWM members met in Cumbria. Temperatures had topped 40 degrees centigrade for the first time in the UK and Britain's transport infrastructure was 'melting' in the heat. I had left my home in Aberdeenshire in the early morning, while the southern contingent had rented a car and were on a journey northwards, punctuated by CoRWM member pick-ups, as train cancellations rolled out across the country.

After a cooling lunch time dip with a view to the Sellafield site at St Bee's, I met the others in preparation for our tour the following day. Our half dozen comprised of the CoRWM chair and deputy chairs and the three 2022 recruits to CoRWM: Simon Webb with expertise in large scale project management, Catherine MacKenzie a legal expert, and me, a geoscientist. We had a full day tour ahead taking in the first-generation Magnox Storage Pond Facility, the Waste Monitoring and Compaction Plant, HALES the Highly Active Evaporation and Storage Plant and finishing off with a tour of the Vitrification Lines. Rather than give a blow-by-blow account of the day I am going to focus on what struck me most. First-up security!

Security

Security, both in terms of site access but also in the security of one's own personal health and safety, was paramount. For our first site visit to the Ponds, personal safety included no facial hair, dosimeter badges (which we wore throughout our visit), clothing, steel toe-capped shoes and additional electronic personal dosimeters. The storage ponds are kept at a highly alkaline PH of 11.4, similar to domestic bleach, that allows long-term storage of the fuel cannisters with minimal corrosion. We were able to access the roof above the ponds to look down on them and to see the robotics (remotely operated underwater vehicles (ROVs)) deployed to move and clean the canisters of waste stored.

Robotic use has revolutionised the working processes in the ponds, allowing work to be done remotely which ensures that workers can carry out their roles without exposure to higher doses of radioactivity, meaning that work can be carried out by individuals more safely and for longer time periods. Robotic

use has required micro-innovations that may sound simple, like the fact that the RoVs use toothbrushes to clean the cannisters in the ponds, but that have a large impact on operational health and safety. Waste currently stored in the ponds will go in a geological disposal facility so ensuring long term up-keep and maintenance is essential whilst the process of securing a site for and building a geological disposal facility takes place.

Time

The knock-on effects of both security checks and health and safety protocols is time. I am sure if you worked at Sellafield on a day-to-day basis, you would be much more efficient at changing and decontamination checks, as well as ensuring your steel-toed shoes are stored in the right place and that you haven't breached protocols. But for a novice it is quite a learning curve. With work length restrictions in some areas and all the changing, hand washing, radiation contamination monitoring it struck me that this was a business that could not be rushed and that the processes in place to ensure personal safety and site integrity were important, thorough, and time intensive.

Scale

The scale of the site hadn't really struck me before. Tucked away on the far side of the Lake District and bordering the sea, it is not immediately obvious that the site is huge. Only when you're being transported inside the compound, and its internal compounds within compounds, does the scale of the operation really hit home. It has the hustle, bustle, and noises of a massive industrial site and I wouldn't dare to guess the meters, or kilometres, of ducting for steam and other services that cross the site. The complexity of the linked buildings and facilities that over Sellafield's lifetime have been erected to ensure the next stage in the process is met and the continual evolving modernisation of processes (from wheel-turned valves to electronically controlled systems) is hard to comprehend.

The history is fascinating, the site is immense, and the interlinked processes and contingent stages make the scale of the job, compounded by longer-term uncertainties, such as the timing of an operational geological disposal facility, challenging. This is where further innovations such as the laser cutting of waste crates are being deployed. In the laser cutting process 2 crates are cut and stored in a third crate that is then compacted to minimise the storage volume required. Learning about the scale of the linked operations and onsite processing and storage of waste made me think of a kind-of intricate chess game in which radioactive material is moved around the site being prepared and waiting for final positioning in the geological disposal facility.

Heat

So, it was a hot a day, not 40 degrees, but hot. The site is full of steam and vents, and the big concrete buildings were reflecting the heat of the day. But there is also the heat of the waste – no central heating is needed

in the vitrification cylinder store. Having been taken through the vitrification process, we ended in the store. Here the vitrified canisters are stored in ‘plugs’ ready for movement elsewhere, including being shipped back to those countries whose waste we have vitrified. You can walk over the top of the store and see the circular tops to the plugs below that contain the carefully shielded vitrified waste. Bend down and touch the floor and you can feel the heat of the waste being emitted from below. Not the comfiest place to be on one of the hottest days of the year, but another insight into the challenges of a geological disposal facility. The geological disposal facility design will include spacing between canisters to ensure that the heat produced by the waste can be effectively conducted out of the facility over the timescales of radioactive decay and the geological disposal facility life.

The people

Last but by no means least I want to mention the people I met. We were joined on our tour by specialists in the different areas and engineering challenges that we visited. Many were people who had worked on the site for years and had huge experience and lots to share. Their enthusiasm for their work and their contribution towards ensuring safe practice and storage is not to be underestimated. They shared their knowledge, stories, and thoughts on future challenges without prejudice, making the visit truly informative and rewarding. As we move forward towards a geological disposal facility, people are going to be as much a key to the process as the engineering and geology of the facility. An engaged host community, workers, and many other people will be required for an effective geological disposal facility.