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Burying the nuclear waste problem

Within 20 years Switzerland should have turned the page on nuclear energy. But what to do with the tens of thousands of tonnes of waste? Scientists at the Federal Institute of Technology Lausanne (EPFL) are testing a storage system using multiple barriers, where waste could be kept for centuries until it becomes harmless.

Today, Swiss nuclear waste is cooled very slowly in massive pools in power stations and in the interim storage facility for nuclear waste in Würenlingen, canton Aargau.

In 2006, the government imposed a ten-year moratorium on the export of nuclear waste. Since then no waste has been sent for recycling at French reactor maker Areva's factory in The Hague. Areva claims that 96 per cent of rods used in French reactors are re-enriched to be re-used as fuel – a figure that makes Greenpeace activists glow with anger. They are convinced that the real number is ten times lower – the difference being explained by the illegal export of rods to dumps in Siberia.

The cabinet decided to decommission Switzerland's five nuclear power reactors by 2034, once they reach the end of their lifespan. But when it comes to nuclear facts and figures, nothing is ever simple or transparent…

Alessio Ferrari, a scientist at EPFL's Laboratory of Soil Mechanics, is working on how rock can take in waste without it ever coming into contact with the environment or groundwater.

This option of deep geological landfill sites is how Switzerland and its neighbours have decided to deal with the problem – and if on the surface the process appears to have reached a standstill, in laboratories the research is making rapid progress. Scientists now have better labs, better results and a better understanding of how soils behave when conditions change. And public authorities are also pushing research – they realise that ultimately a solution has to be found.

The waste that can no longer be recycled is first of all vitrified, i.e. stabilised into a glass matrix which in theory will neither react nor degrade for extended periods of time.

Nevertheless, these substances remain active and this activity generates heat: up to 150 degrees Celsius for centuries. Total cooling takes 10,000-100,000 years. Plus, nothing guarantees that after that period of time radionuclides don't escape from the vitrification process.

So this first barrier isn't enough. The second is a steel container. But this too, even with walls decimetres thick, is no absolute guarantee against radioactive leaks, not to mention any external aggressions, especially by water, which could in the long term corrode the metal.

In principle, rock is almost impermeable to liquid, but in order to not leave anything to chance for their great-great-grandchildren, scientists see a third barrier before that of substratum rock. "You can't simply put the containers at the end of a tunnel," Ferrari says. "There has to be a buffer material between them and the rock. We're testing bentonite, a sort of clay, which has the very interesting property of being able to absorb four to five times its initial volume in liquid. And once saturated, it's impervious." The Laboratory of Soil Mechanics is therefore testing the resistance of bentonite and its behaviour faced with heat, humidity and the pressure of the containers, which weigh between eight and 26 tonnes.

Another part of the work is being carried out in the hillsides of the Grimsel and Mont Terri in the Jura. The laboratory there is run by a consortium of public and academic bodies. This does not mean, however, that this warren of tunnels, dug to a depth of 300 metres, is Switzerland's future "nuclear dustbin". Currently, any storage of nuclear waste is banned.

For weeks a six-year old boy kept telling his teacher about the baby brother or sister that was expected at his house.

One day the mother allowed the boy to feel the movements of the unborn child. The six-year old was obviously impressed, but made no comment. Furthermore, he stopped telling his teacher about the impending event.

The teacher finally asked the boy: "Tommy, whatever has become of that baby brother or sister you were expecting at home?"

Tommy burst into tears and confessed, "I think Mum ate it!"

Everything Mum

How did you find the energy, Mum
To do all the things you did,
To be teacher, nurse and counsellor
To me, when I was a kid.
How did you do it all, Mum,
Be a chauffeur, cook and friend,
Yet find time to be a playmate,
I just can't comprehend.
I see now it was love, Mum
That made you come whenever I'd call,
Your inexhaustible love, Mum
And I thank you for it all.

By Joanna Fuchs