

It has been three years since the Tohoku earthquake struck Japan on March 11, 2011. If the resulting damage had been limited to that caused by the quake and ensuing tsunami, Japan would have finished rebuilding long ago, but the meltdown at the Fukushima Dai-ichi nuclear power plant caused by the natural disasters means that reconstruction efforts are far from done.

The Fukushima meltdown was not the first time that several nuclear reactors have gone out of control at once and it was later discovered that an even greater danger was posed by the plant's interim storage facility and the highly radioactive spent fuel rods being kept there.

When the earthquake struck, Fukushima's No. 4 reactor did not have any fuel in it, but highly radioactive particles leaking from cracks in its protective encasement were dispersed by the wind, possibly because hydrogen-air explosions in the adjacent spent rod storage pool ripped off the roof and exposed the presumably uncovered spent fuel.

At one point, the Japanese government was seriously considering evacuating Tokyo, which is about 200km from the plant.

In Taiwan, those behind the development of nuclear energy in the nation failed to consider whether there is enough space in which to store three or four decades' worth of spent fuel. With six reactors in continuous operation, the country is beginning to run out of places to put spent fuel and the initial single layer of radioactive waste has doubled.

Yet even that is not enough, due to the emergence of the idea that the plants could continue operating not just for three or four decades, but six or eight, and perhaps longer. According to proponents of this idea, all that is needed to extend the reactors' operational life is to transfer the spent rods to dry cask storage units after a period of time to free up room in the spent fuel pools and thereby extend the service life of the nation's three active nuclear plants almost indefinitely.

When the reactors at these three facilities were designed, engineers incorporated a reactor protection system consisting of multiple safeguards in the event that the reactors ever went out

of control. These include a steel reactor enclosure, continuously circulating coolant water, a steel-reinforced concrete containment structure and the maintenance of negative pressure in the reactor containment structure.

Spent fuel rods are far more radioactive, toxic and fragile than the fuel in the reactors, and yet dry storage casks have but one layer of stainless steel that shields the outside world from their contents. If the cylinder is compromised or damaged in any way, there is nothing to stop highly radioactive particles from escaping into the environment.

The dry cask storage procedure employed at Taiwan Power Co's Jinshan Nuclear Power Plant in New Taipei City's Shihmen District (新豐) and at its Guosheng Nuclear Power Plant in the city's Wanli District (萬里) was devised by the Atomic Energy Council's Institute of Nuclear Energy Research. Whether the council's involvement can be deemed as above suspicion depends on how stringently the execution of the procedure is monitored.

According to US research studies, humid and highly saline atmospheres can accelerate the damage or corrosion of dry storage casks. Yet Taipower takes a relaxed approach to the matter, believing that the Taiwan-made casks will last 30 years without rusting. The company also holds that monitoring radiation levels at dry storage areas and taking daily readings of the temperature levels at the casks' inlet and outlet vents is sufficient to ensure safety.

This stance begs certain questions: For example, why are radiation and gas readings not taken for each individual cask? If this is not done, then how can it be detected if the sole thermometer malfunctions? What happens if a landslide blocks the vents, or the cylinder material is damaged, or the integrity of the welding compromised?

Taipower should be running practical tests on non-radioactive material to be prepared for any contingency. Of course, such tests would not be necessary if the company and the council carried out computer simulations that could dispel any safety doubts.

How well prepared are Taipower and the council to handle the nation's growing pile of nuclear waste? To answer this question, one can infer a few things from the way nuclear waste is handled on Orchid Island (Lanyu, 蘭嶼).

In theory, high-level atomic waste remains radioactive or radiotoxic for 100,000 years and therefore needs to be stored for that amount of time, while low-level waste becomes inert — and therefore safe — after only 300 years.

During the Chinese Nationalist Party (KMT) authoritarian era, Lanyu was chosen as a site for the interim storage of low-level radioactive waste. Originally, the plan was to dispose of the toxic material in a nearby ocean trench, but this idea was abandoned when dumping nuclear waste in the ocean was prohibited by international conventions on atomic waste management. However, low-level waste was still shipped to Lanyu to be warehoused there, a practice that only stopped when incensed local residents reached the end of their patience and prevented the ships carrying the waste from docking.

The cylinders containing low-level waste that were already on the island started rusting just 10 years after they were built. In 2008, when the council conducted a comprehensive inspection of the Lanyu containers, it found that they were already severely rusted and some had broken open — not a single one was in a perfect condition.

If the authorities take this approach to low-level waste, which is comparatively simple to handle, it is no wonder that the public is concerned about how they tackle high-level waste, which is thousands of times more dangerous. Despite this, officials refuse to carry out practical simulations, carry out drills on recontaining waste in the event of a cylinder being compromised, or establish a comprehensive monitoring system.

Dry cask storage is supposed to be an interim solution to be employed for several decades only. However, Taipower and the council seem to view it as a permanent solution. Given this, it seems inevitable that sooner or later, a high-concentration radioactive leak will occur that will turn this beautiful country into a ghost island that will be impossible to bring back to life.

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Translated by Paul Cooper

## Nuclear waste will waste Taiwan

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