

Why has Britain done a U-turn on plutonium?

Examining the logic behind the decision to convert Britain's stockpile of plutonium into fuel for future reactors.

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Sellafield Nuclear Power Station in Cumbria was the site of the UK's only mixed-oxide fuel production facility, but the facility was shuttered in August.

Why does the UK government want to convert its 112 tonnes of plutonium — the largest civilian stockpile in the world — into mixed-oxide fuel (MOX), when just a few months ago the Nuclear Decommissioning Authority (NDA) announced the closure of the only MOX production facility in the country because of a lack of demand? Energy minister Charles Hendry announced last week that converting the plutonium to MOX was still the plan, but a new £3-billion (US\$4.7-billion) plant would only be built if it could be shown that it was both affordable and offered value for money.

Although at first glance this may seem fiscally prudent, when taken with other recent events it starts to look nonsensical. Just a few weeks ago the NDA, responding to the government's own request to consider how to deal with the stockpile, advised that the cost of making MOX is greater than its value as a fuel. And therefore, the most cost-effective plan would be to continue storing the plutonium until a geological disposal facility becomes available for it to be buried underground. So what's going on? To make sense of it all, *Nature* peers through the looking glass of the British nuclear industry.

Why would the UK government want to reprocess plutonium into fuel?

Partly, because the plutonium is a huge embarrassment. To continue storing it is not only a constant reminder of how ill-thought-out British nuclear policy has been over the past decades, but it also poses a risk to non-proliferation. So converting it into MOX would transform a huge pile of waste — which the NDA euphemistically calls a “zero value asset” — into something potentially useful, while making the plutonium far harder to weaponize were it to fall into the wrong hands.

So why is it closing the only plant that can do that?

Ostensibly, because, in the wake of the Fukushima nuclear disaster, the Sellafield MOX Plant no longer has any customers. But in truth it never really worked. It was built to convert the UK plutonium stockpile into MOX, but, having been plagued by technical failures and delays, it has managed to produce only around 2.5% of its intended quota since it started operating ten years ago. With such a low throughput, it would have been unable to convert the UK stockpile fast enough to provide MOX for new reactors. And so in 2010 the NDA did a deal with ten Japanese utility companies to process their smaller amounts of plutonium and supply them with MOX, a deal that ultimately sank beneath a tsunami.

Why build a new one?

Because the problem hasn't gone away. Britain still needs to get rid of the plutonium and, despite the failings of the Sellafield plant, MOX production is a proven technology. The one other plant in the world, the Melox plant in Gard, France, has produced around 1,700 tonnes of MOX since it was built in 1995. So, currently, the only other options are to do nothing — keeping the plutonium in storage

until geological disposal becomes possible sometime after 2075 — or to process it so that it can supply a fast reactor, such as the kind that, with almost comic timing, GE Hitachi offered to build at Sellafield last week. The problem with this is that, despite 30 years in development, these reactors are still an unproven technology.

Is it worth it?

According to the NDA, not if you care about making a profit. With the low cost of uranium and the high cost of producing MOX, the reprocessed fuel would probably have to be given away. But profit isn't everything. Indeed, as long-term plutonium managing solutions go, MOX production gets the NDA's backing. And that is the message Hendry is putting out, that although the government is not quite ready to do anything with the plutonium yet, when it is ready it will be taking the MOX route. And if that means not making a profit, that's a small price to pay for getting rid of such an albatross. It's a brave decision, and one that gets the backing of both the Royal Society and the government's former chief scientific adviser David King at the University of Oxford's Smith School of Enterprise and the Environment.

Will it ever actually happen?

Despite all the caveats, we could see a MOX plant approved sooner rather than later. Tied into the decision is a proposal for Britain's next-generation reactors, which would use MOX as fuel, thereby requiring a MOX plant to be in production before they come online. What remains to be seen, however, is whether a new MOX plant will be able to show that the UK nuclear industry has learnt from the mistakes and failures of the Sellafield plant and to get rid of the plutonium once and for all.

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