IPFM blog

Troubles with France's plutonium fuel program

* AUGUST 28, 2022

*Frank von Hippel*

France's government-controlled nuclear fuel company, Orano (formerly part of Areva), is facing significant operating problems at both its Melox uranium-plutonium mixed-oxide (MOX) fuel fabrication plant in southern France and its spent-fuel reprocessing plant for plutonium-separation at La Hague on the English Channel. In a 19 January 2022 press conference, the Chairman of France's Nuclear Safety Authority (ASN), Bernard Doroszczuk, stressed the seriousness of the situation, "if reprocessing is to be continued [in France], it will be necessary either to provide for the renovation of the current installations; or, if reprocessing is to be stopped, alternative solutions for the management of spent fuel, should be available by 2040" (translated quote provided by Yannick Rousselet of Greenpeace France).

France has been reprocessing its spent low-enriched-uranium power reactor fuel since 1976 and, since 1987, has been fabricating most of the recovered plutonium into MOX fuel for use in its oldest (900-MWe) reactors. France's government-owned national nuclear utility, Électricité de France (EDF), has agreed with Orano to continue the separation and fuel use of the plutonium in its spent low-enriched uranium fuel [until about 2040](https://world-nuclear.org/information-library/country-profiles/countries-a-f/france.aspx).

*MOX fuel production.* According to information released by Orano and collected by Rousselet, Melox's output of MOX fuel fell from 124 tons in 2016 to 51 tons in 2021. Melox's production problems also resulted in an increasing fraction of its output being unusable. Orano [states](https://www.orano.group/en/unpacking-nuclear/plutonium-an-incomparable-energy-power) that Melox's production of defective MOX has increased to between 15 and 20 tons per year during the past three years, from its historical rate of five to ten tons a year.

The defective fuel is sent to Orano's reprocessing plant at La Hague for storage. This has contributed to a plutonium storage problem at La Hague. [According to France's reports to the IAEA](https://www.iaea.org/publications/documents/infcircs/communication-received-certain-member-states-concerning-their-policies-regarding-management-plutonium), during 2019 and 2020, the amount of unirradiated plutonium stored at La Hague increased at a rate of about 4 tons per year, about eight times the pre-2016 average. [According to ASN](https://www.french-nuclear-safety.fr/asn-informs/publications/asn-s-annual-reports/asn-report-on-the-state-of-nuclear-safety-and-radiation-protection-in-france-in-2021), that has led to "the site's plutonium storage areas being filled to maximum capacity."

Orano attributes its MOX fuel production problem to the changed characteristics of the depleted uranium dioxide powder Melox uses to dilute the plutonium in the MOX fuel. This resulted from Orano changing the powder's production process. Orano is now building a new uranium oxide powder production facility based on the old process, which it hopes to put into operation by the end of 2023. In the meantime, Orano [has requested](https://www.orano.group/en/unpacking-nuclear/plutonium-an-incomparable-energy-power) permission to increase its plutonium storage capacity at La Hague.

*Spent fuel storage.* Orano is also facing a storage problem in its spent fuel intake pools at La Hague. ASN [projects](https://www.french-nuclear-safety.fr/asn-informs/publications/asn-s-annual-reports/asn-report-on-the-state-of-nuclear-safety-and-radiation-protection-in-france-in-2021) that Orano may run out of space there "earlier than 2028-29" due in part because of spent MOX fuel accumulating at La Hague with no disposal plans.

The filling rate of La Hague's spent fuel pools has been accelerated by the slowing of the rate of reprocessing there due to the need for equipment replacement. ASN [points out](https://www.french-nuclear-safety.fr/asn-informs/publications/asn-s-annual-reports/asn-report-on-the-state-of-nuclear-safety-and-radiation-protection-in-france-in-2021) that "the detection of corrosion in the existing evaporators in Orano's La Hague facility earlier than expected in the design has reduced reprocessing capacity until new fission product evaporators-concentrators are commissioned" and that this could "further degrade the saturation margins of the [spent-fuel] pools at La Hague."

EDF has proposed to build its own central storage pool for its spent MOX fuel but, [according to ASN](https://www.french-nuclear-safety.fr/asn-informs/publications/asn-s-annual-reports/asn-report-on-the-state-of-nuclear-safety-and-radiation-protection-in-france-in-2021), this pool "will not be available before 2034 at best." Orano has proposed to increase the density of spent-fuel storage in the pools at La Hague but ASN has [responded](https://www.french-nuclear-safety.fr/asn-informs/publications/asn-s-annual-reports/asn-report-on-the-state-of-nuclear-safety-and-radiation-protection-in-france-in-2021) that denser spent fuel packing is "not a technical solution that meets current safety standards."

Orano therefore [proposes](http://www.hctisn.fr/IMG/pdf/06_2022_03_08_hctisn_projet_d_entreposage_a_sec_des_combustibles_uses.pdf) to build a dry-cask spent-fuel storage facility at La Hague that could accommodate 900 tons of the spent fuel for which there are no current plans to reprocess: MOX fuel and spent fuel made from re-enriched uranium from reprocessed spent fuel.

Rousselet considers Orano's proposal to build dry cask spent fuel storage "a great first for France." Most countries use dry cask storage after years to decades of cooling in pool storage pending direct disposal without reprocessing in planned deep repositories. Critics of reprocessing have been [advocating](https://link.springer.com/book/10.1007/978-981-13-9901-5) that France and Japan do the same.