

SMP Challenge Statement

Against a backdrop of much-improved performance of the Sellafield MOX Plant (SMP) in recent years, we are looking in and beyond the nuclear industry for technologies and process engineering solutions to implement in this plant, in order to facilitate further progress.

Mixed oxide (MOX) nuclear reactor fuel – a mixture of uranium dioxide (UO₂) and plutonium dioxide (PuO₂) – is manufactured in SMP. The first stage of SMP's manufacturing process, which is known as the Short Binderless Route, involves high-energy mixing of UO₂ and PuO₂ powders in an attritor mill. This mixture is subsequently granulated, before being pressed into fuel pellets, which are then sintered at high temperatures.

Specifically, we are looking for ideas in relation to:

Powders

- Monitoring of powder flow and granulation. As well as off-line systems to measure powder flow (and to ultimately deliver powder flow improvements), we are also interested in *in situ* process monitoring – which may involve lasers or acoustic monitoring.
- Powder-repelling surfaces – possibly based on emerging nanotechnologies.
- Innovative die-filling techniques.
- Technology – perhaps robotic – to assist with the removal of entrenched powder from within vessels and pipes.

Furnaces

- Advanced sintering solutions – in particular, to promote shape control during sintering.
- Novel measurement techniques for variables such as temperature and humidity.