

Mixed Oxide (MOX) Fuel

(Updated 21 March 2011)

- **Mixed oxide (MOX) fuel provides about 2% of the new nuclear fuel used today.**
- **MOX fuel is manufactured from plutonium recovered from used reactor fuel.**
- **MOX fuel also provides a means of burning weapons-grade plutonium (from military sources) to produce electricity.**

In every nuclear reactor there is both fission of isotopes such as uranium-235, and the formation of new, heavier isotopes due to neutron capture, primarily by U-238. Most of the fuel mass in a reactor is U-238. This can become plutonium-239 and by successive neutron capture Pu-240, Pu-241 and Pu-242 as well as other transuranic isotopes (see page on [Plutonium](#)). Pu-239 and Pu-241 are fissile, like U-235. (Very small quantities of Pu-236 and Pu-238 are formed similarly from U-235.)

Normally, with the fuel being changed every three years or so, about half of the Pu-239 is 'burned' in the reactor, providing about one third of the total energy. It behaves like U-235 as its fission releases a similar amount of energy. The higher the burn-up, the less fissile plutonium remains in the used fuel. Typically about one percent of the used fuel discharged from a reactor is plutonium, and some two thirds of this is fissile (c. 50% Pu-239, 15% Pu-241). Worldwide some 70 tonnes of plutonium contained in used fuel is removed when refuelling reactors each year.

The plutonium (and uranium) in used fuel can be recovered through reprocessing. The recovered plutonium could then be used in the manufacture of mixed oxide (MOX) nuclear fuel, to provide energy through electricity generation. A single recycle of plutonium in the form of MOX fuel increases the energy derived from the original uranium by some 12%, and if the uranium is also recycled this becomes about 22% (based on light water reactor fuel with burn-up of 45 GWd/tU).