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Alternative Approaches to Recycling Nuclear Wastes

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Nuclear power exists, and as the demand for non-fossil electricity generation increases, many more nuclear plants are being planned and built. The result is growing inventories of spent nuclear fuel containing plutonium that – in principle, at least – can be used to make nuclear explosives. There are countries and organizations that are believed to want nuclear weapons, posing a knotty proliferation problem that calls for realistic control of nuclear materials. Phasing out nuclear power and sequestering all dangerous materials in guarded storage or in geological formations would not be a realistic approach. Plutonium from commercial spent fuel is very hard to make into a weapon. However, a rogue nation could operate a power plant so as to produce plutonium with weapons-quality isotopes, and then chemically purify it. IAEA safeguards are designed to discourage this, but the only enforcement is referral to the United Nations General Assembly. The traditional reprocessing method, PUREX, produces plutonium that has the chemical purity needed for weapons. However, there are alternative approaches that produce only highly radioactive blends of fissionable materials and fission products. Recycle offers a market for spent nuclear fuel, promoting more rigorous accounting of these materials. Unlike PUREX, the new technologies permit the recycle and consumption of essentially all of the high-hazard transuranics, and will reduce the required isolation time for the waste to less than 500 years. Facilities for recovering recyclable materials from LWR spent fuel will be large and expensive. Only a very few such plants will be needed, leading to appropriate concentration of safeguards measures. Plants for recycling the spent fuel from fast burner reactors can be collocated with the power plants and share the safeguards.