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Fact Sheet

International experience with reprocessing and related technologies

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1. Costs. The separation of plutonium (called "reprocessing") from reactor spent fuel is very costly. France, the worlds reprocessing leader, spends about $1 billion extra per year on plutonium fuel compared to uranium fuel. Plutonium fuel obtained by reprocessing (also called mixed-oxide fuel or MOX) is two to three times more costly than uranium fuel. The use of MOX in France in 20 out of 58 reactors with 30% core loading produces less than 10 percent of its nuclear electricity.

Japan's new reprocessing plant, Rokkasho, will likely provide the most expensive nuclear power fuel in the history of nuclear power, close to about 3 cents (about 3.5 yen) per kilowatt hour of electricity. The major part of this is capital costs. Operating costs and fuel fabrication can also be expected to be significant. It would be much cheaper to not start up the plant and instead write it off. This is true not even taking into account decommissioning costs and high level waste disposal costs, reactor modification costs and other costs, such as added security costs of MOX, and assumes that the Rokkasho plant will operate well and process 1,000 metric tons of spent fuel per year.

2. Need for a repository. *Reprocessing does not decrease waste to be sent to a repository*. While vitrified waste is smaller in volume than the original spent fuel, reprocessing produces large quantities of intermediate level waste that, in France, must be disposed of in a deep repository. The total volume of vitrified and intermediate waste is considerably larger than the original spent fuel. Moreover, there is uranium left over that is contaminated with plutonium and other high activity radionuclides. (Uranium is 94 percent of the weight of spent fuel.) This, too, is radioactive enough to have to be disposed of in a repository. France sends at least some of its recovered uranium to Russia. No public documentation of what happens there is available. There is a near total lack of accountability on this. So, after accounting for the uranium, the intermediate waste (which should be disposed of in a WIPP-like deep repository because of its high specific activity), and the vitrified waste, the volume of waste destined for a repository ends up being far greater than the original spent fuel.

There is also the problem of spent MOX fuel. Most spent MOX fuel is generally not suitable for reprocessing, is hotter in terms of radioactivity and temperature than regular spent fuel, and a bigger problem for disposing of in a repository. The French do not reprocess it at present and will likely have to make provision for it in their repository disposal program. In the U.S. only 3 reactors, at Palo Verde in Arizona, were explicitly designed for MOX fuel use.

A repository is needed for long-lived wastes in all cases. France has a program that resembles Yucca Mountain. According to the French law there should be two sites. A potential one, where research is currently being conducted, is in a politically weak area. The characterization program has some strong points but many weak points and fails to address key issues. It is behind schedule. A search for a second one was canceled because of strong local opposition.

3. Plutonium. There is more than 200 metric tons of surplus commercial plutonium worldwide that have not been used as MOX. This surplus is building up each year. There are many reasons for this. MOX fuel is not made and used immediately. Many reactors need costly modifications to use MOX; some reactors cannot be modified. In France, about half of the reactors cannot be modified to use MOX. There are about 80 metric tons of surplus plutonium at La Hague in France and similar amounts at Sellafield in the UK. More than 30 metric tons are in Chelyabinsk in Russia, stored in tens of thousands of bins (similar to large sugar bins). Accounting for them is difficult. Japan had more than 200 kilograms of unaccounted-for plutonium in 2003.

If the plutonium is stored for too long (more than 5 years) it has to be reprocessed again to clean out the americium-241 that builds up. This is costly and problematic. Much of the stock cannot be used without further huge expenditures, which is a good reason to vitrify it. The surplus is building up each year even with existing reprocessing capacity.

4. Weapons proliferation. Japan has a large stock of separated plutonium, but has not yet used any as commercial power reactor fuel. Its program to do so has been stalled for years. Japanese politicians have spoken in recent years about making nuclear weapons. Japan's Labor Party chief, Ichiro Ozawa, suggested in 2002 that Japan could use its commercial plutonium to make thousands of nuclear weapons if China got too uppity. Most of Japan's separated plutonium comes from La Hague. Japan could become a full-fledged nuclear weapons state in approximately six months, according to IEER calculations.

5. Transmutation. Transmutation requires reprocessing. The leading candidate technology is called electrometallurgical processing, or pyroprocessing. It is not proliferation proof. Pyroprocessing produces impure plutonium but nonetheless it can be used to make nuclear weapons. The U.S. and other weapons states won't want it for weapons (it's too impure relative to weapons-grade) but terrorists and non-nuclear states might. It is much easier to hide than the PUREX technology. Pyroprocessing would do for reprocessing what centrifuges did for enrichment, but on a much more serious scale since it is much more compact than present reprocessing plants. Transmutation was not supported even in some pro-nuclear studies such as the recent MIT study on nuclear power.

6. Liquid waste discharges. Reprocessing creates huge volumes of liquid waste, far more than the original waste volume. In Europe, it is discharged to the sea. France and Britain, the two leading reprocessing countries, have contaminated seafood all the way to the Arctic. Many governments, such as Ireland and Norway, have asked France and Britain to stop their reprocessing discharges, so far to no avail. France and Britain do not count these discharges as waste due to an accounting trick since they are via a pipeline in the sea. If the waste were packaged in drums and thrown overboard from a ship, it would be illegal under international law.

7. High-level waste tanks. High-level liquid waste generated from reprocessing is not immediately vitrified. It is stored in stainless steel tanks that must be cooled. Loss of cooling for few days risks a catastrophic explosion. The 1957 explosion in the Soviet Union of a waste tank contaminated nearly 6,000 square miles. The land is still contaminated. There was complete loss of cooling for five hours in France due to a series of electrical system mishaps in 1980.

Presidents Ford and Carter initiated the U.S. policy to stop commercial reprocessing after India’s nuclear test in 1974. None has taken place in the U.S. since that time. The only commercial reprocessing plant in the U.S., near Buffalo, New York, was closed in 1972. Forgoing reprocessing makes economic sense and is good for non-proliferation and the public purse. Reprocessing should not be pursued.

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