NUCLEAR POWER

# Congress Tells DOE to Take Fresh Look At Recycling Spent Reactor Fuel

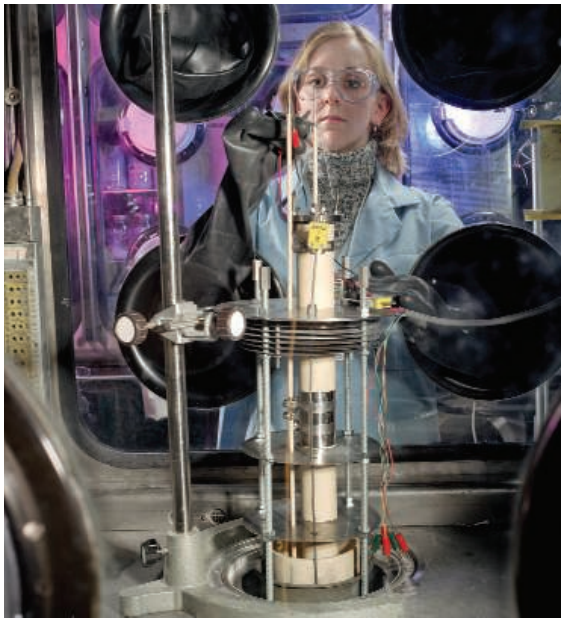
The United States is laying plans that could lead to recycling commercial nuclear waste into fuel for the first time in almost 30 years. But critics worry that such a boost for nuclear power could undermine global efforts to stop the spread of nuclear weapons.

The Department of Energy's (DOE's) new budget, signed by President George W. Bush last month, contains $50 million toward a goal of beginning construction on an engineering-scale reprocessing plant by 2010. Supporters say that recycling fuel could not only save time and money but also ease a mounting nuclear waste problem. Opponents dispute each of those points, adding that the technology needed is not yet at hand and that the United States, by recycling waste, would be sending the wrong signal to the rest of the world.

Researchers have explored reprocessing spent nuclear fuel rods since the dawn of the nuclear age. U.S. government officials pushed recycling commercial fuel in the 1960s when uranium was thought to be scarce and plutonium was considered a good fuel. Separating out the plutonium and uranium from other fissionable material also would reduce quantities of certain types of highly radioactive nuclear waste, thus in theory increasing the storage potential at the yet-to-be-built Yucca Mountain repository in Nevada. "The pursuit of [safe] recycling technologies … must be considered not just a worthwhile but a necessary goal," DOE Secretary Samuel Bodman said earlier this month.

But plutonium is also used in nuclear weapons, and critics say that producing more of it increases the likelihood that some will get into the wrong hands. The United Kingdom, France, and Japan use an aqueous method to recover uranium and plutonium from spent fuel rods. That technique, called PUREX, involves dissolving the rods with acid and chemically separating the two fuels. Japanese scientists have found that the approach is not economically viable, and the French experience has been mixed. Supporters also say reprocessing could forestall construction of an expensive second storage facility if, as projected, Yucca runs out of space within a decade—assuming the facility overcomes legal barriers to open.

With the growing interest in nuclear energy as an alternative to greenhouse gas–emitting technologies, scientists have developed advanced reprocessing techniques aimed at solving the waste issue without adding to the proliferation threat. One experimental approach, touted by scientists at DOE's Argonne National Laboratory in Illinois, is to use aqueous methods similar to PUREX with extra chemical steps to keep plutonium mixed with uranium and to retain nasty fission products that make the product too radioactive to steal. Another method, called pyroprocessing, employs electrochemistry to create a metal fuel that could include a fission product called cerium-144, which remains highly radioactive for 2 years. The fuel, which would be hot and therefore tough for thieves to handle, could theoretically be fed immediately into an adjacent reactor to provide power, say advocates. Argonne deputy associate lab director Phillip Finck says that radiation monitors and tight security could make both recycling methods proliferation-resistant.



**Reduce, reuse, recycle?** Argonne's Laurel Barnes studies a nuclear fuel reprocessing technique that converts oxide fuel to metal.

But Princeton University physicist Frank von Hippel and others dispute the advantages. Most U.S. spent fuel is about 20 years old, he points out, making the nonproliferation advantages of cerium in pyroprocessing "irrelevant for the spent fuel we have." Monitoring techniques to keep track of plutonium in a complex facility are woefully inadequate, says Edwin Lyman of the Union of Concerned Scientists in Cambridge, Massachusetts. Moreover, said Representative Edward Markey (D–MA) during a House debate in May, the current ban on reprocessing nuclear fuel "gives us the high moral ground as we look at the North Koreans and Iranians to tell them not to do it." In 1977, President Jimmy Carter halted federal support for commercial recycling after India used civilian reprocessing to obtain nuclear weapons.

Experts say the technology is likely to remain prohibitively expensive. A 1996 National Research Council study found that recycling existing U.S. spent fuel rods could cost up to $100 billion; building the fast reactors to burn recycled fuel obtained by pyroprocessing or by advanced methods would be a major element of that cost. A 2003 study by researchers at Harvard University and the University of Maryland found that reprocessing uranium using current industrial methods would be economical only if the cost of obtaining uranium were to increase by a factor of 10. Geologists have only recently begun to look for new sources, but former Argonne reprocessing specialist Milt Levenson says the price could soon rise if demand increases—although he says there are too many factors at play to make an economic argument for or against reprocessing.

Reprocessing could cut storage costs by keeping very-long-lasting isotopes in the fuel cycle, say supporters, allowing DOE to store the fission products with less long-term heat more compactly within Yucca. The Yucca repository is designed to store spent fuel rods in dry casks for 10,000 years. Opponents of reprocessing would prefer that U.S. utilities continue to follow that course—and that Congress expand Yucca only after exploring aboveground storage for fuel rods. Research on advanced recycling should continue, they add, but not at the risk of undermining diplomatic efforts to stop reprocessing abroad. If recycling methods show promise down the road, they say, spent fuel could be retrieved from Yucca and tapped for power. "We don't need to do it now. We don't have the technical knowledge to do it now," says physics Nobelist Burt Richter, a member of an American Physical Society technical committee that in May called for a cautious approach.

But growing energy demands require more nuclear plants, say supporters, and the waste problem needs reprocessing. "The federal government does a lot that isn't economical," says Representative Judy Biggert (R–IL), whose district includes Argonne, "often because doing so is in the best interests of the nation for other reasons." By giving DOE its marching orders, Congress has revived the debate over exactly what those interests are.

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