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Challenges of Plutonium Fuel Fabrication: Explaining the Decline of Spent Fuel Recycling

Recycling spent nuclear fuel –to recover plutonium from waste to reuse in fresh fuel –is in sharp decline. A main reason is that fabricating fuel with plutonium presents three enormous challenges: safety, security, and cost. This paper summarizes the findings of NPPP’s recent book, “Plutonium for Energy?”, the first comprehensive global study of using mixed-oxide (MOX) fuel in thermal nuclear power reactors that traditionally had used uranium fuel. Our team conducted research in all seven countries that have engaged in the commercial production or use of thermal MOX: Belgium, France, Germany, Japan, the Netherlands, Switzerland, and the United Kingdom. We found that five of the seven countries already had decided to phase out commercial MOX activities. This retreat is not due to the fuel’s early performance problems, which have been overcome, but to plutonium’s inherent dangers. Because plutonium is toxic, MOX fuel manufacturers faced public opposition and took extraordinary precautions that increased costs and reduced output. Five of the world’s six commercial production facilities for thermal MOX fuel have closed prematurely after underperforming. The price of thermal MOX fuel, in the six countries that have used it commercially, has been three to nine times higher than traditional uranium fuel. Due to environmental and proliferation concerns, plutonium fuel has proved politically controversial in four countries –Germany, Japan, Belgium, and Switzerland –which halted some or all MOX activities while permitting nuclear energy to continue at the time. Security is also a major concern, as each delivery of fresh MOX fuel contains enough plutonium for dozens of nuclear weapons, yet reactor operators have not significantly bolstered physical protection, and the shipments are susceptible to terrorist attack. Ironically, plutonium fuel originally was viewed as vital to the nuclear industry, but instead it has helped undermine the economics, security, and popularity of nuclear power. This paper concludes with lessons for countries that are engaged in, or contemplating, the recycling of plutonium for nuclear energy.

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United States of America

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