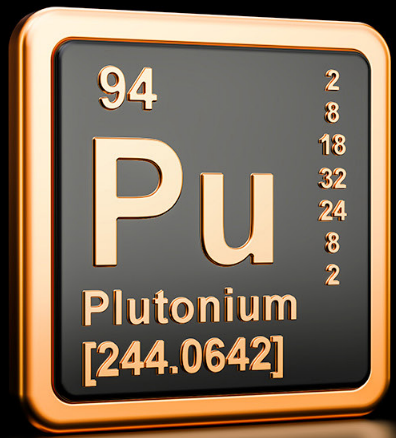
American Nuclear Society

Position Statement #47

Disposition of Surplus Weapons Plutonium



The American Nuclear Society (ANS) endorses timely disposition of surplus weapons-grade plutonium. The end of the Cold War led to universal recognition that both the United States and Russia possess stockpiles of weapons-grade plutonium that far exceed their defense requirements. In 1994 the then National Academy of Sciences stated the following: "The existence of this surplus material constitutes a clear and present danger to national and international security."[1] Russia and the United States held extensive discussions on plutonium disposition, culminating in a September 2000 agreement[2] to dispose of 34 metric tons of surplus weapons-grade plutonium in each country.

The U.S. Department of Energy (DOE) initiated a program to convert weapons-grade plutonium into mixed oxide (MOX) fuel and use it in existing light water reactors. In the process, some weapons-grade plutonium would be consumed with the remainder transformed into reactor-grade plutonium surrounded by highly radioactive fission products (i.e., used fuel). However, cost and schedule concerns arose, and the DOE canceled the program in 2018.[3] Now DOE intends to employ a "dilute-and-dispose" option,[4] by which the weapons-grade plutonium would be mixed with a classified material and then buried at the Waste Isolation Pilot Plant (WIPP), a geologic repository for transuranic waste in New Mexico. Dilute-and-dispose faces its own technical and regulatory challenges[5,6]; in addition, it does not destroy or isotopically degrade any of the plutonium.

Russia, the United States' original partner in plutonium disposition, did not concur that dilute-and-dispose is an acceptable means of plutonium disposition and withdrew from the agreement after the DOE announced its intent to switch methods. Given these considerations, ANS recommends the DOE reconsider its decision to bury the weapons-grade plutonium and evaluate in detail the option of using the material as fuel for advanced reactors—an alternative with a number of attractive attributes, which are discussed below.

Advanced reactors offer many potential advantages as a clean, safe, reliable energy source, and there is considerable public and private investment in bringing designs into operation.[7] Many advanced reactor designs employ a fast neutron spectrum in the reactor core, unlike current light water reactors, which are characterized by a slow (thermal) spectrum. Plutonium can be used as fuel in both fast and thermal reactors, but fast reactors are particularly well-suited for consuming plutonium-239 (the primary constituent of weapons-grade plutonium). If using uranium as a fuel, fast-spectrum advanced reactors would require a higher enrichment of their fuel than the 4- to 5-percent uranium-235 used in current reactors, and there are concerns over the availability of this high-assay low-enriched uranium (HALEU).[8] Using weapons-grade plutonium as fuel in fast reactors could help overcome the initial fuel availability obstacle to the development of some advanced reactor designs. Moreover, the surplus weapons-grade plutonium was produced at great U.S. taxpayer expense, and using it to produce clean energy would be far better than simply throwing it away.

From a nonproliferation perspective as well, using surplus weapons-grade plutonium as reactor fuel is superior to burying it the ground, as would be the case with dilute-and-dispose. Buried weapons-grade plutonium could theoretically be recovered and used again for nuclear weapons. Conversely, using the plutonium as advanced reactor fuel would destroy most of it, while the remainder would be isotopically degraded and part of a highly radioactive used fuel matrix that is unattractive for theft or diversion. Using surplus weapons-grade plutonium as fast-spectrum reactor fuel is consistent with the plutonium disposition approach planned by the Russian Federation. Russia withdrew from the plutonium disposition agreement after the United States announced its intention to switch to dilute-and-dispose, so a common approach for weapons-grade plutonium disposition between Russia and the United States could enable renewed cooperation on this important international nonproliferation program.

It should be acknowledged that any program involving the reuse of plutonium in nuclear reactors could face criticism from those opposed to a beneficial use of the material. In addition, states where surplus weapons-grade plutonium is now being or will be stored are important stakeholders in the ultimate means of disposition. With that being said, the United States expended vast resources to produce a large stockpile of weapons-grade plutonium and then invested additional resources in a program to dispose of the material before ultimately canceling that program. Rather than rushing to implement an alternative that has its own challenges and produces no benefit to the American people, the government should delay converting plutonium metal to plutonium oxide, reevaluate all of its options, and consider a program of using surplus plutonium as fuel for advanced reactors, with a primary focus on fast-neutron-spectrum reactors. Such a course of action could help bring advanced reactors to fruition while encouraging the resumption of U.S.-Russian cooperation on plutonium disposition.

References

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7. American Nuclear Society Position Statement 35, "Advanced Reactors," June 2018; https://cdn.ans.org/policy/statements/docs/ps35.pdf.

8. DOE/EA-2087, "Environmental Assessment for Use of DOE-Owned High-Assay Low-Enriched Uranium Stored at Idaho National Laboratory," January 2019; https://www.energy.gov/nepa/ea-2087-use-doe-owned-high-assay-low-enriched-uranium-stored-idaho-national-laboratory-bingham.

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