Dealing with Russia's Concerns about the Isotopics of Disposed Plutonium

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Senators Lindsey Graham and Tim Scott of South Carolina have interpreted remarks by Russian president Putin on the 2000 U.S.-Russian Plutonium Management and Disposition Agreement (PMDA) as requiring that the United States continue with the costly MOX project in South Carolina. President Putin objected to the less costly dilute and dispose approach proposed by the Obama Administration because the plutonium could be recovered and "converted into weapons-grade plutonium again."[1] RT reported a Rosatom spokesman explaining, "The only way to irreversibly turn plutonium into a material not usable in a nuclear weapon is by changing its isotope composition. Any chemical method is reversible."[2]

This position has little technical merit, because the plutonium that will be produced by Russia's disposal approach, irradiation in its BN-800 plutonium breeder reactor, may not be weapon-grade but it will be weapon-usable.[3] Furthermore, Russia, unlike the United States, intends to separate the plutonium in the irradiated BN-800 fuel and the weapon-grade plutonium produced in the plutonium-breeding blankets around the BN-800 core so that it can be reused, which will also make it susceptible again to diversion by non-state groups.[4] In the interim, the blanket assemblies would contain such a low admixture of fission products that the plutonium in them would have to be considered separated plutonium by the PMDA's low standard for a protective radiation field.[5]

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[1] "Moreover, only recently, they announced that they plan to dispose of their accumulated highly enriched nuclear fuel by using a method other than what we agreed on when we signed the corresponding agreement, but by diluting and storing it in certain containers. This means that they preserve what is known as the breakout potential, in other words it can be retrieved, reprocessed and converted into weapons-grade plutonium again. This is not what we agreed on. Now we will have to think about what to do about this and how to respond to this."
--Excerpt from a transcript of President Putin's April 7, 2017 [sic] "Truth and Justice" media forum attached to an open letter sent by Senators Graham and Scott to Secretary of Energy Moniz, 8 April 2016.

[2] "Plutonium mess: SC wrangling with DOE over nuclear waste facility, Russia grows angry," https://www.rt.com/usa/338987-plutonium-mox-carolina-putin/, 8 April 2016.

[3] "At the lowest level of sophistication, a potential proliferating state or sub-national group using designs and technologies no more sophisticated than those used in first-generation nuclear weapons could build a nuclear weapon from reactor grade plutonium that would have an assured, reliable yield of one or a few kilotons (and a probable yield significantly higher than that). At the other end of the spectrum, advanced nuclear weapon states such as the United States and Russia, using modern designs, could produce weapons from reactor grade plutonium having reliable explosive yields, weight, and other characteristics generally comparable to those of weapons made from weapons-grade plutonium." U.S. Department of Energy, *Nonproliferation and Arms Control Assessment of Weapons-Usable Fissile Material Storage and Excess Plutonium Disposition Alternatives,* DOE/NN-0007, Washington, D.C., January 1997, pp. 37 – 39.

[4] In the PMDA, Russia has committed, however, not to separate the disposition plutonium or the plutonium produced in the BN-800 blankets until all the 34 tons have been irradiated.

[5] The PMDA's requirement for the radiation level from an irradiated BN-800 fuel assembly is 100 rem per hour at 1 meter 30 years after discharge. The calculated radiation level for a radial blanket assembly is 13 rem per hour, Friederike Frieß and Moritz Kütt, unpublished calculation, 14 September 2014.

Nevertheless, if need be, Russia's insistence that the isotopics of U.S. excess weapon-grade plutonium be degraded could be dealt with at a much lower cost than through irradiation in MOX. As the report of DOE's Red Team on plutonium disposition pointed out, reactor-grade plutonium could be imported from the U.K. for blending with U.S. weapon-grade disposition plutonium in order to satisfy Russian concerns.[6] The report estimated that 3-9 MT of plutonium would need to be imported in order to achieve the PMDA standard for non-weapon grade of a Pu-240/Pu-239 ratio greater than 0.1.

Other stocks of reactor-grade plutonium are available around the world, including a Japanese-owned stockpile of 21 tons of plutonium (as of the end of 2014[7]) that is stranded in the U.K.because of the failed UK MOX program. Import of about 7 tons of this material would relieve Japan of part of its plutonium disposition burden and also assist the U.S. in proceeding with plutonium disposition in the most cost-effective manner.[8] Japan could well be willing to pay a modest sum for the U.S. to take this plutonium off its hands. Plutonium transport across the North Atlantic would be required but this would be safer than the ongoing transport of plutonium in MOX fuel between France and Japan.

If the U.S. assumed title to 7 tons of Japanese plutonium, its PMDA-related plutonium disposal problem would be increased from 34 to 41 tons to be disposed of in WIPP or another underground repository. This would still be a small challenge compared to having to convert the 34 tons of plutonium into reactor fuel and either finding or building reactors to irradiate it.

We recommend that NNSA begin studying the isotopic-dilution alternative and highlight it publicly as a possible approach should Russia continue to raise the issue. At a minimum, it would provide a clear and direct response to Russian's government and to those in the U.S. who support Russia's position.

[6] *Final Report of the Plutonium Disposition Red Team*, 13 August 2015, Appendix D.
[7] "The Status of Plutonium Management in Japan" (Japan Atomic Energy Commission, 21 July 2015)
[8] Assuming low-burnup (33 MWt-days/kgU) reactor-grade plutonium containing 56.62% Pu-239 and 23.18% Pu-240.