Fissile Materials Disposition

by

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Presented
at the

American Nuclear Society
Third Topical Meeting
on
DOE Spent Nuclear Fuel
and
Fissile Material Management

September 9, 1998
Charleston, SC

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I. Introduction.

It requires very little plutonium or highly-enriched uranium (HEU) to make a weapon. A one kiloton yield nuclear weapon can be made with as little as one to three kilograms of plutonium or three to eight kilograms of HEU.

There are tens of tons of separated plutonium and HEU at some 80 or more facilities at more than 50 sites in Russia. The material physical security and control and accounting (MPC&A) is inadequate at most of these facilities. There is an even larger and growing surplus of plutonium that has been separated from civil nuclear power reactor spent fuel in Europe and Japan. France, the United Kingdom, Japan and Russia continue to separate plutonium at a far greater rate than it is being burned in existing reactors. France and the U.K. are separating about 20 tonnes (t) of plutonium (Pu) per year, but only 9 t were recycled into fuel in 1997.[1] The U.K stockpile of separated civil plutonium (i.e., not fabricated into fuel or in use in reactors) now stands at 50 t and is projected to grow to 100 t by 2010.[2] The global inventory of separated civil plutonium is now an estimated 170 t—some 3.6 times the 47 t of plutonium reserved by the United States for weapons and comparable to stocks of plutonium reserved for weapons by all nuclear powers.

In both the military and civil sectors, neither the countries involved, nor the International Atomic Energy Agency (IAEA), are able to provide adequate material accounting of plutonium inventories at most of the facilities involved in the chemical separation of plutonium and the manufacture of weapons components or fabrication of civil mixed-oxide nuclear fuel—a mixture of plutonium oxide and uranium oxide, referred to as "MOX. " At present there is no way to determine through inventory procedures whether weapon quantities of plutonium are being diverted from these military and civil bulk handling facilities.

Currently, Iraq, Iran, North Korea and probably Libya are pursuing nuclear weapons. Iraq and North Korea have been caught violating their Nuclear Nonproliferation Treaty (NPT) and IAEA obligations. Terrorists attacks represent a growing threat, both in the frequency of attacks and kinds of explosives devices that are being used.

This is not the time to be promoting technologies that require the stockpiling of nuclear weapon-usable materials, or that utilize inherently unsafeguardable facilities.

Need for Global Accounting of Nuclear Weapons and Weapon-Usable Fissile Material

Transparency in the global stockpiles of nuclear weapons and weapon-usable fissile materials is needed demonstrate progress and fairness in ongoing arms reduction processes, to build confidence around the world that the reductions are significant and unlikely to be reversed, and to improve the MPC&A over scattered stock of fissile materials. Without full transparency, deep

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[1] Frank von Hippel, "How to Simplify the Plutonium Problem, *Nature*, July 30, 1998, p. 415.

[2] Ibid.

reductions in nuclear weapon arsenals become an impossibility. It is imperative that the United States and Russia play a leadership role in achieving greater transparency. It is outrageous that these two countries have done so little to promote increased transparency of the global stockpiles of nuclear weapon inventories in the almost seven years since the breakup of the Soviet Union.

Natural Resources Defense Council (NRDC) and the Federation of American Scientists began advocating an exchange of data on nuclear weapons and weapon-usable fissile material in the late-1980s. These proposals were subsequently endorsed by the Russian Foreign Ministry, and on February 12, 1992 Foreign Minister Andrei Kozyrev formerly proposed a reciprocal data exchange among all nuclear nations on inventories of nuclear weapons and fissile materials, and on nuclear weapons production, storage and elimination facilities. None of the other nuclear weapon states responded positively to this initiative, or offered constructive alternative proposals. On December 16, 1993, the German Foreign Minister Klaus Kinkel proposed the establishment of a nuclear weapon register as a logical extension of the UN registry of conventional arms.[3] The United States, United Kingdom and France opposed this effort. Finally after pressure from Congress, the Clinton administration endorsed the idea of a limited data exchange with the Russians.

In the National Defense Authorization Act for FY 1995 (Section 3155), Congress amended Section 144 of the Atomic Energy Act of 1954, to allow DOE and DOD to release restricted data and formerly restricted data, as necessary, to further fissile material and other weapons material control and accountability programs. In September 1994 Presidents Clinton and Yeltsin agreed to "exchange detailed information at the next Gore-Chernomyrdin Commission on aggregate stockpiles of nuclear warheads, on stocks of fissile materials and on their safety and security." Congress required that the data exchange be made through an agreement for cooperation similar to agreements the United States has with the United Kingdom and France. At the December 1994 Gore-Chernomyrdin meeting the United States tabled a draft agreement for cooperation and a draft list of warhead stockpile information that the United States was willing to exchange with Russia. In January 1995, U.S. Ambassador James Goodby tabled a proposed list of fissile material data to be exchanged. The Russian's initial response was that they needed more time to respond. By the fall of 1995, with no Russian counter proposals forthcoming and no agreement to resume negotiations it was clear that the Russians had cut off all negotiations to achieve an agreement for cooperation and an exchange of nuclear weapon and fissile material inventory data. With no sign of progress in sight, Ambassador Goodby, resigned in disgust. The United States apparently has not pressed the issue, and there has been no further progress in the last three years.

In June 1994, the United States publicly released historical data on the U.S. nuclear weapons stockpile, but refused to reveal the number of nuclear weapons currently in the stockpile.

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[3] See Harald Müller, "The Nuclear Weapons Register - A Good Idea Whose Time Has Come," Peace Research Institute Frankfurt, PRIF-Report No. 51, June 1998.

United States has done somewhat better with respect to publicly releasing its plutonium inventory data. In June 1994 DOE presenting a public accounting of the U.S. Government's plutonium stocks—a total of 99.5 tonnes (t) of plutonium. DOE has not provided the public with an update of its plutonium inventory reconciliation since 1994.

Despite a promise some four years ago to reconcile the U.S. production, removals and inventory of HEU, the Administration has yet to do so.

No other country, including Russia, has provided a public accounting of its weapon-usable fissile material inventories.

U.S. and Russian Declarations of Excess Fissile Material are Paltry

In 1994, when the United States announced that it had 99.5 t of plutonium, it also revealed that 85.2 t was weapon-grade plutonium (WGPu). But only about 69.7 t of this was in assembled weapons or assembled weapon pits at Pantex and Rocky Flats. Thus, when the U.S. declared with much fanfare that 52.5 t of plutonium was in excess of military needs, only 38.2 t was this was WGPu, and of this only about 22.7 t was in the form of plutonium pits. (Table 1) Thus, the United States declared as excess only about one-third of its assembled plutonium pits. Some 47 t of WGPu is being retained in some 15,600 plutonium pits, of which some 10,200 will remain in intact warheads under START II. (Table 2)

The Cold War is over. Why does the United States need 15,600 plutonium pits?

Russian has declared that 50 t of its WGPu is in excess of its military needs. Since the Russians refuse to declare their total WGPu inventory, their declaration of excess plutonium leaves others unsure of how much plutonium Russia is retaining for weapon purpose. I estimate that Russia has produced about 170 t of WGPu. Other estimates of Russian plutonium production are lower, but all substantive estimates indicate that Russia has significantly larger inventories of both weapon-grade and fuel-grade plutonium than does the United States.

In 1996 the U.S. and Russia agreed that "...disposition of U.S. and Russian excess weapons plutonium should proceed in parallel, with the goal of reductions to equal levels of military plutonium stockpiles."[4] Russia cannot dispose of its declared excess over the same period of time that the United States plans to take. Moreover, Russia will be left with substantially larger inventories of both weapon-grade and fuel-grade plutonium inventories. Thus, Russia's plutonium declaration does not comply with its 1996 agreement to proceed in parallel and to reduce to equal levels of plutonium retained for weapon purposes.

With respect to HEU, the United States has declared 174.3 t HEU excess, but only 83.3 t of this is metal. The United States is retaining as a strategic reserve enough HEU for 10,000 intact warheads, thousands of intact thermonuclear secondary components, plus enough

[4] "Joint U.S./Russian Plutonium Disposition Study," September 1996, Executive Summary, p. ExSum-2.

additional HEU to fuel the naval reactors for some 80 years or so, or to construct thousands of additional thermonuclear secondaries.

Russia has declared 500 t HEU from weapons as excess and has begun blending it down into LEU and selling it to the United States for power reactor fuel. But Russia refuses to declare its total HEU inventory. We believe Russia's total HEU inventory is several hundred tonnes larger than that of the United States. It is reasonable to conclude that Russia plans to retain for weapons more HEU than the United States plans to retain.

Dual-Track Disposition of Excess Plutonium

The United States is pursuing two approaches to reducing the weapons-usability of the excess plutonium—fabricating MOX fuel for once-through use in currently operating nuclear power reactors, and vitrifying the plutonium together with fission products in glass logs of the type planned for use in immobilizing military high-level radioactive wastes. The argument for implementing the two track approach in the United States is that the MOX option is the only option acceptable to the Russians, and its implementation in the United States will enhance the probability of success of the Russian program. Relative to the vitrification option the MOX option takes longer; it is more expensive; it is more dangerous; and its use encourages non-weapon states to rely on the more dangerous and inherently unsafeguardable closed fuel cycle for their civil power reactors. Despite this the DOE is planning to dispose of 33 t of U.S. excess plutonium via the MOX option and only 17 t via vitrification. Thirty-three tonnes is the maximum amount of plutonium DOE could dispose of as MOX. The other 17 t is in unsuitable forms. DOE proposes to build a MOX plant with a capacity to utilize 3.5 t of surplus plutonium per year.[5]

The United States and Russia completed a "Joint United States/Russian Plutonium Disposition Study" in September 1996. In this study Russia is on record as agreeing that, "The United States and Russia need not use the same [plutonium] disposition technology."[6] Thus, there is no compelling argument for allocating most of the U.S. excess plutonium to the MOX alternative. The U.S. and Russian disposition options are not so inextricably linked to require the maximum possible amount of U.S. excess plutonium to be converted into MOX. NRDC believe the United States should placed a much higher priority on implementing the vitrification option in both countries.

One week ago, on September, 2, 1998, Presidents Clinton and Yeltsin signed an agreement that directs officials in both countries to draw up detailed plans and schedules for each country to dispose of 50 t of excess plutonium. The U.S. already has detailed plans, so this agreement effectively applies only to Russia. We do not believe that the Russian MOX program will be implemented in a timely manner. Russia does not have a MOX fabrication plant with adequate capacity, nor funds to construct one. Various proposals for constructing a MOX fabrication plant in

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[5] DOE FY 1999 Congressional Budget Request, February 1998, Volume 1, p. 731.

[6] Ibid.

Russia have been floated by U.S. and Russian officials, but none nail down the financing. One U.S. proposal is for the U.S to build a plutonium conversion plant and for Russia to finance the construction of a pilot MOX fabrication plant with money saved by the displaced low-enriched uranium fuel. Russia, France and Germany have a joint proposal for constructing a pilot MOX plant with a capacity of 1.3 t of plutonium annually, sufficient capacity to supply fuel for four VVER-1000 plants operating on ~1/3 MOX cores (0.25 t Pu/reactor-y) and the BN-600 with a partial MOX core loading (0.3 t Pu/y). This proposed pilot plant has a capacity of only 37 percent of the proposed U.S. MOX plant. Moreover, Russia proposes to dispose of all of its excess plutonium by MOX, whereas the United States plans to dispose of 63 percent of its plutonium by MOX. Clearly, the Russian program is not keeping in pace with the U.S. program even on paper. Moreover, the rate of conversion of plutonium using the proposed 1.3 t Pu/y pilot MOX fabrication plant is too slow in light of the fact that Russia is currently, and plans to continue, separating plutonium from VVER-440 power reactors and three plutonium production reactors at an even a higher rate.

France and Germany are interested in constructing the Russian MOX pilot plant provided that someone else pays for it. To date the United States has refused to finance the Russian plant and is unlikely to do so. While we can look forward to some novel financing schemes, in the end, we do not believe the financing for the Russian MOX plant will be forthcoming. In sum, the Russian plutonium disposition program appears to be thoroughly bankrupt, but neither the United States nor Russia will admit it.

The current DOE policy is not to construct the U.S. MOX fabrication plant unless there is "significant progress with Russia on plans for plutonium disposition" by the end-FY 2000 [September 30, 2000].[7] Since no progress in Russia is the most likely outcome, there may be little or no U.S. plutonium converted into MOX for years to come.

Chemical Separation Plants at Savannah River Site

The two chemical separation plants, F and H canyons, at the Savannah River Site are now over 40 years old. These plants are expensive to operate, hazardous and dirty. Their continued operation for waste management purposes undermines efforts to wean the world away from the commercial use of separated plutonium. During the Cold War, DOE made sure that these and other DOE weapon facilities were exempt from the more stringent radiation protection regulations of the Nuclear Regulatory Commission (NRC) and Environmental Protection Agency (EPA). The separation plants also cannot meet the requirements of the Resource Conservation and Recovery Act (RCRA).

DOE policy in recent years has been to use of the canyons for the limited purpose of processing materials that represent an immediate health or safety concern. DOE made this clear

[7] Statement of Howard Cantor, Acting Director, Office of Fissile Material Disposition, at the Council on Foreign Relations "The Management and Disposition of Excess Nuclear Weapons Material," March 9, 1998.

in 1996 Record of Decision for the Final Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel:[8]

> . . . DOE is phasing out its chemical separation activities and is currently conducting chemical separations only at the Savannah River Site to stabilize materials for health and safety reasons.

Some people at DOE, SRS, and the Defense Nuclear Facilities Safety Board as well as congressional representatives from South Carolina do not accept this policy and would like to keep the canyons operating for as long as possible. DOE has recently invited other DOE sites to identify what additional waste materials might be processed through the canyons. As a consequence, some at DOE are now proposing to use the canyons to recover plutonium from wastes generated at the Rocky Flats plant. DOE claims that moving Rocky Flats waste to the Savannah River Site (SRS) and processing some of it through the canyons will save about a billion dollars. This appears inconsistent with the previously policy of limiting canyon processing to stabilizing materials that represent an immediate health and safety threat.

Approximately 315 kilograms of the Rocky Flats waste consists of plutonium fluoride residues containing an estimated 142 kg of plutonium. Because this waste contains fluorides, it is a RCRA regulated waste. Since the F and H canyons are not qualified to handle RCRA wastes, the proponents of the Rocky Flats waste transfer plan are proposing to redefine the waste as "feedstock" to avoid RCRA requirements. This material has been treated as a waste material since the early 1990s. It is not a feedstock, since the product of the chemical separation process is plutonium, a waste. United States policy is that, "The United States does not encourage the civil use of plutonium, and accordingly, not to itself engage in plutonium reprocessing for either nuclear power or nuclear explosive purposes..."[9] Consequently, there are know foreseeable military or commercial uses of the plutonium.

It should come as no surprise that DOE can save money by not complying with environmental regulations. NRDC will oppose any plan to redefine the waste to avoid RCRA compliance.

High-Level Waste Tanks

DOE has begun to withdraw and vitrify the high-level waste (HLW) in the 51 large subsurface steel tanks at SRS. DOE is unable to remove all of the HLW from the tanks, and does not want to dig up and dispose the tanks and the residual HLW. Two tanks already have been "closed," that is, most of the waste has been removed, and the tanks have been filled with grout and

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[8] Federal Register, May 17, 1996, p. 25101.

[9] The President's [Clinton] Nonproliferation and Export Control Policy, September 1993. See also, DOE, Record of Decision, for the Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement, January 145, 1997.

left in place. DOE plans to follow the same procedure with respect to the remaining 49 tanks at SRS and the 177 HLW tanks at the Hanford Reservation. SRS is proposing a performance objective for cleaning out the HLW tanks that would permit DOE to leave several hundred thousand curies of cesium-137, several million curies of Sr-90, and some 100 kilograms of plutonium in the 51 tanks at SRS. On other words, SRS proposed to permit DOE to leave behind the equivalent of tonnes of high-burnup power-reactor spent fuel in the HLW tanks.

Under Section 202(4) of the Energy Reorganization Act of 1974 ("ERA"), as amended,[10] the NRC has licensing authority over the disposal of all HLW. To avoid NRC licensing, DOE proposes to reclassify any radioactive waste remaining in the HLW tanks as "incidental waste," and to exempt such "incidental waste" from NRC licensing authority. To suggest that the equivalent of tonnes of spent fuel is "incidental" and should be treated as low-level radioactive waste is laughable.

NRDC also believes this approach is illegal. On July 28, 1998, NRDC petitioned the NRC to and exercise immediate licensing authority over all HLW stored in the 51 tanks at SRS. In its initial response of August 28, 1998, the NRC staff said it will defer a final response to the NRDC petition and would not exercise licensing authority over the tanks, pending the completion of an ongoing NRC review of the DOE methodology for classifying the residual waste in the tanks.

[10] 42 U.S.C. § 5842(4).