

REDUCING INVENTORIES OF WEAPONS PLUTONIUM: WHAT ARE THE CHALLENGES?

By Neil J. Numark

Published in *Energy Review*, No. 203, December 1997

Fifteen years ago, when Ronald Reagan sat in the Oval Office and Leonid Brezhnev in the Kremlin, the threat of nuclear war loomed large in the public eye; a poll taken at the time showed that 58% of American adults were "very concerned" over the issue. Public concerns reached a peak in the summer of 1982, when peace demonstrations occurred throughout the United States including a huge one in New York City that was described as the largest peace protest in U.S. history. But these events had little real impact on nuclear weapons policy at a time when the U.S. President saw the Soviet Union as an "evil empire" and the prevailing view in both governments was that it was necessary to maintain large inventories of nuclear weapons.

Today, with Cold War tensions having subsided, our governments have already agreed to dismantle a large share of these weapons and public concerns have greatly abated. The public complacency is unfortunate since our arsenals of nuclear materials removed from the weapons are nearly as large and menacing as ever; the low public awareness or concern is also somewhat puzzling, considering that terrorists or rogue states might now be able to acquire and use these stored loose nukes and the risks to humanity could be greater than the risk ever was of nuclear war.

Perhaps as a result of the low public concern, but also due to competing arms control priorities, our governments have not made an international priority of permanently getting rid of these materials so that they can never again be used in weapons, either by making firm commitments to disposition the vast majority of the materials or by agreeing on ways to pay for such disposition programs. This analysis offers some observations on these two principal challenges in reducing weapons plutonium inventories, as well as additional challenges resulting from disagreement over what technologies and facilities should be used, and makes recommendations on possible steps forward.

In approximate order of importance, the challenges may be summarized as follows:

1. **There is still not a sufficient commitment by either the United States or Russia to reduce WPu inventories significantly.**

The most important step the United States and Russia could take toward significantly reducing their inventories of weapons plutonium is, quite naturally, to *agree formally* to make such reductions. However, despite signs that Presidents Yeltsin and Clinton would like to make such a commitment, it remains an elusive goal. **There have been higher priorities on the arms control agenda**, and although there is continuing progress in addressing these, it has been a slow and bumpy road. The Russian Duma has not yet even ratified START II, which will commit both sides to large cuts in deployed warheads. Conservatives there have opposed the treaty, particularly in the face of NATO's eastward expansion, uncertainty about financing the replacement of multiple-warhead missiles banned under START II with single-warhead ones, and concerns that U.S. conservatives still wish to develop anti-missile defenses. (Such defenses

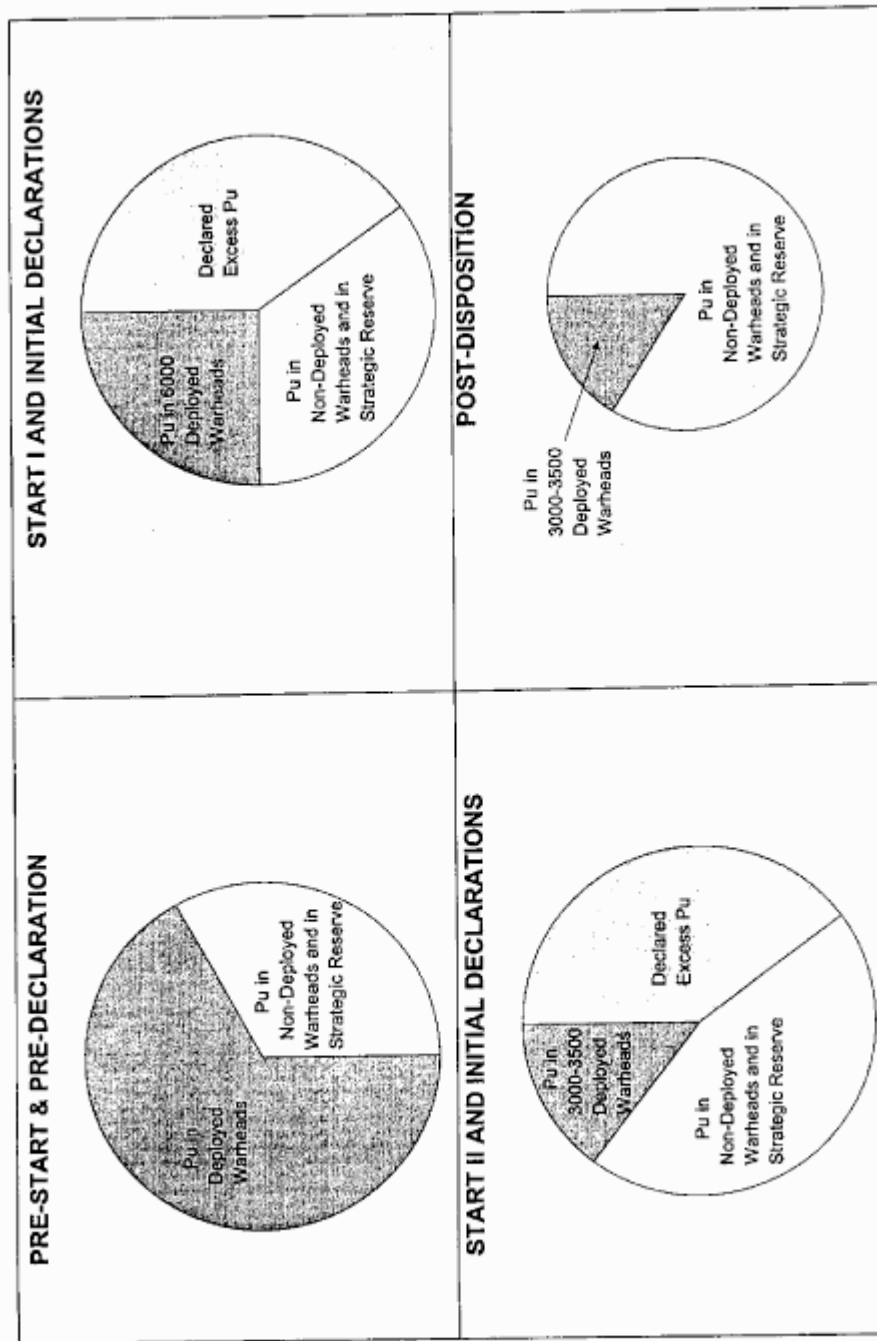
have been avoided in the past out of concern that one side could launch a nuclear first strike against the other if they had a protective shield against retaliation.) Other high priorities have included the Comprehensive Test Ban Treaty; efforts toward an international treaty banning further production of weapons material; and improving the security over stored ex-weapons fissile materials.

Beyond these competing arms control issues, there has also been only modest progress in declaring sufficient portions of our stockpiles of weapons materials to be in excess of national security needs, in light of the large reductions in deployed warheads agreed under START. President Clinton made a unilateral declaration in March 1995 that 200 tons of U.S. fissile material would be permanently withdrawn from the nuclear stockpile (see box below).¹ There are indications that President Yeltsin will soon reciprocate.² However, these declared excess amounts will probably be less than half of our total inventories, even though the number of deployed warheads will be cut by a much larger factor after START II takes effect (see Figure 1). A recent report by the U.S. General Accounting Office found that the U.S. Departments of Defense (DOD) and Energy (DOE) now believe that "each active warhead needs to be supported either by a backup warhead... or by plutonium in the strategic reserve" because they assume a 100-percent failure rate for active warheads (see Table 1).³ DOD and DOE could not technically justify these assumptions, which clearly seem to leave far too much WPU in the military stockpile.

U.S. INVENTORY OF SEPARATED PLUTONIUM	
Weapons-Grade Plutonium	85.0 MT
Fuel-Grade Plutonium	13.2 MT
Reactor-Grade Plutonium	1.3 MT
Source:	<i>Plutonium: The First 50 Years</i> , U.S. Department of Energy, DOE/DP- 0137, February 1996.
FISSILE MATERIAL DECLARED EXCESS BY PRESIDENT CLINTON	
Weapons-Grade Plutonium	38.2 MT
Highly Enriched Uranium	174.3 MT
TOTAL	212.5 MT
Source:	U.S. Department of Energy, Fact Sheet, "Department of Energy Declassifies Location and Forms of Weapons-Grade Plutonium and Highly Enriched Uranium Inventory Excess to National Security Needs," February 6, 1996.

¹ President Bill Clinton, speech at Nixon Center for Peace and Freedom Policy Conference, March 1, 1995.
² Russia has not yet declared how much fissile material is excess to national security needs. President Yeltsin recently asked an interagency committee to make a recommendation on such declaration. However, it should be noted that Russia has already committed to sell 500 MT of HEU to the United States.
³ U.S. General Accounting Office, *Department of Energy: Plutonium Needs, Costs and Management Programs*, GAO/RCED-97-98, April 1997.

FIGURE 1: CURRENT FRAMEWORK FOR WPu INVENTORY REDUCTIONS



October 1997

3

Numark Associates, Inc.

Table 1: U.S. DOE/DOD Uses of Plutonium

Allocation	Principle Uses
1. Active Nuclear Weapons Stockpile	Warheads in active nuclear weapons
2. Inactive Nuclear Weapons Stockpile	
a) Augmentation Warheads	Warheads in storage that could be returned to the active stockpile
b) Reliability Replacement Warheads	Warheads stored for replacing active stockpile warheads if they develop reliability or safety problems
c) Additional Warheads	Warheads stored to replace active stockpile warheads intentionally destroyed during quality assurance and reliability testing
3. Strategic Reserve	Plutonium stored to replace failed active warheads is there is no backup in the inactive stockpile
4. Mutual Defense and Research and Development	Plutonium held to support agreements with allied countries and DOE's research and development programs

Source: *Department of Energy: Plutonium Needs, Costs, and Management Programs*, U.S. General Accounting Office, GAO/RCED-97-98, April 1997, p. 8.

Despite this discouraging context, some positive developments must be acknowledged:

1. Warheads are being eliminated anyway despite the absence of any agreement to do so. Both sides have already been dismantling at a rate of 1,500-2,000 per year each, and efforts have begun to disposition some of the highly-enriched uranium (HEU) contained within them.
2. As a result of recent progress on high priority arms control issues, the agenda can hopefully now shift to addressing total inventories of warheads as well as fissile materials. For example, in a somewhat backward sign of progress, Presidents Clinton and Yeltsin reached agreement at Helsinki in March 1997 to defer the deadline for START II compliance by five years, to the end of 2007, thus improving the prospects for Russian ratification of the treaty. More recently, Vice President Gore and Prime Minister Chernomyrdin agreed in September 1997 that Russia would, with U.S. funding, modify three reactors to stop producing WPU within three years.⁴ Gore and Chernomyrdin also expressed a desire to cooperate in reducing plutonium stocks in the future. Finally, Secretary of State Albright and Foreign Minister Primakov signed a protocol in September clarifying commitments concerning anti-missile defenses.
3. Presidents Clinton and Yeltsin have agreed to work towards an agreement on warhead elimination as a part of a future START III treaty that would seek further cuts in deployed warheads. At Helsinki in March 1997, the Presidents agreed that

⁴ Agreement Between the Government of the United States of America and the Government of the Russian Federation Concerning Cooperation Regarding Plutonium Production Reactors, September 23, 1997.

START III would include "measures relating to the transparency of strategic nuclear warhead inventories and the *destruction of strategic nuclear warheads*."⁵(emphasis added).

4. There is now extensive technical cooperation between the United States and Russia to analyze the technologies of interest for WPu disposition. The United States reached a tentative decision in January 1997 to pursue a dual track involving irradiation of WPu as mixed-oxide (MOX) fuel in existing reactors, and immobilization. The Joint Plutonium Disposition Steering Committee has made progress on technical cooperation and demonstrations of MOX and immobilization technologies.

5. President Yeltsin appears to be increasingly interested in WPu disposition. Yeltsin suggested last year the formation of the U.S.-Russian Independent Scientific Commission on Disposition of Excess Weapons Plutonium, co-chaired by Professor John Holdren of Harvard University and Academician Evgeny Velhikov, Director, Kurchatov Institute). The Commission issued its final report June 1997⁶, before the Denver "Summit of the Eight." On the basis of these recommendations Yeltsin appointed Academician Velhikov to head a new Interagency Standing Committee on Plutonium Disposition, directing this committee to make recommendations by October 15 on:
 - 1) a disposition path for excess WPu;
 - 2) a U.S.-Russian agreement on excess WPu disposition; and
 - 3) declaration of the amount of excess WPu in Russia.

Considering the forceful recommendations of the Holdren-Velhikov group on these three fronts (see box below) and the fact that Yeltsin asked Academician Velhikov to lead the new Interagency Standing Committee, it seems highly plausible that Yeltsin will seek to move forward with significant steps towards WPu inventory reductions.

Notwithstanding these positive signs, there clearly is not yet a strong enough commitment to irreversibly destroy material, nor enough momentum to make significant reductions in WPu inventories. There is still a mindset on both sides -- based on an enduring concern over nuclear parity -- that holds back progress, and in light of these concerns in both governments, it appears that Presidents Clinton and Yeltsin are proceeding cautiously. Although the United States has already declared that 50 MT of WPu is excess to national security and it appears that the Russian Federation is preparing now to reach a similar finding, it is unclear how long it will be before an agreement is reached committing both nations to eliminate these excess inventories by a date certain. In any case these levels would still leave a very large inventory behind, including a great

⁵ Fact Sheet: Joint Statement on Parameters on Future Reductions in Nuclear Forces, White House Office of the Press Secretary, March 21, 1997.

⁶ *Final Report of the US-Russian Independent Scientific Commission on Disposition of Excess Weapons Plutonium*, June 1, 1997 (co-chaired by Professor John Holdren, Harvard University, and Academician Evgeny Velhikov, Director, Kurchatov Institute).

deal of material not contained in deployed weapons. The two presidents have agreed to begin focusing on destroying warheads as part of the START III process, but this could move very slowly and still might not, in any case, require the disposition of WPu contained in the warheads.

HIGHLIGHTS OF U.S.-RUSSIAN INDEPENDENT SCIENTIFIC COMMISSION'S RECOMMENDATIONS

- 1) Methods of disposition: *The United States has made a formal statement of its intention to pursue [a] dual-track approach to plutonium disposition [using the plutonium in MOX fuel for nuclear power reactors, and vitrifying plutonium together with fission product wastes]... The Russian government should now make a corresponding formal statement of its intention to pursue this dual-track route. Indeed, we recommend that the United States and Russia agree on a joint document formally indicating their mutual intention to pursue this dual-track route at the fastest rate consistent with the availability of funds to do so.*
- 2) U.S.-Russian agreement: *The United States and Russia should begin discussions with the goal of reaching a formal agreement governing plutonium disposition.*

The U.S. and Russian programs of... disposition... should continue to proceed in parallel, seeking to complete comparable steps in this process on comparable time scales, and to reach equivalent remaining quantities of plutonium and HEU in the two military stockpiles.
- 3) Declaration of excess plutonium: *Russia, like the United States, should begin declaring specific quantities of nuclear material to be excess to its military needs. We hope that declarations of further material as excess will occur regularly in the future on both sides.*
- 4) Implementation of WPu disposition: *The U.S. and Russia should move promptly to select, authorize, fund, and bring to the point of operability [both the MOX and immobilization approaches]... The two governments should establish appropriate managerial structures -- one in each country, as well as an international framework for managing joint activities -- to be responsible to the Presidents... Contracts should be sought with existing European MOX fabrication plants to produce initial batches of WPu MOX for U.S. and Russian reactors, while MOX fabrication facilities in the U.S. and Russia are being prepared...*
- 5) Financing: *We recommend that financing for cooperative activities related to plutonium disposition be immediately and substantially increased... The issue of financing of plutonium disposition in Russia is probably the single largest barrier to accomplishing the plutonium disposition mission... A plan should be developed and implemented for international cooperation in financing the needed facilities in Russia.*

2. **The Russian government does not currently have sufficient financial resources to move forward with disposition, nor is there a clear international financial solution in sight.**

It is generally assumed that the international community, particularly the G-7 countries, will be required to fund programs for the disposition of Russian WPu, while the U.S. will pay its own costs. Unfortunately, the G-7 countries have made virtually no progress in considering funding mechanisms. This appears to reflect public complacency and the fact that the United States and Russia still have not made WPu disposition a major disarmament priority.

Whatever the reason, it has been difficult to elevate the importance of the issue sufficiently to get the G-7 nations to do anything. There had been expectations that this process could begin at the

June 1997 Summit of the Eight in Denver, but the issue of WPu disposition only received brief mention in the final communiqué. The foreign ministers' report from the summit addressed the question of funding only indirectly, stating that their "Non-Proliferation Experts Group should begin discussion of possible arrangements for coordinating and implementing plutonium management efforts." However, since Denver the NPEG has not yet even met.

Given that international financial assistance is needed, another hurdle that must be passed before Russian disposition can begin -- in addition to simply coming up with the money -- is for Russia and the funding countries to reach agreement on the *conditions* for such international assistance, which may not be easy because of different perspectives on the problem. In comparison with Russia, the United States and other G-7 countries seem to have a greater sense of urgency concerning the disposition of weapons materials, even though both sides presumably have an equal interest in reducing the other side's arsenals. This disparity probably stems from international concerns over the degree of security over fissile materials within Russia, as well as doubts over the adequacy of material accountancy. The U.S. National Academy of Sciences' 1994 assertion that surplus fissile material presented a "clear and present danger" was based on concerns over serious risks of theft of nuclear weapons or fissile materials in the former Soviet Union.⁷ Russia, in contrast, may have sufficient confidence in U.S. security and accountancy over stored fissile materials that they are in no great hurry to rid the U.S. of its excess WPu, or may simply have higher priorities given its current economic difficulties.

As a result, the United States seems to be leading the charge, and perhaps even pushing Russia to commit to a WPu disposition program. In the U.S., arguments in favor of early and rapid WPu disposition efforts usually include the statement that such activity will encourage the Russians to do the same thing. This is intended to dispel fears in Congress and elsewhere that the U.S. proposes to reduce arsenals too quickly and unilaterally. For example, the U.S. Department of Energy's January 1997 "Record of Decision" announcing its dual-track strategy for WPu disposition, states that:

Disposition of the surplus plutonium will serve as a nonproliferation and disarmament example, encourage similar actions by Russia and other nations, and foster multilateral or bilateral disposition efforts and agreements.⁸

U.S. officials have also been careful to point out that reductions must happen in both countries simultaneously. For example, President Clinton's Science and Technology advisor stated in 1995 that "neither the U.S. nor Russia is likely to be willing to eliminate its stockpile of thousands of bombs' worth of excess plutonium while the other side keeps its stockpile in reserve. So this job is going to be done together, or not at all."⁹

⁷ U.S. National Academy of Sciences, Committee on International Security and Arms Control, *Management and Disposition of Excess Weapons Plutonium*, National Academy Press, January 1994.

⁸ U.S. Department of Energy, *Record of Decision for the Storage and Disposition of Weapons-Usable Fissile Materials, Final Programmatic Environmental Impact Statement*, January 14, 1997.

⁹ John H. Gibbons, Assistant to the President for Science and Technology, "Managing Nuclear Materials in the Post-Cold-War Era," *Second International Policy Forum: Management and Disposition of Nuclear Weapons Materials*, Lansdowne, Virginia, March 22, 1995.

The fact that the United States (and others) are pushing for action could embolden Russia to shape the terms for moving forward, particularly to seek the greatest possible degree of economic assistance from other countries, possibly even to include support for building new Modular Helium Reactors or CANDU reactors. Meanwhile, the U.S. has already put forth its own set of conditions for any Western assistance to WPu disposition in Russia: 1) that MOX fuel fabrication facilities built to process surplus WPu must be used only for that purpose and will not process civilian Pu; and 2) that spent MOX fuel resulting from the WPu disposition program will not be reprocessed, at least until all WPu has been dispositioned. In an encouraging sign, the Holdren-Velikhov Commission, in its June 1, 1997 report, recommended that the United States and Russia agree to these two conditions.

Thus, it is not only that the international community must come up with the money for Russian WPu disposition; there may also be hurdles in setting parameters for the Russian program that will be acceptable to both sides. Of course, the United States will not move very far with its own disposition programs without corresponding progress in Russia.

3. **There are not enough facilities within Russia for rapid disposition of the large inventory of WPu.**

It is generally assumed that disposition will take place within the United States and Russia, despite some limited consideration that has been given to burning WPu in "third countries" that either have existing infrastructure for Pu fuel utilization or the ability to adapt facilities for the purpose, particularly Canada. Unfortunately, while it appears that the United States has sufficient reactor capacity and will have the necessary immobilization facilities to disposition its surplus WPu inventory within two decades or so, Russia -- which has more WPu than the United States and should therefore disposition its inventory at a faster pace -- has few reactors suitable for burning MOX fuel made from WPu (see Table 2) and currently no financial ability to construct a MOX fuel fabrication plant. Relatedly, the U.S. will likely be ready to begin disposition sooner than Russia.

Table 2: Russian Operating Reactors Suitable for WPu Disposition

Reactor	Type	MWe	Design
Balakovo-1	PWR	950	VVER-1000
Balakovo-2	PWR	950	VVER-1000
Balakovo-3	PWR	950	VVER-1000
Balakovo-4	PWR	950	VVER-1000
Beloyarskiy-3	LMFBR	560	BN-600
Kalinin-1	PWR	950	VVER-1000
Kalinin-2	PWR	950	VVER-1000
Novovoronezhskiy-5	PWR	950	VVER-1000

Source: International Nuclear Safety Center

Third-country disposition scenarios could add a great deal of reactor capacity and would take advantage of the best-equipped facilities. However, the only such third country that has thus far shown a serious interest is Canada, which has proposed a scenario in which both Russian and U.S. WPu would be burned in CANDU reactors operated by Ontario Hydro, but even this

scenario would require complex negotiations among the three nations, which thus far do not appear to be moving forward. One of the difficulties with this proposal is that it would require the United States to abandon its current intention of finding U.S. reactor operators willing to burn WPu, which could be a great disappointment to several companies who have made substantial efforts to prepare for this program.

Another third-country scenario would be for Russia to send some of its WPu to suitable reactors in the Ukraine having the same design as the Russian reactors that would be used for the purpose (see Table 3). However, the Ukrainian government has not expressed a position on such involvement in WPu disposition.

Table 3: Ukrainian Operating Reactors Suitable for WPu Disposition

Reactor	Type	MWe	Design
Khmel'nitsky	PWR	950	VVER-1000
Rovno-3	PWR	950	VVER-1000
South Ukraine-1	PWR	950	VVER-1000
South Ukraine-2	PWR	950	VVER-1000
South Ukraine-3	PWR	950	VVER-1000
Zaporozhye-1	PWR	950	VVER-1000
Zaporozhye-2	PWR	950	VVER-1000
Zaporozhye-3	PWR	950	VVER-1000
Zaporozhye-4	PWR	950	VVER-1000
Zaporozhye-5	PWR	950	VVER-1000
Zaporozhye-6	PWR	950	VVER-1000

Source: International Nuclear Safety Center

Apart from the Canada and Ukraine scenarios, other third-country scenarios are plausible that would take advantage of existing worldwide infrastructure for civilian Pu utilization. This could mean either an increase in the extent of Pu utilization -- i.e., more reactors taking MOX fuel -- or a substitution of WPu for further separation of civilian Pu (so as to avoid a buildup of civilian separated Pu in exchange for WPu). Unfortunately, neither of these scenarios is attractive to the affected industries. An increase in Pu utilization would require utilities, e.g. in Europe or Japan, to handle additional MOX fuel and fuel that contained weapons-grade Pu, which they do not wish to do. And, unfortunately, it would be very difficult to convince countries with successful reprocessing industries to defer reprocessing to make way for WPu, given the important employment and trade benefits. It would also require utilities that currently ship spent fuel to reprocessing facilities after only a few years of storage to find ways to provide long-term storage of spent fuel instead. Furthermore, both of these scenarios are complicated by the fact that, besides WPu, there is also a significant standing inventory of civilian separated Pu awaiting MOX fabrication and disposition. For example, the United Kingdom currently has approximately 45 metric tons in storage (resulting from the reprocessing of fuel from its gas reactors) and no plans to utilize it.

4. **Anti-nuclear groups have generated confusion over the MOX option.**

On the U.S. side, as noted above, the Democratic Clinton Administration has tentatively approved a dual-track strategy involving both WPu immobilization and irradiation as MOX fuel. But some of the groups who oppose civilian plutonium utilization -- most notably Greenpeace and the Nuclear Control Institute -- fear that a limited U.S. program to consume existing WPu in nuclear power plants would lead to reprocessing of spent fuel and recycling of civilian plutonium within the United States, and possibly would help other countries already using civilian plutonium to justify their activities. These groups will therefore continue to appeal to the Clinton Administration to reject the MOX option, and will fight its implementation by trying to raise public opposition even after the Administration gives its final blessing to MOX.

In fact, there is no evidence that a limited WPu-MOX program would lead to further reprocessing, and there have been clear statements from the Clinton Administration concerning the limited scope of the proposed MOX program. For example, the Administration's January 1997 Record of Decision announcing the dual-track strategy stated that:

implementing the MOX alternative would include government ownership and control of the MOX fuel fabrication facility at a DOE site, and use of the facility only for the surplus plutonium disposition program. There would be no reprocessing or subsequent reuse of spent MOX fuel...

The use of MOX fuel in existing reactors would be undertaken in a manner that is consistent with... the United States' policy¹⁰ discouraging the civilian use of plutonium... Extensive measures will be pursued... to ensure that federal support for this unique disposition mission does not encourage other civil uses of plutonium or plutonium reprocessing.¹¹

Moreover, there is at best only an extremely remote possibility that U.S. utilities would have any interest whatsoever in having their spent fuel reprocessed after this mission is completed, by which time many of the now-existing reactors within the U.S. will have already shut down. The reality is that a limited U.S. MOX program for WPu disposition can and would be established by the Clinton Administration that would have no impact on civilian plutonium recycling either in the United States or abroad. Groups advancing the opposite view are focused on cessation of all civilian plutonium utilization, not on nuclear disarmament, and will therefore continue to oppose the MOX option in the United States even though it would be at the expense of the United States' and Russia's abilities to move forward quickly with arsenal reductions. This single-issue focus prevents them from acknowledging that MOX technology is valuable to disarmament and from accepting its use simply because it is the same technology that is used for civilian plutonium programs.

Other disarmament and non-proliferation experts who have also been frequent critics of the

¹⁰ President Clinton's September 27, 1993 Non-Proliferation and Export Control Policy, announced in an address to the United Nations, stated that "the United States does not encourage the civil use of plutonium and, accordingly, does not itself engage in plutonium reprocessing... The United States, however, will maintain its existing commitments regarding the use of plutonium in civil nuclear programs in Western Europe and Japan."

¹¹ *Record of Decision...*, Note 7 *supra*.

nuclear industry, and particularly plutonium utilization, recognize the benefits of using existing MOX infrastructure for WPu disposition. For example, the Natural Resources Defense Council has proposed that the U.S. offer MOX fuel made from WPu to European utilities as a substitute for further reprocessing.¹² Similarly, disarmament experts Albright, Berkhout and Walker have proposed a solution in which U.S. and Russian WPu would be burned in reactors throughout the European Union, taking advantage of the countries with the greatest experience and infrastructure for Pu utilization which have already established the necessary safeguards and physical protection systems for the purpose.¹³

Despite the continuing opposition, there is strong support for the dual-track strategy in the United States and the outlook appears to be positive. President Clinton himself stated in February 1997 that:

I believe that the dual-track approach for eliminating excess U.S. weapons plutonium stockpiles announced by the Department of Energy best serves our arms reduction and nonproliferation goals.¹⁴

Furthermore, as noted earlier, the U.S.-Russian Independent Scientific Commission praised the U.S. dual-track decision, urged the Russian government to pursue the dual-track route as well, and even recommended that the United States and Russia agree on a joint document stating their mutual intention to pursue dual-track strategies.

Although some members of the Administration reportedly have concerns about introducing MOX fuel use in the United States, they (or members of a subsequent administration) are likely to ultimately accept it because of the priority of disarmament. Nevertheless, the opponents will also fight MOX by going to the communities served by the U.S. utilities that wish to participate in the program. Depending on the degree of opposition to nuclear energy in that region, they may or may not be successful.

Proponents of civilian plutonium use outside the United States should exercise caution not to interpret a Clinton Administration decision to go forward with the MOX option as being supportive of overseas reprocessing and civilian MOX fuel use. Overstatements of the significance of the U.S. dual-track policy could potentially jeopardize that policy, by playing into the hands of the anti-nuclear groups who claim that the policy will lead to more civilian use of plutonium worldwide, against Clinton policy.

POSSIBLE STEPS FORWARD

The four factors cited above combine to make progress difficult. However, as noted earlier, the path may now be clear for Russia's ratification of the START II treaty. In addition, we may be at

¹² T. Cochran and C. Paine, Natural Resources Defense Council, "Proposal for the Disposition of U.S. Plutonium From Weapons," November 16, 1994.

¹³ T. Harrison, "Fissile Material Disposal Needs International Action, Authors Say," *NuclearFuel*, March 24, 1997, p. 1; Albright, D., Berkhout, F. and Walker, W., *Plutonium and Highly Enriched Uranium 1996: World Inventories, Capabilities and Policies*, SIPRI and Oxford University Press, 1997.

¹⁴ President Bill Clinton, letter to Congressman Edward Markey, February 5, 1997.

a point where an agreed international strategy for WPu disposition could be established. The first of the following recommended steps forward should be the leading element of such a strategy:

1. **Make joint commitment to reduce stocks ("Strategic Materials Reduction Treaty"):**

The only way the United States and Russia are likely to make firm, top-level commitments to disposition WPu is if they do so *in unison*. Furthermore, if both sides act together, it would increase the chance of declaring larger amounts of WPu as excess destined for disposition. The two sides should agree to keep only enough WPu to support the deployed warheads allowed under START, plus modest reserve inventories. Figure 2 illustrates a desired path forward for WPu inventory reductions.

A joint commitment to reduce inventories, which might be called a Strategic Materials Reduction Treaty (SMART), should aim to achieve equal remaining inventories on both sides by a date certain, just as START does with respect to deployed warheads. This is important since Russia's total WPu inventory is believed to be substantially larger than that of the United States, meaning that Russia should be willing to eliminate its inventory at a faster pace.

This commitment should aim to disposition all but a small remaining inventory within about 20 years, to perhaps 10 tons of WPu per side. It should allow compliance by whatever method or combination of methods each country prefers, including domestic and third-country scenarios.

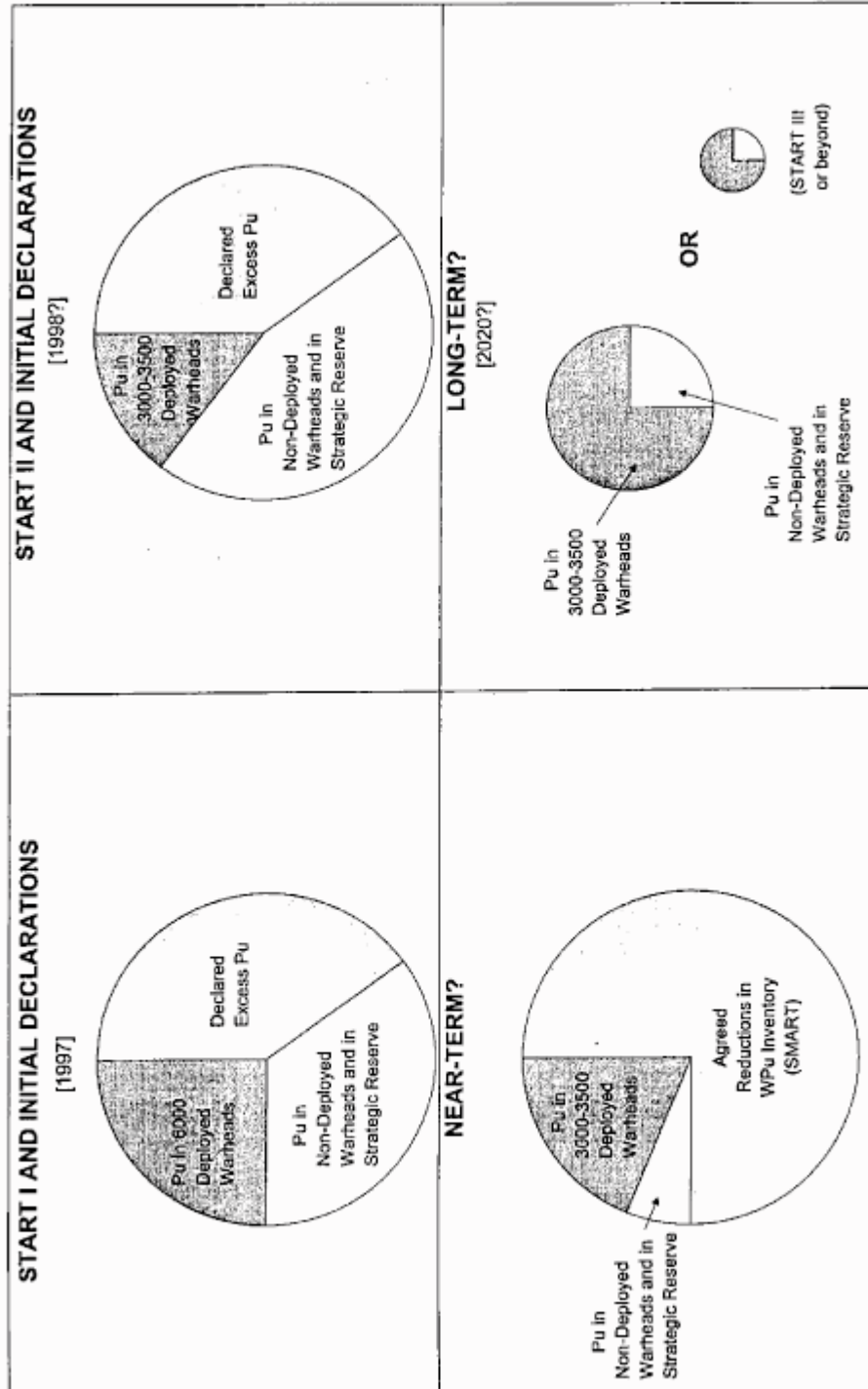
The Holdren-Velikhov Commission's June 1997 report recommends a practical, two-stage approach to reaching a formal disposition agreement. They suggest the two governments start work now to prepare an "agreement in principle to implement plutonium disposition as rapidly as practicable... and to work toward a second, more formal agreement setting out the quantities, schedules and approaches for disposition of excess weapons plutonium."¹⁵

2. **Link the bilateral and international processes:**

The process of achieving a U.S.-Russian bilateral commitment on WPu disposition and the process of arriving at an internationally-agreed method of financing the Russian side of the program should be linked together in order to add momentum for both to move forward. At the moment, there appears to be a total deadlock on the financial side. If the G-7 nations perceive real progress between the United States and Russia, their willingness to help fund the program could increase. The United States in particular might see this as an opportune investment in global security, but other nations could be convinced to join in as well if there is such momentum. At the same time, the availability of financing could potentially even motivate the United States and Russia to move forward with commitments to WPu disposition. Once again, the U.S. should take the lead and provide a large share of the funding as part of a SMART-type agreement. To gain the necessary public/taxpayer support, the White House and key figures in Congress should

¹⁵ *US-Russian Independent Scientific Commission...*, Note 6 *supra*.

FIGURE 2: DESIRED PROGRESSION OF WPU INVENTORY REDUCTIONS



Numark Associates, Inc.

take steps to inform the public of the importance of such assistance for U.S. and global security, and the relatively low cost in comparison with defense and other expenditures.

One possible opportunity to link the two processes would be on the next occasion of parallel P-8 and Clinton/Yeltsin summits, at the next P-8 economic summit in Birmingham, England in May 1998. Extensive preparatory work would need to be performed by -- and integrated between -- the Non-Proliferation Experts Group of the P-8 and the U.S.-Russian Joint Plutonium Disposition Steering Committee in order to issue parallel communiqués at that time. Something resembling the first-stage document recommended by the Holdren-Velhikov Commission, as noted above, would seem to be a realistic goal.

3. **Explore possible barter schemes to finance Russia's WPu disposition programs:**

As it may be difficult to organize direct financial aid from the international community, it is important to consider possible barter schemes or other financing ideas. Creation of a self-financing strategy based on good economics has already allowed an agreement to move forward for the disposition of Russian HEU, and may also be what is necessary to accomplish the same with respect to WPu. One idea that has been proposed is for Russia to sell *additional* HEU and use the proceeds to pay for WPu disposition.¹⁶ Another possibility results from a recent expression of interest by Russia in selling tritium to the U.S., which currently lacks a facility for producing this essential material for maintaining its remaining nuclear warheads. Reportedly, Russian officials are interested in a tritium sales agreement whereby the proceeds would be used for Russian nuclear energy and non-proliferation activities.¹⁷

4. **Proceed expeditiously with a dual-track approach in both Russia and the United States, with consideration given to using a variety of domestic and third-country facilities to augment total disposition capacity for Russian WPu:**

As noted above, the small number of suitable Russian reactors may not in themselves allow a rapid disposition program, considering that Russia has more WPu to get rid of than the United States. Disposition capacity could be augmented if Russia included the immobilization option for some of its WPu and/or if an agreement could be reached with Ukraine to disposition WPu in some of their Russian-design reactors. Furthermore, if new reactors are built in Russia for energy supply reasons, such as the Modular Helium Reactor or the CANDU, such new facilities could be considered for WPu disposition as well.

In parallel, other third-country disposition scenarios (besides Ukraine) should be on the table. The Canadian proposal continues to be attractive; consideration should be given to disposition of Russian WPu in Canada even if U.S. WPu is dispositioned domestically. Furthermore, a

¹⁶ M. Bunn, "Getting the Plutonium Disposition Job Done: the Concept of a Joint-Venture Disposition Enterprise Financed by Additional Sales of Highly Enriched Uranium," International Conference on Military Conversion and Science "Utilization/Disposal of the Excess Fissile Weapons Materials: Scientific, Technological and Socio-Economic Impacts," Como, Italy, March 18-20, 1996.

¹⁷ M. Hibbs, "Russia Would Sell Tritium to DOE, Russian Defense Official Says," *Nucleonics Week*, September 25, 1997, p. 1.

scenario that takes benefit from existing MOX utilization infrastructure in a few countries remains attractive as well. A workable strategy might be to blend WPu with civilian plutonium in existing European MOX fuel fabrication plants, and increase the number of reactors burning MOX to absorb the additional plutonium.¹⁸ In this manner, no third country would have to receive weapons-grade material, but such countries could still participate in disarmament actions based on their experience in and infrastructure for burning MOX fuel, including the existing safeguards and security infrastructure. The candidate countries for such a blending program would be those having civilian plutonium already present in European MOX plants: France, Germany, Japan, Belgium and Switzerland.

5. **Establish an international organization to implement the program:**

The Holdren-Velhikov Commission recommended in their report that:

The United States, Russia, and their P-8 partners should, without delay, establish an international entity for financing and implementation of plutonium disposition, responsible to the leaders of the participating countries for carrying out plutonium disposition to specified endpoints on a specified timetable.¹⁹

Other experts have made similar recommendations. Such an entity should be established concurrent with the announcement of joint commitments to reduce WPu stocks.

6. **Deform plutonium pits:**

As a first step under a SMART-type agreement, the United States and Russia should agree to a timetable for deforming plutonium pits, which would be relatively quick and inexpensive. Once they were deformed, pits would need to be refabricated if either side ever wanted to use them again in weapons. If we could also agree to decommission facilities that could be used for pit fabrication, we would introduce an even greater barrier to a rearmament program.

CONCLUSION

Although significant challenges remain, the difficulties in reducing weapons plutonium inventories seem to flow more from a lack of political momentum than from any fundamental philosophical differences on the subject between the United States and Russia. This suggests that the obstacles are surmountable, but there is a need for improved public and political awareness and pressure, hopefully influencing negotiators to move forward quickly and with deep cuts in fissile material inventories.

¹⁸ Details of a possible blending scenario are discussed in N. Numark, "Get SMART: The Case for a Strategic Materials Reduction Treaty, and Its Implementation," International Conference on Military Conversion and Science "Utilization/Disposal of the Excess Fissile Weapons Materials: Scientific, Technological and Socio-Economic Impacts," Como, Italy, March 18-20, 1996.

¹⁹ *US-Russian Independent Scientific Commission...*, Note 6 *supra*.