Response by Thomas B. Cochran to the paper on Plutonium Disposition and Control presented by Wolfgang K.H. Panofsky at the ``Future of Foreign Nuclear Materials Symposium,'' at the U.S. Naval Postgraduate School, Monterey, California, December 8, 1993.

I am in almost total agreement with the Professor Panofsky Panofsky's analysis of the objectives and standards for managing the plutonium from weapons, and his analysis of the technological options. Most of our differences are over emphasis.

Professor Panofsky approaches this as a national security problem. I agree. Let's be clear where the problem lies. The risks are in Russia, not the United States--what Panofsky aptly terms the risks associated with *break-up, break-down, and break-out.* The most important question then is not how should the U.S. manage its plutonium, but what steps should the U.S. be taking to reduce the risks associated with the management of Russian plutonium. It is because of the situation in Russia that Panofsky is correct when he concludes, ``The need for immediate action is urgent.'' Management of weapon-usable materials in Russia, to the extent the U.S. can influence Russian policy, should be the highest priority of the Department of Energy. Sadly, it is not.

Turning to the national security objectives, Panofsky identifies three--minimizing the risks of unauthorized use; minimizing the risks that the warheads or materials will be reintroduced into the arsenals; and strengthening controls to prevent the spread of nuclear weapons and assure continued arms reductions. This raises several questions:

> Are any of these objectives being met with regard to warheads and weapon-usable materials in Russia?
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> Does the U.S. Government have a program in place for achieving those objectives that are not being met?
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> Why isn't the Department of Energy providing leadership on these issues, given that warhead dismantlement and fissile material production and disposal are the responsibility of the Department?

The answer to the first two questions is no.

When the Ministry of Defense of the former Soviet Union began removing thousands of tactical nuclear weapons from Ukraine in December 1991, no U.S. or United Nations inspectors were on hand to verify the process, despite the desire of the new Ukrainian government for international inspection to assure elimination of Russian warheads, and the willingness of at least some senior political authorities in the new Russian government to grant it. The main problem, as it turned out, was not in

Moscow or Kiev but in Washington, where erstwhile advocates of ``effective verification'' had suddenly reversed field, arguing that U.S.-Soviet ``unilateral'' arms reductions did not require any mutual verification measures.

At the very moment of maximum political opportunity--and general technical need--for extensive nuclear inspections throughout Russia and other states of the CIS with nuclear weapons on their territory, the Bush Administration considered, and then chose not to establish, verification arrangements that would assure nuclear warhead elimination and monitoring of the nuclear explosive materials removed from dismantled warheads. The Bush Department of Defense placed a higher priority on insuring that there would be no reciprocal oversight over U.S. weapons and fissile material by Russia. By not advancing a reciprocal control regime the Bush Administration's verification effort was limited to offering to assist Russia in upgrading its own internal fissile material accounting and control procedures, and to accepting whatever transparency Russia was willing to provide at the proposed fissile material storage facility in return for the U.S. paying for the facility with Nunn-Lugar funds. Last month, under the FY 1993 National Defense Authorization Act, Congress conditioned U.S. funding of Russia's proposed fissile material storage facility on certification by the President that Russia ``(1) is committed to halting the chemical separation of weapon-grade plutonium from spent-nuclear fuel; and (2) is taking all practical steps to halt such separation at the earliest possible date.'' Thus, even the minimal Bush effort at excess fissile material transparency is now in jeopardy.

And today, ten months into the Clinton Administration, the U.S. Government still has not yet advanced a coherent program for verifying the elimination of tens of thousands of former Soviet warheads and tracking the ultimate disposition of hundreds of tons of surplus bomb-grade materials in the Russian nuclear stockpile. In place of a serious proposal for comprehensive warhead and fissile material controls, the Clinton Administration's program has only offered to make ``excess highly-enriched uranium and plutonium subject to the U.S.-IAEA voluntary safeguards agreement.'' As before, we will be left not knowing how many warheads Russia has, how many have been dismantled, or how much plutonium and highly-enriched uranium is in weapons or available for weapons. There will be no independent--U.S. or IAEA--means of confirming whether or not warheads or weapons-usable materials have been diverted to unauthorized use.

As Panofsky pointed out, ```establishment of a total declaratory regime between the U.S. and Russia is a matter of considerable urgency.'' Let us hope this conclusion appears and is highlighted in the National Academy report. But Panofsky goes on to say that ``there is little enthusiasm for this measure on both sides within the responsible government authorities.'' I

believe he is correct with regard to the U.S., but incorrect with regard to Russia.

In October 1991--over two years ago, shortly after Presidents Bush and Gorbachev had each made unilateral commitments to eliminate thousands of tactical nuclear warheads, and shortly after the failed putsch to oust Gorbachev--an international workshop was held in Washington, D.C. on verified storage and elimination of nuclear warheads. The workshop participants included Viktor Mikhailov, then deputy Minister of Atomic Power and Industry and now Minister of Atomic Energy (Minatom), Evgeniy Avrorin, Scientific Leader of Chelyabinsk-70, and Sergei Kortunov, then Counsellor for Arms Limitations, Foreign Ministry of the USSR. The workshop participants reached general agreement on a number of steps that the two countries should undertake: (a) each should declare at an early stage that the fissile material removed from weapons would not be used for new weapons; (b) each should exchange and make public the total number of warheads in their respective stockpiles, the number of warheads, by class, that are planned to be eliminated, and the total quantity of plutonium and HEU removed from these warheads; (c) the two sides should establish at the earliest possible time bilateral safeguards over warheads to be dismantled; and (d) the two nations should discuss what additional steps should be undertaken at the dismantlement facilities to insure that the warheads in safeguarded storage are actually dismantled and the fissile material recovered from warheads is placed under safeguards. In sum, these senior Soviet officials called for a reciprocal data exchange of the type advocated here by Panofsky.

As a direct consequence of this workshop, four months later--on April 12, 1992--Russian Foreign Minister Andrei Kozyrev formally proposed a reciprocal exchange of data among all nuclear weapon powers on inventories of nuclear weapons and fissile materials, and on nuclear weapons production, storage, and elimination facilities. President Bush did not, and President Clinton has not responded positively to this Russian initiative. Because Foreign Minister Kozyrev often has been accused by Russian hard-liners as being too eager to please the United States, the Foreign Ministry does not believe it can aggressively push a program that could be attacked as giving away secret Russian date to the United States. Therefore, any further initiatives must come from the U.S. side. None have. Thus, I believe Panofsky is wrong to fault the Russians for ``lacking enthusiasm for a data exchange.'' The blame rest squarely with the Executive Branch of the United State Government.

This failure has not gone unnoticed by the Congress. On July 2, 1992, the Senate Committee on Foreign Relations adopted a condition to the ratification of the START I Treaty--approved by the full Senate in October 1992--that directs the President to seek an appropriate arrangement, ``in connection with any further agreement reducing strategic arms,'' for monitoring nuclear stockpile weapons and fissile material production facilities,

through the use of reciprocal inspections, data exchanges, and cooperative measures. measures. And last month the Congress included in the conference report of the National Defense Authorization Act the following language:

> The conferees do believe that the United States must have the ability to track nuclear materials. Therefore the conferees are disappointed that, despite the inclusion of section 3151(b) in the National Defense Authorization Act for Fiscal Year 1993, there has been no discernable progress between the United States and the states of the former Soviet Union on an agreement to reciprocally release information on their nuclear stockpiles.

Ironically, yesterday the Department of Energy declassified the total production of weapon-grade plutonium at Hanford and Savannah River sites and the current plutonium inventories at these and several other sites. No attempt had been made to seek a reciprocal release of comparable Russian data.

On the issue of verification, I think Panofsky would agree with me that the number and location of warheads is something that can be easily verified, if there were the political will. If not, we should return to this issue. Panofsky claims, on the other hand, ``that while declarations might narrow our uncertainty in estimating fissionable material inventories in other countries, verification in the classical arms control sense of these figures is extremely difficult.'' This statement deserves clarification. In my view, IAEA safeguards are inadequate to verify the flows of weapon-usable plutonium and highly-enriched uranium through chemical separation plants and enrichment plants, respectively. This is one of the reasons I oppose the commercial use of nuclear weapons-usable materials. It is an argument against commercial use; not an argument to avoid implementing safeguards at these facilities if they exist.

Verification of warhead dismantlement and weapon components present the added difficulties associated with protecting design information. This raises two questions:

> If the U.S. and Russia were willing to divulge to each other, but to no other party, the mass--but not the shape--of the plutonium and HEU in warheads, could not one construct a bilateral verification regime that presents no more difficulties than those encountered by the IAEA in safeguarding cooperative states?
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> Isn't it in the U.S. national security interest to exchange these warhead design data and institute a comprehensive bilateral safeguards regime, rather than have no exchange and no regime?

On the issue of burning plutonium in reactors, the Russian option favored by Panovsky appears to be burning MOX in VVER-1000s. There are only six of seven such reactors in Russia. If, for safe operation, they are limited to one-third core loading of plutonium, then together they could burn only about two tonnes of plutonium per year. This is about the rate at which Russia is currently separating out new plutonium annually. At this plutonium burn rate it would take forever to dispose of the Russian plutonium unless the chemical separation plants are shut down, and then it would take some seventy-five years, or so, to burn or convert into spent fuel some 150 tonnes of plutonium. Panovsky claims that the VVER-1000s can be readily modified to add additional control rods, which would permit the entire core to be loaded with plutonium, thereby increasing the plutonium burn rate to about seven tonnes per year.

In closing I want to highlight two important conclusions of Panofsky's with regard to final disposition of plutonium:

> [T]here is little merit to the argument that some new reactors types could produce larger burnup of weapons-grade plutonium. We believe that the question of support for a new generation of nuclear reactors should be decided on the basis of their utility in respect to economy and safety in regards to civilian nuclear power, not in respect to their value in burning plutonium.
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> Similarly the matter of co-producing tritium is also irrelevant.

Finally, my preferred option for plutonium disposal is vitrification and burial. I would have preferred to have seen more attention devoted to this option. In Russia, however, this option has no support within Minatom, and therefore it does not appear to be a politically viable option. There is strong support within Minatom to close the back end of the civil nuclear fuel cycle and develop liquid metal fast breeders. This will only exacerbate the plutonium problem. The challenge for the U.S. will be to insure that whatever assistance is provided Russia with respect to plutonium disposal does not encourage the development of a civil plutonium economy.