

## **FEASIBILITY AND OPTIONS FOR PURCHASING NUCLEAR WEAPONS, HEU AND PLUTONIUM FROM THE FSU**

### **A. INTRODUCTION**

In response to a recent tasking from the National Security Council, this report, prepared by the U.S. Department of Energy, seeks to analyze the possible options open to the U.S. for purchasing, from the former Soviet Union (FSU) substantial quantities of plutonium (Pu) and highly enriched uranium (HEU) recovered from the accelerated weapons retirements and dismantlements that will soon be taking place. It is the purpose of this paper to identify and assess the implications of some of the broad options that now appear to be open to the United States, it being recognized that several issues might have to be addressed in further detail if the U.S. Government, on its own, or acting with others seeks to negotiate any such purchases on an early basis.

As an outgrowth of the dissolution of the Soviet Union three of the C.I.S. republics now possessing nuclear weapons, namely the Ukraine, Belarus, and Kazakhstan, have stated that it is their goal, without undue delay, to become non-nuclear weapon states as defined in the Non-Proliferation Treaty. These unprecedented developments are expected to yield significant excess quantities of HEU and plutonium and the disposition of these materials is of important concern to the United States.

Of overriding U.S. concern is the proliferation of nuclear weapons in the Third World, and the significant opportunity that the availability of such a large quantity of surplus weapons grade material might present in this regard, especially to a cash-starved FSU Republic. Additionally, the United States, in its endeavor to drawdown its own arsenal, needs to assure itself that these materials are not being reconfigured into more modern weapons within the CIS in a manner which would be inconsistent with the stated intentions and publicized activities. The direct purchase of these valuable materials by the U.S. government or by interested U.S. private enterprises could alleviate these security concerns in a straightforward and very expeditious manner, while at the same time pumping vitally needed hard currency into the struggling CIS economy. Such a purchase would seem to be entirely consistent with the Congressional mandate indicated by the Soviet Nuclear Threat Reduction Act of 1991.

### **B. BASIC ASSUMPTIONS**

In approaching this issue we have made certain basic assumptions, namely that: the republics involved will be interested in selling the material to the U.S. or other industrialized countries, but that the "price" might vary depending on the anticipated disposition of the material. We also assume that if the material were sold to the U.S. the sellers might stipulate that it not be used for any military purpose. Also, if any such

material is sold to a non-nuclear weapon state IAEA safeguards would have to apply to the materials in accordance with the obligations the Soviet Union assumed pursuant to the NPT. It is recognized that if the U.S. agrees to employ the material it acquires only for non-military purposes, this will limit our theoretical freedom of action. However, it is believed that the foreign policy benefits of adopting a "swords" to "plough shares" posture in the handling of these materials should more than offset any theoretical losses in flexibility. Also, while the different options discussed below have their pros and cons, we see no inherent conflict between having the U.S. acquire such C.I.S. materials and the basic obligations the U.S. has assumed under the NPT and other arms control treaties.

We also have postulated that if the U.S. is to control and shape the process that time is of the essence. Also the approach taken to HEU may not necessarily be the same as that for plutonium even though both materials are usable in nuclear weapons. Further, all things being equal, we have assumed that U.S. interests would best be served if the materials involved either were removed from the jurisdiction and control of the C.I.S. or altered in form so that they were no longer readily usable in nuclear weapons.

### C. MAJOR CHOICES

In approaching this issue the U.S. has some major alternatives to consider:

- It can move to acquire, either at the governmental or private level, the HEU that may be available rather than the plutonium since the issues associated with HEU, while complex, probably are more straightforward than those relating to plutonium. Alternatively, it can move on both fronts.
- It can opt to move on its own or in some coordinated manner with other advanced industrialized nations, like France, and Japan. Unilateral action is most appropriate in addressing the HEU issue but for plutonium some factors suggest that serious attention should be given to some joint action.
- It can move to "terminally" dispose of the materials after appropriate processing without any expectation of near term peaceful use. (This could involve placing the materials in suitable repositories either in the U.S. or CIS. This would appear to make sense only in the case of plutonium since HEU can readily be converted through blending to a usable low enriched form which is less sensitive from a proliferation perspective. While options like partitioning and transmutation and shooting the materials to the sun are theoretically available, they are not addressed here in any detail since they clearly are not available for any near term practical use).
- It could acquire the materials but move to place them in storage, pending the identification of need and a defined use. This could apply to all or a fraction of the materials. The storage could take place in the U.S. or C.I.S., and could be subjected to IAEA safeguards and possibly interim "IAEA control" while in storage in accordance with Section XXII of the IAEA Statute.

- It could move to put all or a portion of the materials (in suitably altered form) to near term peaceful use. For HEU this would involve blending the materials (either in the USSR or elsewhere) down to low enriched material for power reactor use which would then be employed in the U.S. civil nuclear power program or in foreign countries with whom we have appropriate agreements for cooperation. If the material were plutonium it could be employed in LMR programs in the U.S. or those few countries having active LMR programs or as MOX in light water reactor recycle programs. However, moves to initiate a MOX thermal recycle program in the U.S. are judged to be wholly impracticable at this time and any options involving the constructive use of plutonium as an energy source can be expected to draw some political fire from anti-plutonium hardliners. Nevertheless, such opposition might be manageable if it is clear that the program involved is significantly reducing the scale and scope of nuclear weaponry.

#### **D. THE HEU OPTIONS (TO BE SUPPLIED)**

#### **E. THE PLUTONIUM OPTIONS**

OPTION #1: Move to dispose of the acquired C.I.S. plutonium in some terminal manner presumably either in the Russian Republic or in the United States. Prior to disposal the plutonium could be "denatured" by spiking it with highly radioactive materials and incorporated in a suitable glass matrix. While geologic disposal would be the near term plan, both countries could continue to explore, for possible application to such materials, the options of "destroying" the materials in various actinide destruction regimes - including in LMR's or accelerators. Since the material involved would be by definition "waste", the U.S. financial assistance provided to the C.I.S. presumably would be in support of the disposal operations rather than a purchase of the "plutonium" per se.

##### Assessment

This option would have the "virtue" of permanently "disposing" of a very dangerous material and it most likely would be warmly received by those anti-nuclear plutonium advocates who have favored a total ban of such materials. However, as such it would ignore the potential energy value of the material and might aggravate pressures, (which the Bush/Reagan Administrations have resisted) favoring an absolute ban of plutonium and HEU in the civil nuclear fuel cycles around the world. While the U.S. has opposed plutonium use and reprocessing in nations of proliferation concern, it has not opposed such operations in the European Community or Japan - given the strongly positive non-proliferation credentials of these parties.

Also, the designation of the plutonium as "waste" might make it very politically difficult to dispose of the material in the U.S. since there is apt to be domestic political resistance to having the U.S accept foreign radioactive waste - even in the context of some major arms

control initiative. This suggests that disposal in the former USSR would be the only viable option. If disposal in the USSR were to occur, the U.S. would have to decide on the nature, if any, of the verification opportunities that it would wish to have to help assure itself that the material involved is, in fact, disposed of and remains, in waste form, at the repository.

**OPTION #2: Move to arrange for the appropriate interim or longer-term storage of the subject plutonium pending the development of a bona fide civil need and use for the material.** The storage site or sites could be located in the U.S. or C.I.S., there would be agreed understandings related to the conditions for releasing the material to civil use and the storage site could be voluntarily made subject to safeguards administered by the IAEA. Also, the U.S. and the C.I.S. could jointly seek to make the storage sites test beds for the development of an "international plutonium storage" regime administered by the IAEA pursuant to Section XII of the IAEA Statute. However, this would not have to be an essential part of the package. The IAEA has the statutory power to assume responsibility, pending need, of plutonium that is judged to be in excess of civil needs, but despite past attempts this has never been made into an operational program. The U.S. and C.I.S. could now try to develop the IPS concept further as a way of seeking to develop and strengthen the international non-proliferation regime.

#### **Assessment**

This option has the virtue of allowing the plutonium to be removed from the military sector while leaving the option open for subsequent bona fide civil use. The potential energy value of the plutonium would be preserved for such time as plutonium use makes more sense economically, and institutionally (i.e. when there is a revival in nuclear power pointing to early near term deployment of liquid metal reactors). It also should be stressed that a plutonium storage option would not necessarily be incompatible with a plutonium use option since there could be a hybrid scheme allowing some near term reactor use of the material while the excess is placed in storage. On the other hand, this option could be attacked by anti-plutonium and environmentalist groups for not conclusively shutting the door on subsequent plutonium use. They are more apt to press for total ban, hoping that a reduction in the military stockpile will reinforce their efforts to discourage plutonium use in the civil nuclear fuel cycle.

If a variant of this option were adopted it is assumed that the plutonium involved would be given little or no economic value in terms of price and that the U.S. financial contribution would go into the establishment, maintenance and operation of the plutonium store.

**OPTION #3: Move to purchase, fabricate and introduce some of the plutonium into defined civilian reactor programs while placing the excess in appropriate storage and under continuing IAEA safeguards.** Under this heading three major sub-options appear credible:

- first, the U.S. and C.I.S. countries could limit the use to LMR's in their respective countries;

- second, they could invite the West Europeans and Japanese to also acquire some of the material for use in their LMR programs; or
- third, the allowed end use could be broadened to include recycling of the plutonium in some thermal as well as liquid metal reactors in Europe and Japan, but not in the U.S. at this time.

### Assessment

It should be noted that the U.S. has no thermal recycle program in existence nor is such a program likely to be initiated in the foreseeable future. Any proposal to recycle plutonium in light water reactors most likely would trigger a very adverse political debate within the United States - judging from the experience during the Carter Administration. Also, based on recent consultations held by the Edison Electric Institute, it appears that the U.S. utilities have absolutely no interest in pursuing such an option at the present time.

Within this context, if the plutonium purchased from the C.I.S. were to be used principally in liquid metal reactors, the U.S. nominally could participate in the enterprise since we have an LMR program underway. Moreover, confining the use of the plutonium to LMR programs would severely limit its introduction into the civil nuclear fuel cycle since only a very limited number of countries now have LMR programs still in place. The opposition might be softened since the opponents of plutonium use are particularly hostile to thermal recycling since they feel that, in concept, it suggests that any LWR might be amenable to using plutonium fuel. On the other hand, such a constrained use of the plutonium might severely limit the amount of plutonium that would be burned to a relatively token amount leaving the vast bulk in storage.

As noted, the U.S. and C.I.S. countries could consummate the purchase agreement on their own or they could seek to involve other countries in the arrangements. Under one sub-option, the U.S. and C.I.S. states could seek to involve the Japanese, French and other West Europeans in the proposed deal under which the U.S., Japanese and Europeans would share the purchase responsibility and would agree to burn a fixed amount of the C.I.S. plutonium in their national plutonium use programs, including both their LMR's and light water reactors, so long as this would not be expected to alter the major thrust of their already established programs. Under this approach the U.S. would not be expected to burn and plutonium in light water reactors although some might be used in our LMR program. However, since the Japanese and West Europeans already have major thermal recycle programs underway they might be prepared to amplify their efforts to some degree to allow the introduction of C.I.S. plutonium in some additional light water reactors. No nation not already engaged in recycling would be expected to participate in the effort. Any excess C.I.S. plutonium not destined for usage would be placed in storage under IAEA safeguards.

This option would broaden the international responsibility for burning the C.I.S. plutonium, it presumably would make for a greater reduction in the stockpile, yet at the same time it would not introduce plutonium usage in any U.S. ally that is not already engaged in such an activity. It also might help reduce the financial burdens that would otherwise fall on the

U.S. if it alone sought to conclude an arrangement bilaterally with the C.I.S.

On the negative side, the involvement of other nations could serve to reduce the freedom of action otherwise open to the United States. Moreover, such an initiative might be attacked that those political elements (including Senators Glenn and Cranston), who generally have been quite hostile to plutonium use, including such usage in Western Europe and Japan. Also, conceivably the West Europeans and Japanese might be cool to the idea since they already will have in hand significant stocks of their own plutonium to dispose of. However, they might be very supportive to such a proposal if they judged that it would strengthen U.S. political and other international support of their own plutonium use and reprocessing programs. One would have to ask them to determine their interest and receptivity.

### **RECOMMENDATION**

It is recommended that the U.S. explore together with the CIS Republics, the French and Japanese, a combination option that would entail a purchase from the C.I.S. countries of an mutually agreed amount of plutonium that would be put to use and if not used stored under safe and secure arrangements. To the maximum extent feasible, and under terms to be mutually agreed, the plutonium to be purchased would be employed in the U.S, West European and Japanese LMR programs as well as thermal recycle programs in Europe and Japan. However, if the quantity purchased is in excess of current need (which it is expected would be the case), this excess quantity of plutonium would be stored at mutually agreed locations, under continuing IAEA safeguards. Consideration also would be given to the merits of establishing any such stores as test beds for the possible later establishment of an IAEA International Plutonium Storage regime (IPS). However, exploring the IPS idea would not necessarily be an integral part of the package.

### **DISCLAIMER**

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.