

# Introduction

---

This report presents three proposals to expand existing programs for reducing stockpiles of high-enriched uranium (HEU) in Russia and other nations of the Former Soviet Union. Under the first proposal, the United States government would pay Russia to double the current rate at which it transforms HEU that has been removed from nuclear weapons into low-enriched uranium (LEU), which is too dilute for weapons use. The additional LEU would be stored in Russia and eventually sold for use as nuclear power plant fuel under an existing agreement which this proposal would build upon. Under the second proposal, the United States would expand its efforts and incentives for nuclear institutes in Russia to reduce—or preferably eliminate—their use and stocks of HEU. The HEU would be consolidated with larger stockpiles at other facilities and possibly be blended to LEU. Under the third proposal, the United States would provide more help to institutions in Russia and elsewhere that depend upon research reactors for their work to replace their HEU fuel with high-density LEU fuel.

Implementation of these three proposals would significantly reduce the risk that terrorists or other groups might divert HEU for use in nuclear weapons. All three are low cost options that could be started and would produce results quickly.

## The Threat of Diversion of Nuclear Weapons or Weapon Material from Russia

The events of September 11, 2001 destroyed any belief that the United States is invulnerable to determined groups bent on mass destruction. Yet, as terrible as those events were, the explosion of even a small nuclear weapon in an urban area would be many times more destructive. Fortunately, the possibility that a sub-national group—even one as well funded and organized

as al-Qaeda—could develop its own nuclear weapons, without outside help in obtaining the necessary nuclear material, is extremely small. There is a substantial risk, however, that such a group could clandestinely acquire a fully assembled nuclear weapon from an existing nuclear weapons state or acquire sufficient weapons-grade material to dramatically reduce the barrier to making a nuclear weapon. There have been numerous reports that the al-Qaeda organization sought to purchase nuclear weapons or material.

The vast quantity of nuclear weapons and weapon materials in Russia and other nations of the Former Soviet Union (FSU) presents the greatest risk of theft or diversion. At its peak, there may have been as many as 45,000 nuclear warheads in the Soviet stockpile.<sup>1</sup> Today, about 10,000 warheads are still deployed, and there may be another 10,000 warheads in reserve or awaiting dismantlement.<sup>2</sup> A large fraction of the rest have been dismantled, but most of their nuclear materials are still in storage. The FSU still has a vast industrial and research complex in which nuclear weapon materials are located at more than sixty sites. At least thirty-two sites have more than one-hundred kilograms (kg) of high-enriched uranium or plutonium (sufficient for several nuclear weapons), and many of them have quantities that are measured in tons (i.e., in thousands of kilograms).<sup>3</sup> The smaller sites, with less HEU, may actually present the highest risk, since the smaller institutions generally have fewer resources to devote to security.

The economic and political collapse of the Soviet Union has created a formidable challenge to keeping its nuclear weapons and materials under

*Thefts of HEU pose the most serious nuclear security threat of all; therefore, reducing HEU stockpiles should have the highest priority.*

adequate control. As early as 1994, the National Academy of Sciences called the existence of surplus nuclear weapon material in the Former Soviet Union “a clear and present danger to national and international security.”<sup>4</sup> Since then, the US government has established several programs to deal with the problem (see Appendix A). They have had some notable accomplishments, but much more remains to be done. In January 2001, a bipartisan task force chaired by former Senate majority leader, Howard Baker, and former White House counsel, Lloyd Cutler concluded:

The most urgent unmet national security threat to the United States today is the danger that weapons of mass destruction or weapons-usable material in Russia could be stolen, sold to terrorists or hostile nation states, and used against American troops abroad or citizens at home.<sup>5</sup>

The danger is not merely theoretical. A recent report by the National Intelligence Council,<sup>6</sup> which coordinates intelligence assessments from several US government agencies, lists several cases in the past decade in which a kilogram or more of weapons-usable material has been stolen or lost, including:

- An incident in 1992, in which 1.5 kg of 90-percent enriched uranium was stolen from the Luch Production Association, in Podolsk, Russia.
- An incident in 1994, in which 3 kg of 90-percent enriched uranium was stolen in Moscow.
- A report of a theft in 1998 in Chelyabinsk Oblast, about which a Russian official stated that the amount stolen was “quite sufficient material to produce an atomic bomb”. This case remains the only nuclear theft that has been so described, and the HEU has since been recovered.

In addition to actual thefts, there have been dozens of incidents during the past ten years in which individuals and groups have stolen or attempted to steal uranium or plutonium from sites in the FSU, but have been caught.<sup>7</sup> Given the inadequate Soviet-era record keeping for fissile material stocks, there is no way to know for sure that other significant diversions have not already occurred. If they have not, and security is not upgraded quickly, it may only be a matter of time before they do.

## HEU Stockpiles—A Serious Threat, A Solvable Problem

Over the past years, there have been several appeals for a comprehensive program to address the problem of poorly secured nuclear weapons and

### BOX 1. What is HEU and why does it pose a greater security threat than fully assembled nuclear weapons or plutonium?

The stockpiles of fissile materials in the Former Soviet Union present a greater opportunity for terrorists than intact nuclear weapons because fissile material security is generally poorer. Soviet nuclear weapons have all been consolidated in Russia and are guarded by highly trained professional security forces. Nuclear weapons are relatively large, heavy objects that are not easily stolen. They come in discrete units that are easily counted. Contrary to the numerous thefts of nuclear materials, there are no known cases of theft or attempted theft of actual nuclear weapons. The nuclear material of greatest concern is high-enriched uranium (HEU). HEU is defined by international convention as uranium containing 20-percent or more U-235, but the greatest security threat is posed by 90-percent-enriched weapons-grade uranium.

There is a more urgent need to reduce stockpiles of HEU than plutonium stockpiles, because HEU is the material of choice for terrorists. Once the barriers to obtaining weapons-grade HEU have been overcome, the rest of the nuclear-weapon assembly process is relatively simple. While it takes three times as much HEU as plutonium to make a nuclear weapon, HEU can be used in rudimentary nuclear weapon designs (such as gun-barrel-type weapons) in which plutonium cannot be used. HEU is less radioactive and less hazardous than plutonium, which makes it easier for terrorists to transport, store, and fabricate into a weapon. In addition, there is six times as much HEU as plutonium in Russia, and it is located at many more sites.

materials in Russia and other nations of the Former Soviet Union.<sup>8</sup> We support those pleas. However, the political will to fully fund an all-inclusive solution has not yet materialized. Pending the emergence of such support, this report proposes giving higher priority to the expansion of three existing approaches for reducing the number and size of HEU stockpiles in Russia and other countries.<sup>9</sup> Thefts of HEU pose the most serious nuclear security threat of all (see Box 1); therefore, reducing HEU stockpiles should have the highest priority. In addition, these proposals all cost relatively little. They provide readily available solutions that can be pursued now to produce significant results quickly, while other efforts continue to address some of the more challenging long-term problems.

Efforts to reduce HEU stockpiles can produce results quickly and inexpensively because:

- HEU can be easily converted into non-weapons-useable LEU by blending it with uranium of lower enrichment.
- Blended-down HEU has monetary value as fuel for nuclear power plants, and can thus be used to fund stockpile reductions.

While the downblending of HEU may involve some political challenges, these challenges pose less of an obstacle than those associated with plutonium disposition.<sup>10</sup>

Although intact nuclear weapons and plutonium pose a credible threat, both the US and Russia can significantly benefit from HEU stockpile reductions. The following proposals for reducing HEU stockpiles in Russia are relatively easy and inexpensive steps that have substantial payoffs for both countries in enhanced nuclear security.

### Three Proposals to Expand Efforts to Reduce HEU Stockpiles in Russia

In 1993, the United States agreed to purchase LEU derived from 500 metric tons<sup>11</sup> of HEU from dismantled Russian nuclear weapons. This agreement, commonly referred to as “the HEU deal,” has proven to be one of the most successful of all US-Russian nonproliferation programs. Since 1993, about 140 tons of Russian weapons-origin HEU has been blended into LEU<sup>12</sup> and sold for use as fuel in nuclear power plants. This transac-



*Cylinders of the first shipment of warhead-derived LEU fuel arrive at USEC's Portsmouth, Ohio plant (1995).*

tion was facilitated by USEC Inc., the American company currently responsible for implementing the HEU deal. However, implementation of this agreement is limited by the rate at which LEU can be sold without disrupting the international market for nuclear fuel. Under the current schedule, the full 500 tons of HEU will not be eliminated until 2013. Furthermore, if all Russian nuclear weapons scheduled for retirement are eliminated, there will be hundreds of tons of additional excess HEU in storage (see Proposal 1 below).

A significant portion of Russia's HEU is not used in nuclear weapons and so is not covered under the HEU deal. This material is located at storage facilities, research institutes, nuclear fuel processing facilities, and other locations that generally have less security than storage sites for nuclear weapons and weapons-origin material.

The three proposals discussed below would all expand upon existing programs for reducing HEU stockpiles in Russia. All three are low-cost options

that could be started and would produce results quickly without unduly affecting the market for nuclear fuel.

Under the first proposal, the United States government would pay Russia to blend the remaining HEU from the existing agreement, and additional quantities of excess weapons-origin HEU, to LEU as rapidly as practical. The blended LEU would be stored in Russia and sold for use as fuel for nuclear power plants at the same pace as under the current agreement.

Under the second proposal, the United States would provide incentives to civil institutions in Russia to reduce—or preferably eliminate—their use of and stocks of HEU. The HEU would be consolidated with larger, more secure stockpiles at other facilities and possibly be blended to LEU.<sup>13</sup>

Under the third proposal, the United States would help organizations that have Soviet-designed research reactors replace HEU fuel with

high-density LEU fuel. Thus, security concerns need not interfere with the operation of research reactors that Russian institutes need for their continuing mission. A US-funded program in Russia is currently developing high-density LEU fuels that can provide similar performance to HEU fuel. Under this proposal, the United States would accelerate the research program and facilitate the transition of research reactors to LEU fuel.

The three proposals are described in detail below. An understanding of the existing HEU agreement is useful in putting these proposals into context. This agreement has been controversial and its implementation has proceeded in fits and starts. Proposals to further reduce HEU stockpiles will not be considered seriously unless the original agreement is proceeding and the new proposals do not threaten that operation. The history and status of the existing HEU deal is reviewed in Appendix B.