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I. INTRODUCTION

It would unfold like the opening scene of a Tom Clancy novel, but it would be all too real . . .

At 5:00 a.m., the urgent voice of a personal aide awakens the President of the United States. Fumbling for the bedside light while shaking off the fog of sleep, the Commander-in-Chief of the most powerful military in the history of the world lazily wonders what the crisis might be this time. Bosnia taking a turn for the worse? Or the North Koreans, maybe there were some succession-related problems finally turning up there. Stepping into his slippers, the President is only halfway down the hallway when he is confronted by his National Security Advisor (NSA). The NSA looks like he, too, has been roughly pulled from sleep. Without preamble, he speaks.

"Mr. President, sir, I just got off the phone with the Director of the FBI. Sir, two hours ago, an FBI agent in New York received an

anonymous phone call from a man threatening to detonate a nuclear bomb in lower Manhattan by midnight tomorrow night, unless his demands are met. He gave the agent the address of an apartment, said he'd call back in three hours with his demands, and hung up. The agent assumed it was a crank call, but followed normal procedure anyway, sending investigators over to the address. Mr. President, those men found the door to the place open, with absolutely nothing inside except an open suitcase. There was a small packet in it, containing a piece of metal. Sir, they've already tested it . . . it was . . . plutonium, sir. Mr. President, we need to act quickly. If you'll come with me . . ."

"My God . . ."

The horrible truth is that the threat of nuclear terrorism is real, in light of the potential existence of a black market in fissile material. Nuclear terrorists might issue demands, but then again, they might not. Their target could be anything: a U.S. military base in a foreign land, a crowded U.S. city, or an empty stretch of desert highway. In one fell swoop, nuclear terrorists could decapitate the U.S. government or destroy its financial system. The human suffering resulting from a detonation would be beyond calculation, and in the aftermath, the remains of the nation would demand both revenge and protection. Constitutional liberties and values might never recover.

When terrorists strike against societies already separated by fundamental social fault lines, such as in Northern Ireland or Israel, conventional weapons can exploit those fault lines to achieve significant gains.[1] In societies that lack such pre-existing fundamental divisions, however, conventional weapon attacks do not pose a top priority threat to national security, even though the pain and suffering inflicted can be substantial. The bedrock institutions of the United States will survive despite the destruction of federal offices; the vast majority of people will continue to support the Constitution despite the mass murder of innocent persons.

The consequences of terrorists employing weapons of mass destruction, however, would be several orders of magnitude worse than a conventional weapons attack. Although this threat includes chemical and biological weapons, a nuclear weapon's devastating

1. *See* Philip B. Heymann, The U.S. and Terrorism 9 (June 19, 1996) [hereinafter Heymann] (unpublished manuscript, on file with the *Loyola of Los Angeles International and Comparative Law Journal*).

potential is in a class by itself.[2] Nuclear terrorism thus poses a unique danger to the United States: through its sheer power to slay, destroy, and terrorize, a nuclear weapon would give terrorists the otherwise-unavailable ability to bring the United States to its knees. Therefore, preventing terrorists from obtaining nuclear weapons should be considered an unparalleled national security priority dominating other policy considerations.

A would-be nuclear terrorist's only real obstacle is the difficulty inherent in acquiring an adequate amount of weapon-usable nuclear material. In years past, terrorists had little prospect of acquiring this material. Those few nations that possessed nuclear weapons material kept their caches under the highest security conditions. The disintegration of the Soviet Union, however, has changed this situation.

Presently, large amounts of unsecured and unaccounted-for weapons-usable material are scattered throughout the former Soviet Union.[3] Moreover, deteriorating economic conditions have generated powerful incentives among soldiers and scientists in the former Soviet Union to provide "insider" access to this material. Such access bypasses even the scant security measures actually in place.[4] Police in Europe have already confirmed several instances of attempted fissile material smuggling, and these incidents may only be the tip of the iceberg.[5]

This Article explores the contours of fissile material availability from the perspective of terrorism prevention. Part II provides a framework for consideration of this issue by establishing the overwhelming significance of fissile material availability. Part III conducts an in-depth review of the nascent black market in weapons-usable material, focusing on the security problems in the former Soviet Union. Part IV examines the nature of the U.S. response to this problem. It identifies the most significant programs and policy initiatives, highlights their limitations, and concludes that the United States has failed to adequately prioritize prevention efforts. Part V considers the impact of recent legislative modifications to

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2. *See id.* at 118.

3. *See id.* at 121.

4. Oleg Bukharin & William C. Potter, *Potatoes Were Guarded Better*, BULL. OF THE ATOMIC SCIENTISTS, May-June 1995, at 48, 49.

5. Wendy L. Mirsky, *The Link Between Russian Organized Crime and Nuclear Weapons Proliferation: Fighting Crime and Ensuring International Security*, 16 U. PA. J. INT'L BUS. L. 749, 753 (1995).

the U.S. effort and finds that the U.S. response to the threat of nuclear terrorism remains inadequate. In Part VI, the Article concludes that to implement policies commensurate with the degree of risk to the national security, a significant shift in the perception of the stakes involved must take place among both politicians and the public. Such a shift would generate the political maneuverability to enact truly comprehensive and effective prevention measures, but achieving it will probably require the active engagement of the agenda-setting and persuasive powers of the Presidency; the alternative is to proceed with half-measures in the face of a cataclysmic risk.

II. THE SIGNIFICANCE OF FISSILE MATERIAL AVAILABILITY

A. Framework For Nuclear Terrorism Prevention

There can be little doubt that the national security of the United States is inversely related to the number of state and substate actors that have weapons of mass destruction (WMD), which include nuclear, chemical, and biological arms.[6] When former Secretary of Defense William Perry recently articulated the bedrock principles underlying U.S. defense policy, he declared that "[t]he U.S. program of preventative defense rests on the premise that fewer weapons of mass destruction in fewer hands makes America and the world safer."[7] The threat to the United States, however, is not limited to the military use of WMD by a hostile state. A WMD strike against U.S. interests would cause disastrous loss of life and property regardless of the attacker's identity. Considering the context of recent trends in terrorist activity, this observation is cause for alarm.

Two terrorist trends in particular give rise to concern. First, terrorists have broken the taboo against the use of WMDs.[8] On

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6. A "weapon of mass destruction" is "any weapon or device that is intended, or has the capability, to cause death or serious bodily injury to a significant number of people through the release, dissemination, or impact of—(A) toxic or poisonous chemicals or their precursors; (B) a disease organism; or (C) radiation or radioactivity." Defense Against Weapons of Mass Destruction Act of 1996, 50 U.S.C. § 2302(1) (1996).

7. William J. Perry, *Defense in an Age of Hope*, FOREIGN AFF., Nov.-Dec. 1996, at 64, 66.

8. The scenario of a terrorist group either obtaining or manufacturing and using a weapon of mass destruction is no longer the stuff of science fiction or even adventure movies. It is a reality which has come to pass and one which, if we do not take appropriate measures, will increasingly threaten us in the future.

Global Proliferation of Weapons of Mass Destruction: Hearings on S. 104-422 Before the

June 27, 1994, members of the Aum Shinrikyo religious cult conducted a sarin nerve gas attack in Matsumoto City, Japan, killing 7 and hospitalizing over 500 others.[9] Less than a year later, the cult again employed sarin gas, in the infamous Tokyo subway attack, this time killing 12 and injuring over 5000 people.[10] These incidents marked the first significant uses of weapons of mass destruction by non-state actors, "signal[ling that] the world has entered into a new era."[11]

Although these particular incidents did not directly target the United States, it would be a mistake to assume that this new trend did not concern U.S. security. The Aum believe that they have reason to take action against the United States. For example, "a core belief of the Aum was that the United States was their enemy and . . . a war with the United States was a central component of their prediction of Armageddon."[12]

The second major development was the appearance of large-scale terrorist violence within the United States itself. First, the 1993 bombing of the World Trade Center in New York by followers of the "Blind Shaykh," led by Umar Abd al-Rahman, shocked a country complacent in the belief that attacks of this magnitude could, and would, only occur abroad.[13] The results of the World Trade Center bombing paled, however, in comparison to the carnage caused by the April 19, 1995, attack on the Murrah Federal Building in Oklahoma City. That attack killed 168 persons and wounded more than 500 others.[14]

Combining these trends, it is clear that the probability of a terrorist attack within the United States, employing a WMD, has grown to unprecedented levels. This conclusion is consistent with

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Permanent Subcomm. on Investigations of the Senate Comm. on Governmental Affairs, 104th Cong. 5 (Part I) (1995) [hereinafter *WMD Hearings Part I*] (opening statement of U.S. Senator Sam Nunn (D-GA)). "Terrorists are turning increasingly to 'super-terror'—weapons of mass destruction." Charles E. Schumer, *Terrorism Must Not Be Allowed to Hide Its Face*, 22 SYRACUSE J. INT'L L. & COM. 1, 2 (1996).

9. The attack was an assassination attempt directed at three judges who were hearing a case involving the cult at that time. *See WMD Hearing Part I, supra* note 8, at 23 (testimony of John F. Sopko, Deputy Chief Counsel to the Minority, Permanent Subcomm. on Investigations, U.S. Senate).

10. *See id.* at 5 (opening statement of Senator Sam Nunn).

11. *Id.*

12. *See id.* at 8 (testimony of John F. Sopko).

13. *See* U.S. Dep't of State, Office of the Coordinator for Counterterrorism, *1995 Patterns of Global Terrorism* (1996) (visited on Sept. 5, 1997) <gopher://gopher.state.gov:70/00ftp...%20Terrorism%3A1995%20PGT%20Report>.

14. *See id.*

a belief that terrorist activity normally poses a true threat to a society only when it can exploit pre-existing fractures within that society. In societies relatively devoid of such fundamental fault lines, such as the United States, terrorists intent on having a real impact may be driven to employ tactics of far greater destructive magnitude.[15]

Even absent the logic of fault lines, however, it is conceivable that a terrorist group might resort to a WMD attack if sufficiently frustrated in its conventional attempts to further its aims.[16] This grim prospect is disturbing enough when the threat is limited to chemical and biological weapons, the impact of a nuclear terrorist attack would involve nightmarish consequences on an incomparable scale.[17] According to former CIA Director John Deutch, the United States is poorly prepared to deal with nuclear terrorism.[18] Therefore, it is absolutely crucial that policy makers give thoughtful consideration to the threat of nuclear terrorism. The United States must develop both effective policies and the political capital to execute them.[19]

There will be numerous obstacles to crafting an effective counterterrorist policy. Foremost is the likelihood that nuclear terrorism countermeasures cannot be developed on a narrowly-targeted basis.[20] This consequence flows from the multiplicity of both targets and terrorists. The almost limitless supply of federal buildings, landmarks, historic locations, and population centers within the United States makes specific-target hardening a strategy

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15. *See* Heymann, *supra* note 1, at 119.

16. Broadly speaking, terrorists will not engage in overkill if their traditional weapons . . . are sufficient to continue the struggle and achieve their aims. But the decision to use terrorist violence is not always a rational one. . . . What if, after years of armed struggle and the loss of many of their militants, terrorist groups see no progress? Despair could lead to giving up the armed struggle, or to suicide. But it might also lead to a last desperate attempt to defeat the hated enemy by arms not tried before.

Walter Laqueur, *Postmodern Terrorism*, FOREIGN AFF., Sept.-Oct. 1996, at 24, 31.

17. "Chances are that of 100 attempts at terrorist superviolence, 99 would fail. But the single successful one could claim many more victims, do more material damage, and unleash far greater panic than anything the world has yet experienced." *Id.* at 36.

18. *See Global Proliferation of Weapons of Mass Destruction: Hearings on S. 104-422 Before the Permanent Subcomm. on Investigations of the Senate Comm. on Governmental Affairs*, 104th Cong. 76 (Part II) (1996) [hereinafter *WMD Hearings Part II*] (testimony of John Deutch, Dir., Central Intelligence Agency).

19. A variety of initiatives have already been attempted, or are currently on deck; their relative merits are considered below in Parts IV-V.

20. Louis Rene Beres, *On International Law and Nuclear Terrorism*, 24 GEO. J. INT'L & COMP. L. 1, 18 (1994).

that is unlikely to even marginally decrease the risk of nuclear terrorism. Similarly, it is unwise to depend to any great extent on a strategy of identifying the likeliest perpetrators of nuclear terrorism, as "there is no such thing as 'the terrorist mind'"[21] enabling precise identification of a subset of terrorists likely to take the nuclear leap. Thus, absent fortuitous intelligence, targeted prevention is insufficient to address this problem. Fortunately, there is still the option of untargeted prevention.

"Prevention of nuclear terrorism should, like all prevention, focus on the steps in the terrorist plan that can be made most difficult at a reasonable cost. . . ."[22] This strategy requires the identification of the likeliest chokepoint(s) among the chain of conditions necessary for a terrorist to succeed with nuclear terrorism.[23] Broadly speaking, nuclear terrorism cannot take place without sufficient amounts of the following ingredients: technical knowledge, funds, equipment, transportation, willpower, credibility, and fissile material. Untargeted prevention seeks to identify which, if any, of these inputs is a chokepoint, susceptible to substantial disruption.[24]

B. Identifying the Nuclear Chokepoint

Despite popular belief to the contrary, the technical knowledge necessary to construct a nuclear weapon is widely available in the public literature,[25] and there is no requirement of access to classified literature.[26] Nor would a terrorist have to attempt the more elaborate designs employed by a Los Alamos scientist; the simplest designs would be capable of producing yields in the range of several kilotons.[27] In addition, the Internet has accentuated the

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21. *Id.*

22. Heymann, *supra* note 1, at 121.

23. *Id.* at 122.

24. *See id.*

25. "The recipe . . . is no secret, and has not changed appreciably in many decades . . . All the information necessary to solve [the more difficult technical] problems . . . are available in the open literature, and have been for some time." Owen R. Coté, Jr., *Appendix B: A Primer on Fissile Materials and Nuclear Weapons Design*, *in* AVOIDING NUCLEAR ANARCHY: CONTAINING THE THREAT OF LOOSE RUSSIAN NUCLEAR WEAPONS AND FISSILE MATERIAL 203, 224 (1996) [hereinafter *Fissile Material Primer*]; *see also* Interview with Ted Taylor, *Morning Edition: Nuclear Safety and Security in Russia-Part 2*, (National Public Radio, Apr. 17, 1996), *available in* 1996 WL 2814493.

26. *See* Beres, *supra* note 20, at 14, *citing* U.S. CONGRESS, OFFICE OF TECHNOLOGY ASSESSMENT, NUCLEAR PROLIFERATION AND SAFEGUARDS (1977).

27. *See Fissile Material Primer*, *supra* note 25, at 214. One kiloton is equivalent to a

widespread dissemination of the relevant technical knowledge.[28] It would be a mistake, however, to conclude that censoring this information from the information superhighway would impose any real burden on the ability of a terrorist to fabricate a nuclear device.

Nor would funding and equipment requirements pose a significant obstacle.[29] The Office of Technology Assessment concluded that less than $1 million dollars would be necessary to create a nuclear weapon.[30] While this is a significant amount, it is no doubt available to a subset of potential nuclear terrorists. In any event, existing anti-terrorism legislation already seeks to constrict the flow of funds to terrorist organizations.[31] According to Professor Graham Allison, a few hundred thousand dollars could satisfy the funding needs, and the equipment is readily available at stores such as Radio Shack.[32]

Once built, it would be a simple matter to transport a nuclear device. The fissile material component of the device, comprised of either uranium or plutonium, would be neither heavy nor unwieldly.[33] Approximately twenty-five kilograms of uranium, or eight kilograms of plutonium, could suffice for a bomb.[34] Such a quantity of uranium would be about the size of a grapefruit, while

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thousand tons of TNT. For a comparison, the yield of the "Little Boy," dropped on Hiroshima, was approximately 15 kilotons. *See id.* at 222.

28. *See, e.g.*, J.D. Dyson, *Documentation and Diagrams of the Atomic Bomb* (visited on Oct. 8, 1996) <http://neutrino.nuc.berkley.edu/neutronics/todd/nuc.bomb.html>.

29. *See* Beres, *supra* note 20, at 14, *citing* U.S. Congress, OFFICE OF TECHNOLOGY ASSESSMENT, NUCLEAR PROLIFERATION AND SAFEGUARDS (1977).

30. *See id.*

31. *See generally* Antiterrorism and Effective Death Penalty Act of 1996, Pub. L. No. 104-132 (Apr. 1996); Note, *Blown Away? The Bill of Rights After Oklahoma City*, 109 HARV. L. REV. 2074 (1996).

32. *See WMD Hearings Part II*, supra note 18, at 22 (testimony of Graham T. Allison, Ctr. for Science and Int'l Affairs, John F. Kennedy School of Gov't, Harv. Univ.).

33. *See id.*

34. *See WMD Hearings Part II, supra* note 18, at 18 (testimony of Harold J. Johnson, Jr., Assoc. Dir., Int'l Relations and Trade Issues, National Sec. and Int'l Affairs Division, General Accounting Office). These amounts presume a high degree of "purity." In other words, certain isotopes of plutonium and uranium can constitute a critical mass at lower weights, and the greater the percentage of those isotopes in the fissile material batch, the less it will be necessary for the weapon to weigh. Note that the relationship is not linear; thus, a uranium core with 50% U-235 has a critical mass at a weight three times greater than that of a core with 90% U-235. Further, the use of a neutron-reflecting metal surface in the weapon's design can dramatically reduce the amount of the element needed to achieve critical mass. *See Fissile Material Primer, supra* note 25, at 206.

the plutonium mass would be equivalent to a baseball.[35] The greater the purity of the fissile material involved, the smaller the nuclear device's physics would be package.[36] An ordinary vehicle could probably transport the entire device.[37] Furthermore, fissile materials, including plutonium or enriched uranium, pose almost negligible health threats to those handling them directly.[38] Plutonium's radioactive emissions, known as alpha particles, are unable to penetrate the skin, and thus do not pose significant harm unless ingested. Uranium is also safe to handle, and would have to be ingested in significant quantities before a health problem arose.[39]

Questions of willpower are clearly beyond the scope of government intervention, even the most draconian disincentives for participation in nuclear terrorism will probably fail to dissuade at least some marginal terrorists. After all, it is plausible to argue that, at the very least, a subset of terrorists are not rational actors: "the decision to use terrorist violence is not always a rational one; if it were, there would be much less terrorism, since terrorist activity seldom achieves its aims."[40]

The question of credibility is similarly unproductive. If nuclear terrorists sought to employ their nuclear device as a bargaining chip, they could obtain the necessary credibility either by providing a sample of the fissile material employed in the weapon, or worse, by actually detonating a device. This analysis leaves only one input to which terrorists can realistically be denied access: fissile material.

C. The Need to Restrict Access to Fissile Material

1. Overview: Physics of a Simple Nuclear Weapon

"There is an overwhelming consensus that fissile material constitutes the major obstacle to a simple nuclear weapons capability."[41] A nuclear weapon cannot be fabricated without either plu-

35. *See WMD Hearings Part II*, *supra* note 18, at 22 (testimony of Graham T. Allison).

36. *See Fissile Material Primer*, *supra* note 25, at 210.

37. *See WMD Hearings Part II*, *supra* note 18, at 22 (testimony of Graham T. Allison).

38. *See* GRAHAM T. ALLISON ET AL., AVOIDING NUCLEAR ANARCHY 44 (1995).

39. *See id.* at 45.

40. Laqueur, *supra* note 16, at 31.

41. *Fissile Material Primer*, *supra* note 25, at 225.

tonium or enriched uranium.[42] The nuclei of these elements are capable of fission,[43] which occurs when a nucleus, struck by a neutron from any source, splits into two parts. These two successor elements combined will have less atomic mass than the original nucleus, with the difference having been transformed into a release of various forms of radiation. Not all isotopes of uranium and plutonium fission with equal ease. The odd-numbered isotopes of both are considered "fissile," in that fission will occur whenever a neutron strikes their nuclei.[44] In contrast, some isotopes are merely "fissionable," in that only neutrons with sufficient levels of energy can cause their nuclei to fission. Thus, fissile isotopes, are preferred for weapons purposes.

When a nucleus fissions, the neutrons emitted are capable of striking a neighboring nucleus, potentially triggering more fission.[45] When each fission reaction triggers at least one other fission reaction, a chain reaction is created.[46] When each reaction triggers more than one reaction, an explosive chain reaction occurs. A mass of fissile material sufficient to cause such a reaction is called a supercritical mass, which is achieved by using force to compress non-critical masses of the material together.[47] Roughly speaking, this is what occurs when a nuclear device is detonated. Significantly, Pu-239's critical mass is significantly smaller than that of U-235. Thus, a plutonium device can be much smaller than a uranium weapon.[48]

Obviously, then, those wishing to possess the power of a nuclear weapon must first possess an adequate amount of fissile (or fissionable) material.[49] This can only be achieved by either creat-

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42. *See id.* at 204-14. This bare bones account is entirely derived from Mr. Coté's insightful primer. For clarity's sake, this Article does not attempt to provide anything approaching a detailed review of the physics of a nuclear weapon. It deals with the topic only to the extent necessary to facilitate an understanding of the significance of various facets of the fissile material security problem in the former Soviet Union. For a more detailed account, see *id.* at 204-14.

43. Since hydrogen bombs present far less likely pathways to nuclear terrorism due to added complexities, this Article does not address fusion.

44. *See Fissile Material Primer*, *supra* note 25, at 204.

45. *Id.*

46. *Id.*

47. *Id.*

48. *See generally id.*

49. Since it would be more difficult to create a supercritical mass with fissionable material than it would with fissile material, for the remainder of this Article it will be assumed that the threat to be addressed concerns weapons relying on the latter.

ing the material or acquiring it. To understand why both the hopes and fears of those seeking to prevent nuclear terrorism rest on the prospects of the latter option, the greater difficulties attached to the former option, creating the material, must first be discussed. Of course, sub-state actors themselves are highly unlikely to be in a position to create their own fissile material. They may in certain instances, however, benefit from the indigenous nuclear programs of patron states.[50]

2. The Indigenous Production Route

To develop a uranium-based weapon requires complex industrial processes, because it is difficult to aggregate a sufficient amount of the fissile isotope U-235; that isotope accounts for only .072% of natural uranium.[51] Developing a useful quantity of U-235 requires "enrichment."[52] Enrichment is the immensely difficult process of separating U-235 from the more common isotopes of uranium, which are relatively indistinct from one another chemically.[53]

Highly enriched uranium (HEU) can be produced in several different ways. All of the options, however, require technologies that are both extraordinarily difficult to hide from outside observers and are equally as difficult to obtain. The acquisition hurdle results from efforts to restrict the transfer of technologies adaptable to this purpose, such as the Nuclear Non-Proliferation Treaty.[54] In light of these obstacles, it is highly unlikely that an aspiring proliferant could successfully produce its own HEU without drawing the full attention of the global community in advance.[55]

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50. The fissile material prospects of some proliferant states are discussed below. *See infra* Part III.B.2.

51. *See Fissile Material Primer, supra* note 25, at 212.

52. A 20% level of U-235 would suffice to create a weapon, though to qualify as the much preferable (for size of critical mass reasons) "weapons grade" requires approximately a 93% U-235 level. *Id.* at 216-17.

53. *See id.* at 216.

54. *See id.* at 221-22.

55. It is not, however, impossible. Iraq, for example, progressed far beyond the expectations of outside observers in its uranium enrichment program. In fact, it appears that they developed sufficient HEU for at least a small weapon and would have certainly had much more if their crash program had reached its fruition in the end of 1991. The Persian Gulf War and the efforts of both the United Nations Special Commission and the International Atomic Energy Agency seem to have reduced this threat. *See WMD Hearings Part II, supra* note 18, at 98 (testimony of Ambassador Rolf Ekeus, Executive

Nor would proliferants have much success producing their own plutonium. Plutonium is created in nuclear reactors when nuclei of the non-fissile isotope U-238 (which comprises the bulk of most reactor fuel) are joined by neutrons emitted in the fission process. Given their disparate chemical natures, the process of separating the plutonium from the uranium (reprocessing) is less difficult than uranium enrichment. Thus, the plutonium option is relatively feasible. Regardless, the technology required is extraordinarily difficult to disguise and is highly restricted on global markets.

In short, home-grown production of fissile material is effectively limited. First, the non-proliferation regime, in combination with individual state efforts, provides a system of economic restriction and sanction that limits and deters the acquisition of the relevant technologies. Second, nuclear weapons states maintain a careful vigil over developments in aspiring nuclear weapons states. Both of these factors necessitate slow, covert development of indigenous production capacity, if there is to be any such capacity at all.[56]

If the patronage of a proliferant state were the only route by which terrorists might obtain fissile material, then there would be relatively little cause for concern. The difficulties inherent in the indigenous development of fissile material already provides a window of opportunity in which the United States can act to prevent the successful culmination of such projects.[57] This has the result of reducing the pressure to develop and implement new prevention policies targeted at this particular route. Unfortunately, patronage is not the most likely pathway for terrorists to obtain fissile material.

3. The Underappreciated Black Market Route

A terrorist group seeking to obtain fissile material will turn, if at all possible, to the black market. The illicit sale of fissile material enables the purchaser, whether a state or a sub-state actor, to

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Chairman of the United Nations Special Commission).

56. *See Fissile Material Primer*, *supra* note 25, at 221-22.

57. For example, the United States was able to successfully negotiate a suspension of North Korea's indigenous plutonium production program. *See Hearing on Current and Projected National Security Threats to the United States before the Senate Select Committee on Intelligence*, 105th Cong. (1997) [hereinafter *National Security Hearing*] (testimony of Toby T. Gati, Assistant Secretary of State for Intelligence and Research), *available in* 1997 WL 8218799.

avoid all obstacles inherent in the production of the material, essentially nullifying the entire process-based prevention system outlined above. As Graham Allison states, "[w]hen fissile material itself is on sale, the traditional source of leverage on the nonproliferation challenge disappears . . . nuclear leakage enables states [or anyone else for that matter] to leap over the hardest part of acquiring nuclear weapons."[58] Thus, the ultimate question, from the perspective of nuclear terrorism prevention, is whether or not a nuclear black market exists.

The purported nuclear black market has its roots, ironically, in the United States' Cold War victory over the Soviet Union.[59] For decades, the analysis of the nuclear threat facing the United States was driven almost exclusively by considerations of Cold War tensions and the nuclear arms race. Thus, the national security of the United States was thought to be advanced by, first, a series of nuclear disarmament treaties and, second, the collapse of the Soviet Union.[60] Unfortunately, these Cold War successes simultaneously decreased the level of security surrounding the world's largest collection of fissile material.[61] To the degree that decreased security has increased the probability that terrorists will gain possession of fissile material, the declining odds of nuclear war have raised the odds of nuclear terrorism.

Despite the overwhelming consensus among experts that unsecured nuclear material in the Former Soviet Union (FSU) constitutes a top priority national security threat, this dynamic is not widely appreciated. The National Academy of Sciences issued a report in 1994, describing the status of fissile material in the FSU as a "clear and present danger to national . . . security."[62] This warning, however, did not trigger a substantial increase in public

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58. *See* ALLISON ET AL., *supra* note 38, at 52.

59. *See* Mirsky, *supra* note 5, at 751.

60. In 1991, the Doomsday Clock, the Bulletin of the Atomic Scientists' measure of the proximity of nuclear war, was set back to 17 minutes to midnight, its most optimistic placement ever. *See Listen to the Nuclear Clock Tick*, CHICAGO SUN TIMES, Dec. 11, 1995, at 33.

61. While the fall of the Soviet Union has certainly diminished the risk of a major war between the United States and a would-be challenger, it has also created new risks which could have a very severe impact on the United States . . . the challenge . . . is to ensure that the former Soviet Union does not become a vast supermarket for the most deadly instruments known to man. Unfortunately, there are already many prospective customers.

WMD Hearings Part I, *supra* note 8, at 4-5 (opening statement of Senator Sam Nunn).

62. Jessica Mathews, *Beware the Loose Nukes*, WASH. POST, Oct. 31, 1995, at A13.

concern.[63] The issue did receive top-level attention, however, in the wake of the Aum Shinrikyo's taboo-breaking sarin gas attack. The Permanent Subcommittee on Investigations of the Senate Committee on Governmental Affairs, chaired by Senator Richard Lugar (R-IN), held hearings on WMD proliferation during 1995 and 1996.[64] These hearings brought together academic experts and government officials in an effort to determine the nature and the adequacy of the U.S. response to the WMD threat. The committee focused much attention on loose fissile material in the FSU.[65] In the wake of the testimony, Senator Lugar concluded that the "U.S. response 'has not even begun to approximate U.S. stakes in the matter.'"[66]

In contrast to the vivid threat of nuclear conflict during the Cold War, the post-Cold War threat of loose nuclear material does not resonate with most Americans. Senator Lugar attempted to forge popular support for his campaign for the 1996 Republican Presidential nomination by highlighting the nuclear terrorism threat. He ran a series of ads in New Hampshire and Iowa containing dramatic portrayals of domestic nuclear terrorism scenarios, but voters paid scant attention.[67] It did not appear that the public believed another candidate could better address this issue; rather, "[t]hey've simply said that it's irrelevant."[68] In short, "nobody gets it. Mostly people don't believe it. Even when you say it, mostly people don't take it seriously . . . . [I]t is a matter of waking up to something that is fairly unbelievable."[69] Such disbelief is prominent despite expert consensus that the proliferation of nuclear weapons and weapons-capacity powerfully invokes the national interest of the United States.[70] If a nuclear black market

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63. *Id.*

64. *See WMD Hearings Part I, supra* note 8; *WMD Hearings Part II, supra* note 18. Senator Lugar has been joined by Senator Sam Nunn (D-GA) in his tireless efforts to promote awareness of this threat and generate the necessary political momentum to act decisively in response to it. *See WMD Hearings Part I, supra* note 8; *WMD Hearings Part II, supra* note 18.

65. *See WMD Hearings Part I, supra* note 8; *WMD Hearings Part II, supra* note 18.

66. Mathews, *supra* note 63.

67. *See Alexander and Lugar Give Up Race*, PLAIN DEALER, Mar. 6, 1996 at 8A, *available in* 1996 WL 3539995.

68. *Id.*

69. *WMD Hearings Part II, supra* note 18, at 23 (testimony of Graham T. Allison).

70. "The threat of nuclear diversion and trafficking from the former Soviet Union is our Nation's No. 1 national security threat. The threat is not theoretical, but real. . ." *WMD Hearings Part II, supra* note 18, at 131 (testimony of John F. Sopko, Deputy Chief

has indeed risen from the ashes of the Soviet nuclear complex, then this disjunction between perceptions and realities could prove disastrous for national security, since the political pressure necessary to vitalize and expedite a decisive policy reaction appears to be missing.

III. THE NASCENT FISSILE MATERIAL BLACK MARKET

If there were no grounds for fearing that fissile material can, realistically, be obtained by terrorists, then it would be unnecessary to clamor for extraordinary preventive measures. The truth is, unfortunately, that the conditions of supply security in the FSU constitute just such grounds.[71] The evidence indicates overwhelmingly that fissile material in the FSU is currently vulnerable to theft, particularly by those with inside access. Moreover, there is little border security to prevent the export of stolen material.[72] Furthermore, there is reason to believe that a demand for this material exists. In fact, there have been several confirmed incidents of actual fissile material theft and smuggling. Worse, it is likely that these incidents only constitute the visible tip of a black market iceberg. The inescapable conclusion is that there is a supply of fissile material within terrorists' reach.

A. Fissile Material Security in the Former Soviet Union

Confidence in the security of a fissile material cache derives from: (1) knowing the exact amount of material that should be present; (2) maintaining the best available protective measures to guard it; and (3) ensuring this amount remains intact. This mix of security inputs is referred to as material protection, control, and accounting (MPC&A).[73]

The inadequacy of MPC&A within the states of the FSU is the primary cause of concern. The security of most of the material in the possession of the Russian military reasonably approaches that provided by the U.S. military and civil sectors.[74] This subset of secure materials, however, is a dwindling island in a growing sea of insecurity, wherein mounting economic pressures both enable and exacerbate the possibility of fissile material diversion. Before

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Counsel to the Minority, Permanent Subcomm. on Investigations, U.S. Senate).

71. *See* Mirsky, *supra* note 5, at 756.

72. *Id.* at 776.

73. *See* ALLISON ET AL., *supra* note 38, at 80.

74. *Id.* at 39.

identifying the specific shortcomings of security within the FSU, however, it is worth comparing the chains of fissile material custody in the United States and in Russia in order to appreciate why the FSU's problems are likely to get worse in the coming years.

1. Comparing U.S. and FSU Fissile Material Security Practices

In both the United States and Russia,[75] actual possession of uranium and plutonium is distributed among a variety of entities, each with varying standards of security for the material in their possession.[76] A short comparison of the nuclear networks in the United States and Russia demonstrates that the Russians are faced with a unique problem that seriously aggravates the MPC&A concerns outlined below.

The United States currently possesses approximately 500 metric tons of HEU and 100 metric tons of plutonium.[77] The United States ceased producing new HEU for weapons in the 1960s, and stopped new naval fuel production in the 1980s.[78] Today, the only active HEU chain is a one-way link between the U.S. Navy and the pre-existing national HEU stockpile in Oak Ridge, Tennessee.[79] In addition, the United States ceased production of plutonium in 1989.[80] The only significant movement within the nuclear complex, aside from the one-way naval fuel chain, is the dismantlement and storage of nuclear weapons components, which is expected to end at the turn of the century.[81]

The dismantlement and storage process begins when a U.S. nuclear weapon is due to be dismantled. At this point, the Department of Defense (Defense) transports it to one of 196 heavily guarded underground concrete bunkers, where custody is trans-

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75. This subsection deals exclusively with fissile material security within Russia because it seeks to illustrate the particular aggravating effect of nuclear weapon dismantlement on Russian security, as well as to demonstrate why parallel concerns have not arisen within the United States. This is not meant to suggest that similar security concerns do not exist in the other states of the FSU.

76. *See* ALLISON ET AL., *supra* note 38, at 198-99.

77. Owen R. Coté, Jr., *Appendix A: The Russian Nuclear Archipelago, in* AVOIDING NUCLEAR ANARCHY: CONTAINING THE THREAT OF LOOSE RUSSIAN NUCLEAR WEAPONS AND FISSILE MATERIAL 177, 199 (1996) [hereinafter Russian Nuclear Archipelago].

78. *See id.* at 198.

79. *See id.* at 198-99.

80. *See id.* at 198.

81. *See id.* at 199.

ferred to the Department of Energy (Energy).[82] Energy transports the weapon to the Pantex facility in Amarillo, Texas, where it is again stored in a heavily guarded underground concrete bunker. Once dismantled, HEU components are sent to the national stockpile at Oak Ridge, while plutonium is kept at Pantex. In either case, there is a surplus of storage "slots" available within these maximum security installations, obviating the need for potential low-security improvisation. Every last gram of the material is painstakingly accounted for and guarded.[83] The key points of interest in this brief overview are, first, that the United States is no longer producing fissile material; second, that civilian MPC&A is both highly effective and unaffected by the flood of materials entering civilian custody due to weapons dismantlement. Unfortunately, neither of these conditions exist in the Russian system.

Russia currently possesses approximately twice as much HEU (1 kiloton) and plutonium (200 tons) as does the United States.[84] Moreover, the Russian stockpiles are being increased through weapons dismantlement and continued production.[85] Dismantlement is proceeding at a pace of between two and three thousand weapons per year, injecting an additional fifteen tons of plutonium and forty-five tons of HEU into the system annually.[86] Ongoing plutonium production at three Russian reactors contributes an additional 2.5 tons per year, but there is only a minimal amount of continued HEU production.[87] These numbers are not appreciably different from those that the U.S. nuclear material system must absorb in these years of disarmament. There is, however, a crucial distinction between the two systems: when fissile materials leave the relatively secure-hands of the Russian Ministry of Defense (MOD), and fall into the possession of the Ministry of Atomic Energy (MinAtom), they are no longer adequately protected. "In the U.S., these components are being stored in highly secure, unused weapons storage bunkers. In Russia, they are being stored in con-

82. *See id.* at 196.

83. *See id.*

84. *See Morning Edition: Nuclear Safety and Security in Russia-Part 1*, National Public Radio (Apr. 16, 1996), *available in* 1996 WL 28814493 [hereinafter *Nuclear Safety and Security*].

85. *See* Russian Nuclear Archipelago, *supra* note 77, at 199.

86. *See* David Hoffman, *Russia's Nuclear Sieve; Moscow Meeting to Focus on Plugging Safety Gaps*, WASH. POST, Apr. 17, 1996, at A25.

87. *See* Russian Nuclear Archipelago, *supra* note 77, at 199.

verted warehouses with much less security."[88] Thus, successful weapons conversion has turned out to be a double-edged sword: the more nuclear weapons are dismantled, the more fissile material is subject to theft.[89]

The retraction of Russia's nuclear arsenal since the early 1980s has drastically exacerbated the shortage of slots in Russia. Over a six year period, some 12,000 weapons were removed from, initially, Eastern Europe, and later, other states of the FSU.[90] At the same time, the retraction of borders has prevented Russian access to many previously available storage sites. Due to the consolidation and dismantlement trends, Russian secured storage capacity is being overwhelmed.

The most shocking aspect of this story is that there are available secured storage slots. MOD's weapons storage bunkers have been emptying at a fast rate, and the overflow of fissile materials in MinAtom custody could be substantially accommodated by them. All that is required is that dismantled weapons components be returned to the secured slots they occupied when in the form of nuclear weapons.[91] This would require MinAtom to return the fissile material to MOD. For bureaucratic and political reasons, however, it is utterly unlikely that MinAtom will relinquish its custody of this vast amount of potential hard-currency generating material.[92]

> MinAtom's top officials have demonstrated a disturbing proclivity to promote the use of nuclear technology, even at the risk of increased proliferation, as in their insistent campaign to complete nuclear reactor deals with Iran and their rather resentful response to suggestions for improved safeguards at their own facilities.[93]

Moreover, MinAtom's unsecured backlog continues to increase in four locations, each within a "closed city": Chelyabinsk,

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88. *Id.* at 189.

89. *See WMD Hearings Part II*, *supra* note 18, at 133 (testimony of John F. Sopko).

90. *See* Russian Nuclear Archipelago, *supra* note 77, at 179.

91. *See id.* at 190. Another option is to forego dismantlement in the first place, leaving the material within the weapons, and thus denying MinAtom the chance to ever acquire custody. This rests on the view that "there is more reason to be confident in the ability of the Russian military to safeguard these materials than in that of the nuclear enthusiasts at Russia's Ministry of Atomic Energy." Alton Frye, *Banning Ballistic Missiles*, FOREIGN AFF., Nov.-Dec. 1996, at 99, 104.

92. *See* Russian Nuclear Archipelago, *supra* note 77, at 191.

93. Frye, *supra* note 91, at 105.

Tomsk, Krasnoyarsk, and Sverdlovsk.[94] The first three locations also store Russia's newly-produced plutonium.[95] These are not, however, the only locations, within the Russian nuclear network with security problems. For example, fissile material also exists in an inadequately secured state at several research laboratories.[96] Recent cooperative efforts between Russian and U.S. labs, however, have substantially improved conditions at some of these facilities, such as the Kurchatov Institute.[97]

The Russian naval fuel cycle raises even greater concerns. William Potter, Director of the Center for Russian and Eurasian Studies at the Monterey Institute of International Studies, pointed to the inadequate protection of fresh naval reactor HEU as a top concern.[98] There are approximately ninety-six tons of HEU in the naval fuel cycle, with much of this amount in the form of fresh fuel rods stored on site at Russian shipyards[99] under low-security conditions.[100] The naval fuel problem is more than a matter of front-end security, however, as dozens of Russian submarines have been decommissioned without having their reactors removed.[101]

The potential trouble spots number approximately ninety facilities, each storing fissile material without adequate security,

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94. The Soviet Union created ten "secret" cities for the nuclear industry, each revolving around a MinAtom laboratory or facility designed for material, component, or weapons research and fabrication. Travel to and from these cities is restricted. Interior Ministry soldiers guard the outside and FSB troops guard the inside. Approximately 700,000 people inhabit the closed cities and MinAtom is largely responsible for their welfare. *See* Russian Nuclear Archipelago, *supra* note 77, at 181-84.

95. *See id.* at 200.

96. For example, at Obninsk, a vault storing pellet-sized plutonium elements was guarded with only a wax seal. *See WMD Hearings Part II*, *supra* note 18, at 20 (testimony of Harold J. Johnson, Jr.).

97. *See Nuclear Safety and Security*, *supra* note 84.

98. *See WMD Hearings Part II*, *supra* note 18, at 29 (testimony of William C. Potter, Dir. of the Ctr. for Russian and Eurasian Studies, Monterey Institute for Int'l Studies).

99. Largely located in Murmansk, Archangel, and Vladivostok. *See* Russian Nuclear Archipelago, *supra* note 77, at 185.

100. In a 1993 visit to the Murmansk naval base, Joshua Handler noted that the security depended on fences with gaping holes. *See WMD Hearings Part II*, *supra* note 18, at 60 (testimony of Joshua Handler, Research Coordinator for Disarmament Issues, Greenpeace).

101. Only 35 to 40 of 140 recently decommissioned submarines have had their fuel removed. Aleksey Yablokov, head of the Russian Security Council's interagency commission for environmental safety, estimates that removal will cost approximately 1.5 trillion rubles. *See Official on Funds Needed to Dispose of Nuclear Submarines* (Foreign Broadcast Information Service) Apr. 16, 1996, FBIS-SOV-96-074.

grouped within approximately forty-five different locations.[102] The basic problem at each location is inadequate MPC&A, which is in itself a sufficient window of opportunity for terrorists to obtain fissile material. The ongoing over-accumulation of fissile material from both dismantled weapons and fresh production significantly magnify these security problems. In turn, the loss of storage capacity because of the retraction of Russia's borders and the consolidation within them of the FSU's entire nuclear arsenal has exacerbated the over-accumulation problem. In the midst of it all, a plethora of secured slots are available to MOD due to weapons dismantlement, but MinAtom continues to employ improvised storage facilities, maintaining a status quo that is intolerable from a terrorism prevention viewpoint.

2. The MPC&A Deficit in the FSU

The magnitude of the fissile material security problem, and the variations in it among facilities, prevent a simple description of its nature. There are, however, sufficient similarities to reveal the contours of a significant problem.

It is not known how much fissile material has been produced in the FSU. This is because there has never been, nor is there now, a system to keep an exact account of fissile material production at any of these facilities.[103] Such accounting, however, is fundamental for any adequate security measures.

> The bedrock of secure custodianship of nuclear weapons and fissile materials is an effective and meticulous system of material control and accounting. . . [this] requires that an accurate inventory be maintained at all times of the weights and isotopic content of safeguarded materials. Such material control and accounting systems provide a basis for determining whether a theft, diversion, or loss of material has occurred.[104]

The consequences of this lack of accounting are not merely speculative. For example, when the United States removed 600 kilograms of HEU from Kazakhstan in 1994, scientists were

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102. *See WMD Hearings Part II, supra* note 18, at 175, 176 (testimony of Charles B. Curtis, Deputy Secretary, Dep't of Energy).

103. This almost unbelievable fact is acknowledged by MinAtom. *See WMD Hearings Part II, supra* note 18, at 131 (testimony of John F. Sopko).

104. ALLISON ET AL., *supra* note 38, at 37.

shocked to discover that the cache consisted of four percent more HEU than expected.[105] This four percent margin of error provided sufficient material to build a nuclear weapon.[106] Even if the accounting error was only one percent, when applied across the entire FSU, this would provide adequate material to build nearly a thousand bombs.[107]

According to Gosatomnadzor (GAN), a Russian nuclear regulatory agency, facilities in the Russian civil nuclear industry typically keep track of their fissile material inventories not by weight, but by ruble value.[108] It is no surprise, then, to learn that one facility has admitted that its best estimate of its inventory "could be off by tens of thousands of fuel elements."[109] Moreover, at the Kurchatov Institute, the only basis for accounting were boxes full of "old paper receipts."[110]

Furthermore, some facility administrators under-reported production each year and withheld some fuel elements in order to compensate for shortfalls in years of lesser production.[111] This exacerbates the untrustworthiness of these so-called "accounting" systems. Although the Russian government recently announced plans to set up a registry system to account for fissile materials,[112] there is little reason to be optimistic since some Russian officials continue to believe this to be a U.S. problem rather than their own.[113] Even if an effective registration system is implemented, however, accounting alone cannot prevent theft; it can only reveal it after the fact. Unfortunately, the preventive aspects of fissile material security in the FSU is often as inadequate as the accounting.

The vast majority of the facilities in question do not contain adequately sealed containers for the fissile material. In addition,

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105. *See Weekend Edition: Unguarded Nuclear Material Abounds in Russia*, (National Public Radio, Apr. 20, 1996), *available in* 1996 WL 7992682 [hereinafter *Unguarded Nuclear Material*]

106. *See id.*

107. *See* ALLISON ET AL., *supra* note 38, at 38.

108. *See WMD Hearings Part II, supra* note 18, at 132 (testimony of John F. Sopko).

109. *Id.*

110. *See* ALLISON ET AL., *supra* note 38, at 38.

111. *See WMD Hearings Part II, supra* note 18, at 132 (testimony of John F. Sopko).

112. *See Government Approves proposals on Nuclear Material Security*, (Foreign Broadcast Information Service, Oct. 23, 1996) FBIS-SOV-96-207.

113. *See WMD Hearings Part II, supra* note 18, at 156 (testimony of Frank Miller, Principal Deputy Assistant Secretary of Defense, Int'l Sec. Policy, Dep't of Defense).

facilities lack fissile material-detecting portal monitors and perimeter barriers sufficient to repel determined thieves.[114] For example, the Obninsk laboratory contained pellet-sized pieces of plutonium in a wax-sealed vault, without guards, cameras,[115] or portal monitors.[116] This problem is not limited to the research laboratories, however. At one MinAtom facility in Chelyabinsk-65, a warehouse containing thirty tons of plutonium was secured only by padlocks on the door,[117] with completely unsecured windows.[118] An official report of the Russian government disclosed that at Tomsk-7, security consisted entirely of guards and barbed wire fences without any electronic measures capable of defeating insider theft.[119] Furthermore, Russian Naval facilities lay claim to the dubious distinction of being the least well-guarded fissile material facilities in the entire FSU. The security at Murmansk inspired the classic line "even potatoes were guarded better."[120]

Graham Allison summarizes the Russian nuclear security system in the following manner:

> The quality of security is generally low: at its best, for weapons in Ministry of Defense custody, it approaches U.S. standards, but MinAtom's military fissile material inventory is poorly secured, and its civil plutonium stockpile is even worse. The security of fissile materials used in research institutes, naval fuel cycle facilities, etc., is nothing short of terrifying.[121]

Considering that a Russian officer has admitted that an actual warhead could be stolen by an insider from his ready launch facility with relative ease due to consistent electrical outages that de-

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114. *See id.* at 18 (testimony of Harold F. Johnson, Jr.).

115. A total of 50-55 of these elements, which could probably be accumulated by a single worker dropping the pellets into his pockets over a several week period, would suffice to create a bomb. *See id.* at 20.

116. *See id.* at 61 (testimony of Joshua Handler).

117. This report comes from the eyewitness testimony of Frank von Hipple, physicist with the White House Office of Science and Technology. *See Nuclear Safety and Security, supra* note 84.

118. *See* ALLISON ET AL., *supra* note 38, at 40.

119. *See id.*

120. This apt description was made by the chief military prosecutor in a case involving the theft of 10 pounds of HEU from the Sevmorput shipyard near Murmansk, inspiring the title *Potatoes Were Guarded Better.* Burkharin & Potter, *supra* note 4, at 46; *see also WMD Hearings Part II, supra* note 18, at 26 (testimony of William C. Potter).

121. ALLISON ET AL., *supra* note 38, at 39.

activate alarms,[122] it is disheartening to consider that abundant amounts of Pu-239 and U-235 are also available at the lower end of the security hierarchy. The full scope of the security dilemma, however, is yet to be revealed.

Although the foregoing discussion dealt exclusively with Russian nuclear security, it would be a mistake to ignore the significance of fissile material in the other states of the FSU. While the FSU's nuclear weaponry now belongs exclusively to Russia,[123] there are still significant quantities of fissile material, as well as the capacity to generate more, in the other successor states. Moreover, there can be no certainty as to how much of this material exists, nor can there be confidence in the security measures protecting it.[124] For example, in 1994, the United States removed 1100 pounds of HEU that Kazakhstan had unexpectedly discovered at a nuclear facility in Ustkaminigorsk.[125] Then, in 1995, Kazakhstan notified the International Atomic Energy Agency (IAEA) that an additional 205 kilograms of HEU had been discovered at the nuclear facility in Semipalatinsk.[126] Russia, insisting on ownership rights, is negotiating a disposition of the material with the United States, but in the meantime has denied Kazakhstan permission to apply IAEA safeguards to the site.[127]

The Semipalatinsk discovery is most significant not as a material theft risk, but rather, as a symbol of the potentially numerous unknown caches of fissile material outside of Russia's borders. Unfortunately, Kazakhstan's importance for proliferation concerns is not limited to the unknown. Aktua, a Caspian Sea port across the waters from Iran, possesses a fast breeder reactor with significant amounts of plutonium and a fast-growing Iranian pres-

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122. The power outages resulted from a failure to pay the facility's electric bill. The launch facility possessed 20 SCUD-B nuclear warheads, in addition to numerous nuclear artillery shells. *See WMD Hearings Part II, supra* note 18, at 68 (testimony of John F. Sopko).

123. Belarus returned the last of 81 nuclear missiles to Russia on November 27, 1996; Ukraine and Kazakhstan had already returned all of the missiles in their possession. *See Belarus Delivers Last Nuke to Russia for Destruction*, SAN ANTONIO EXPRESS-NEWS, Nov. 28, 1996, at 12A, *available in* 1996 WL 11508551.

124. According to William Potter, "[t]here may well be . . . substantial caches of nuclear material in the non-Russian successor states, about which neither Moscow nor the national authorities, say in Central Asia or in the Caucuses or in Ukraine or Belarus, may be familiar with." *Unguarded Nuclear Material, supra* note 105.

125. *See id.*

126. *See WMD Hearings Part II, supra* note 18, at 29 (testimony of William C. Potter).

127. *See Unguarded Nuclear Material, supra* note 105.

ence.[128]

Ukraine is also a cause for concern, because it inherited an extensive nuclear reactor network from the FSU, including a large amount of fissile material.[129] This financially-strapped nation has not been able to put in place an adequate regulatory structure. According to Andrei Glukhov, former Deputy Chief of the Ukrainian Nuclear Regulatory Agency, that agency is understaffed and overwhelmed.[130] Not surprisingly, although Ukraine has attempted to inventory this material, it has not yet succeeded.[131]

As to security, Ukrainian Interior Minister Yuriy Kravchenko declared that no theft has taken place since independence.[132] Even if true, this trend is not likely to continue. Former Director Glukhov described a non-fissile material theft for the Permanent Subcommittee on Investigations in the 1996 hearings, indicating that it took place in one of the more adequately-secured facilities.[133] This suggests serious risks of theft at the less-secured research reactors, which do possess HEU.

In Georgia, another unexpected cache of fissile material surfaced, under circumstances graphically demonstrating the danger associated with unknown nuclear stockpiles in unstable locations. The Georgian cache, consisting of several kilograms of HEU, was located in an obsolete nuclear reactor outside of Tbilisi, where it remained completely unguarded throughout the upheavals of the Georgian civil war.[134] After its discovery, the United States, Georgia, and Russia began to negotiate its disposition, but these

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128. *See WMD Hearings Part II, supra* note 18, at 30 (testimony of William C. Potter).

129. For example, a one ton cache of enriched uranium at the Kharkov Institute of Physics and Technology is known to be HEU. *See id.* at 50 (testimony of Andrei Glukhov, Former Deputy Chief, Ukrainian Nuclear Regulatory Agency).

130. For example, there are only three regulators employed at the agency's headquarters. *See id.* at 51.

131. *See id.*

132. *See Minister Rejects Idea of Nuclear Thefts in Ukraine*, (Foreign Broadcast Information Service, Jan. 31, 1996) FBIS-SOV-96-022.

133. The stolen material consisted of two fuel rods (non-HEU), each 3.5 meters long, which were never recovered. *See WMD Hearings Part II, supra* note 18, at 50 (testimony of Andrei Glukhov). Other thefts are known to have been attempted. At Chernobyl, three workers were caught having stolen 5.5 kilograms of uranium, of unknown enrichment levels. The judge in their case has noted that this was not the first theft attempted at the facility, and reprimanded the plant for its lax security. *See Chernobyl Workers Arrested Trying to Sell 5.5 Kilograms of Uranium*, (Foreign Broadcast Information Service, Oct. 26, 1996) FBIS-SOV-96-209.

134. *See U.S. Trying to Remove Cache of Nuke Material*, SAN ANTONIO EXPRESS-NEWS, Jan. 5, 1997, at 12A, *available in* 1997 WL 3156324.

efforts have been "thwarted by months of diplomatic impasse."[135] Georgian officials have now declared the material for sale, so long as it is bought with the guarantee that it will not be used for military purposes.[136] While it is unlikely that this highly visible cache will be sold to the "wrong" customers, this certainty will not always be present when the various successors to the Soviet Union discover secret caches. According to one source, at least seven of the successor states probably possess fissile material, and only in Latvia have decent safeguards been put into place.[137] Thus, Russia does not stand alone in its security shortcomings. Nor should this be surprising, since the citizens of each of the successor states, including soldiers and scientists, share the same economic hardships, and it is in significant part the pressure created by these hardships that both enables and enhances the possibility of fissile material theft.

3. The Role of Insider Theft

Insider theft is by far the most significant threat to fissile material security.[138] While the existing security measures, scant as they are, suffice to provide relatively significant barriers to a purely external security threat, the MPC&A failures riddling the FSU provide a gaping window through which scientists, military personnel, and lay employees of nuclear material-containing facilities may pass with ease. These observations were every bit as true during the peak of Soviet power, but at that time the incentive structure was entirely different.

The post-Soviet world has produced drastic economic uncertainties, resulting in hardships never experienced by soldiers and scientists under the old regime. At the same time, the U.S.S.R.'s harsh but highly effective system of internal control has collapsed, providing the opportunity for conduct that was previously inconceivable. The problem, from the perspective of fissile material theft, is that the security measures at Soviet nuclear material fa-

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135. *Id.*

136. *See Georgia Offers to Sell Highly Enriched Uranium*, SAN ANTONIO EXPRESS-NEWS, Jan. 8, 1997, at 5A, *available in* 1997 WL 3156662.

137. *See Unguarded Nuclear Material, supra* note 105. This contrasts with the situation in Belarus, where officials originally denied possession of fissile material, but later reversed themselves, and requested help in securing their cache. *See id.*

138. *See WMD Hearings Part II, supra* note 18 at 32 (testimony of Sarah Mullen, Chair, Global Organized Crime Nuclear Black Market Task Force, Ctr. for Strategic and Int'l Studies).

cilities were premised on the functioning of that internal control system. They were simply not designed to protect the material from insider theft.[139] After all, in Soviet society, a renegade insider would have had nowhere to go.[140] There was no access to, or even awareness of, black market purchasers. Even if there had been, economic pressures of the magnitude sufficient to compel such a risk-laden act did not exist. The heart of the matter is that these premises are inapplicable in the FSU of 1997.

Thus, the greatest risk comes from the FSU's scientists, soldiers, and workers who already have access to fissile material. The only conceivable barrier to diversion by such insiders is a portal monitor, or similar devices capable of detecting the improper removal of fissile material from restricted areas. Of course, this sort of safeguard is absent in the at-risk facilities. This is not to suggest that these insiders are, as a class, given to this type of behavior. Even the most law-abiding individuals, when confronted with sufficient hardship, such as a starving family, may be pushed across the line, a step made psychologically palatable by the absolute ease with which a diversion could be accomplished.

Nuclear scientists in the FSU are drastically underpaid, when they are paid at all. The "cream of the scientific community" earns $50 per month, an amount several times lower than that earned by plumbers,[141] while in some of Russia's closed nuclear cities, physicists' salaries are less than half of what is paid to a Moscow bus driver.[142] At the Kurchatov Institute, nuclear scientists earn only $30 per month,[143] while Georgian high technology weapon designers actually subsist on between $2 and $5 per month.[144] The economic and self-esteem problems generated by these low wage levels are inconsequential, however, compared to the effects of periodic non-payment of wages.[145]

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139. *See* ALLISON ET AL., *supra* note 38, at 40.

140. *See id.* at 42.

141. *Weekend Edition: International Community Helps Russian Scientists* (National Public Radio, Apr. 1, 1995), *available in* 1995 WL 2880395.

142. *See Morning Edition: Russian "Secret Cities" Look for Peaceful Pursuits* (National Public Radio, Apr. 1, 1995), *available in* 1995 WL 2880395.

143. *See WMD Hearings Part II, supra* note 18, at 138 (testimony of Alan Edelman, Counsel to the Minority, Permanent Subcomm. on Investigations, U.S. Senate).

144. *See WMD Hearings Part II, supra* note 18, at 64 (testimony of Glenn E. Schweitzer, Dir., Office for Central Europe and Eurasia, National Acad. of Sci., Founding Dir., Int'l Sci. and Tech. Ctr. in Moscow).

145. *See id.*

Wage arrearages are "extremely acute" in the Russian nuclear industry,[146] with some facilities being as much as four months behind,[147] and others providing credit in the place of cash.[148] Recently, economic deprivation provoked a nation-wide strike in the nuclear industry,[149] including a planned hunger strike by hundreds of employees at a St. Petersburg area nuclear reactor. President Boris Yeltsin's explicit promise of back pay only partially preempted the strike.[150] There can be no doubt about the magnitude of the pressures resulting from these tumultuous circumstances. Vladimir Nechay, the director of a nuclear facility in Chelyabinsk, committed suicide last fall, leaving a note attributing his decision to financial stress.[151]

Another indication of the immense economic pressure and job frustration afflicting the FSU's scientists is the "brain drain."[152] Other nations are courting these experts for their unique knowledge, and some of these experts are only too willing to accept. "[A]s the economic conditions continue to deteriorate, the hands of more and more specialists remain idle for longer and longer periods of time, and the temptations to turn wherever for economic relief grows."[153] It is not just that the scientists are not paid, even if the money was there, they have no work to do,[154] nor any equipment with which to do it.[155] Worse, the situation deterio-

146. *See Nuclear Industry, Power Plant Workers Ready to Strike*, (Foreign Broadcast Information Service, Sept. 19, 1996) FBIS-SOV-96-183.

147. Such is the case at Arzamas-16, for example, where wages lag from two to four months behind. *See WMD Hearings Part II, supra* note 18, at 64 (testimony of Glenn E. Schweitzer).

148. *See Nuclear Industry, Power Plant Workers Ready to Strike, supra* note 146.

149. *See Morning Edition: Russian Workers Strike to Protest Long-Overdue Wages* (National Public Radio, Oct. 4, 1996) [hereinafter *Russian Workers Strike*], *available in* 1996 WL 12730096. One striking worker appeared insulted by the suggestion that the financial hardships against which he protested might prompt him to steal fissile material for a black market sale. *See id.*

150. Nine nuclear engineers remained on hunger strike. *See Some Progress Reported in Russia's Labor Strike*, SACRAMENTO BEE, Dec. 7, 1996, at A6.

151. The facility's deputy director saw the suicide note before the police took custody of it. *See Chelyabinsk Nuclear Director's Suicide Due to "Stress,"* (Foreign Broadcast Information Service, Oct. 31, 1996) FBIS-SOV-96-212.

152. *See WMD Hearings Part II, supra* note 18, at 139 (testimony of Alan Edelman).

153. *See id.* at 54 (testimony of Glenn E. Schweitzer).

154. *See id.* at 145 (testimony of Alan D. Edelman).

155. Labs are often bereft of equipment, which has either been sold or stolen. *See id.* at 146 (testimony of John F. Sopko).

rates each year, as more and more new scientists are produced.[156]

Proliferant states are attempting to take full advantage of this dynamic. Nuclear weapon designers have traveled to China,[157] nuclear physicists have received offers from Iran,[158] and missile guidance experts were stopped on a Russian runway just before taking off for North Korea.[159] North Korea, Iran, and Iraq recruited nuclear scientists from Uzbekistan, while Georgian and Kazak nuclear physicists are involved in an Iranian "scientific exchange" program.[160] Fortunately, of approximately 60,000 FSU scientists with WMD knowledge of proliferation concern, the vast majority are extremely loyal to their countries,[161] and have little interest in permanent emigration.[162] Still, the real world consequences of financial pressures cannot be ignored. Investigators for the Permanent Subcommittee on Investigations discovered a flyer being circulated in the Middle East that proclaimed the availability of "detailed files" on FSU nuclear weapons experts seeking "reasonable pay."[163]

From an economic perspective, life in the military is no better than in the nuclear industry. Since 1992, Russian military spending has declined by nearly half,[164] and wage arrearages have become common.[165] Significantly, General Maslin, head of the 12th Main Directorate of the Ministry of Defense, recently revealed that the salaries of soldiers in charge of nuclear weapons have not been paid in one or two months.[166] The overall situation has led the Russian Defense Minister to declare the military in a "state of emergency."[167] In addition, former Russian Security Council Chief Alexander Lebed has warned that the army is in "a condi-

156. *See id.* at 144 (testimony of Alan Edelman).

157. *See id.* at 53 (testimony of Glenn E. Schweitzer).

158. *See id.* at 65.

159. These scientists had the approval of their laboratories, and were being offered $25,000 a year. Apparently, previous information exchanges with the North Koreans had already taken place. *See id.* at 66.

160. *See id.* at 138 (testimony of Alan Edelman).

161. *See id.* at 53 (testimony of Glenn E. Schweitzer).

162. *See id.* at 145 (testimony of John F. Sopko).

163. The "Hong Kong Sunshine Industrial Company," an illegal arms-sale group, circulated the flyer. *See id.* at 139 (testimony of Alan Edelman).

164. *See Strategic Survey: US Military Strongest, Russia's in Decline*, B. GLOBE, Oct. 10, 1996, at A13.

165. *See Russian Workers Strike*, *supra* note 149.

166. *See WMD Hearings Part II*, *supra* note 18, at 138 (testimony of Alan Edelman).

167. *See Russian Workers Strike*, *supra* note 149.

tion very much like the condition before [a] mutiny."[168]

Low or non-existent wages have driven some soldiers, like those of the Kantemirov Tank Division, to farm for cabbage and turnips in the fields.[169] Others are less fortunate; involvement in the black market sale of weaponry has become common from top to bottom in the military.[170] In one instance, two soldiers lost their lives while attempting to dismantle a live nuclear warhead in order to sell its parts on the scrap metal black market.[171] Other soldiers, like Director Nechay, have taken their own lives in response to their economic plight.[172]

It is not difficult to imagine a hungry scientist or soldier agreeing to take a small quantity of fissile material out of a facility to which that person already has access because that person is burdened by a crushing sense of despair and frustration for failing to support a family. In many facilities, there are no internal safeguards to prevent the theft, nor any accounting system to discover that it had taken place.[173] Guards on the outside would most likely just nod their heads at the familiar sight of the insider entering and leaving the facility, unaware that fissile material filled that person's pockets. In the post-Soviet world, the disincentives to theft are simply gone, replaced by frustration and need. These conditions suggest that the only true hurdles for a would-be nuclear terrorist are identifying, contacting, and reaching an agreement with those who have access to fissile material and are desperate enough to help.

4. The Additional Problem of Border Security

Mere possession of fissile material is not sufficient, however, to accomplish the aims of a would-be nuclear terrorist. Obviously, in order to pose a serious risk beyond the FSU, fissile material must be moved across the FSU's borders. This raises questions concerning border security in the FSU; if policy makers can rely on border controls, then there is much less cause for alarm concerning

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168. *Lebed Says Russian Army Near Collapse*, ARMED FORCES NEWSWIRE SERVICE, Nov. 27, 1996, *available in* 1996 WL 12392110.

169. *See Lebed Warns of Military Uprisings; Kremlin's Security Chief Steps Into Power Vacuum*, BALTIMORE SUN, Sept. 26, 1996, at A16 [hereinafter *Lebed Warns of Military Uprisings*].

170. *See WMD Hearings Part II*, *supra* note 18, at 138 (testimony of Alan Edelman).

171. *See Lebed Warns of Military Uprising*, *supra* note 169.

172. *See id.*

173. *See* ALLISON ET AL., *supra* note 38, at 40.

internal security matters.[174] Unfortunately, border security in the FSU does not, and cannot, provide such a guarantee.[175]

Illegal exportation is a significant problem in the FSU.[176] Currently in Russia, there is no comprehensive export control law,[177] although the country has joined major international export control treaties, such as the Missile Technology Control Regime.[178] The Russian government does have a patchwork of export-related decrees, but at least some Russian courts have refused to apply criminal sanctions for violations of rules not passed by the Duma.[179] Although the ranks of customs officials have recently begun to swell, it is probable that this is more a reflection of the lucrative opportunities open to corrupt customs officials than it is of a growing emphasis on effective border controls.[180] In light of the involvement of various Russian and Ukrainian officials in the export of sensitive missile technologies,[181] and the conviction of Kazakhstan's former Defense Minister for a $2 million arms sale,[182] it is difficult to argue that a genuine top-level commitment to tighten border controls exists.[183]

Even if such a commitment existed, however, the ultimate result is that only a fraction of illegal exports would ever be interdicted.[184] Those who cannot export legally always have the option of smuggling their goods across the border, and in the FSU, the border is more than 40,000 miles long.[185] The western portions of that border lead on to the well-policed states of Europe. A far larger stretch of border, however, runs through the Caucuses and

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174. *See WMD Hearings Part II, supra* note 18, at 138 (testimony of Alan Edelman).

175. *See id.*

176. *See WMD Hearings Part II, supra* note 18, at 36-37 (testimony of Gary Bertsch, Dir., Ctr. for Int'l Trade and Sec., Univ. of Georgia).

177. *See id.* at 36.

178. *See All Things Considered: Yeltsin Fires Three Top Officials Linked to Chechen War* (National Public Radio, June 30, 1995), *available in* 1995 WL 2918636.

179. *See WMD Hearings Part II, supra* note 18, at 36-37 (testimony of Gary Bertsch).

180. The more positive spin on this development was put forth by Gary Bertsch in testimony before the Permanent Subcomm. on Investigations, but it was rejected by William Potter, whose interpretation appears more plausible in light of continued financial strains in the FSU. *See id.* at 40 (testimony of William C. Potter).

181. *See id.* at 42.

182. *See id.* at 38 (testimony of Gary Bertsch).

183. *See id.* at 42 (testimony of William C. Potter).

184. *See id.* This is a fact also well known to those involved in combating international narcotics.

185. *See id.* at 37 (testimony of Gary Bertsch).

Central Asia, referred to as the "southern tier."[186] The southern tier smuggling route would be both shorter and safer, and "[d]espite difficult terrain, a direct overland route [to the south] could avoid Western detection altogether."[187] Smugglers traveling to the Azerbaijan-Iran border would discover few, if any, border guards, with the same situation pertaining in the other southern tier states.[188] Nor would the presence of a border guard necessarily be a problem; in Turkmenistan, for example, a bottle of vodka suffices to wave a person through, and $100 will clear the path for an entire vehicle.[189] Bribery, however, may not even be necessary.

> Russia's many border posts and points of entry lack even the most rudimentary equipment for detecting nuclear materials, and the underpaid officials who staff these posts have received no special training in the identification and detection of nuclear materials. (This is also true, it should be noted, of the U.S. Customs Service.) The situation in the other former Soviet republics is even worse: not only do they lack trained officials and special detection equipment, but as new states they also generally have inadequate export control laws and regulations. . . .[190]

Compounding the problem, the U.S. intelligence and law enforcement communities have access to very little information in the southern tier.[191] The CIA, however, is developing a working group to address this potentially-disastrous shortcoming.[192] In light of the foregoing, it appears quite certain that fissile material is both vulnerable to theft and amenable to smuggling. But, mere availability, without more, does not suffice to establish the existence of a black market.

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186. *See id.* at 137 (testimony of Alan Edelman).

187. Barry Kellman & David S. Gualtieri, *Barricading the Nuclear Window—A Legal Regime to Curtail Nuclear Smuggling*, 75 U. ILL. L. REV. 667, 677 (1996).

188. *See WMD Hearings Part II, supra* note 18, at 137 (testimony of Alan Edelman).

189. *See id.* at 138.

190. ALLISON ET AL., *supra* note 38, at 94.

191. *See WMD Hearings Part II, supra* note 18, at 32 (testimony of Sarah Mullen).

192. *See id.* at 172 (testimony of Gordon C. Oehler, Dir., Non-Proliferation Ctr., CIA). Then CIA Director John Deutch, when asked by Senator Nunn about U.S. intelligence capacities in the southern tier, declined to comment in open session. *See id.* at 77 (testimony of John Deutch).

B. The Demand for Fissile Material

1. Demand at the Terrorist Organization Level

An available supply of fissile material poses little risk to the United States if there is no demand for it. In the past, so long as terrorists were not actively interested in WMDs there was no special reason to guard against terrorists' acquisition of the precursors of WMD capability. But it is impossible to deny that at least some terrorists now desire such weapons. The Aum Shinrikyo cult is perceived to have pioneered terrorist use of weapons of mass destruction with their sarin gas assault on the Tokyo subways in 1995.[193] In fact, the cult had already conducted a smaller-scale sarin attack in 1994, in Matsumoto, Japan.[194] Nor is the United States immune from the new threat. In 1995, members of an extremist right-wing organization were convicted of planning to use ricin, a biological weapon, against federal officials.[195] In another incident, a white supremacist was arrested for purchasing three vials of bubonic plague.[196]

There is no reason to believe that terrorists willing to resort to chemical and biological weapons would not also employ nuclear weaponry if available.[197] The Aum Shinrikyo cult, for example, has explored the nuclear option. Not surprisingly, the cult looked to the FSU to fulfill this purpose, viewing it as "a supermarket for technology, equipment and expertise."[198] Moreover, the notes of Aum Shinrikyo's "Construction Minister" revealed that at a meeting with unidentified officials, the price for an actual nuclear weapon may have been discussed.[199] Another example occurred in 1995, when Chechen rebels managed to place a 30 pound backpack containing cesium-137[200] in Izmailovsky Park in Moscow.[201] The rebels did not attempt to disperse the radioactive material, but

193. *See* Jessica Stern, *Terrorism Multiplied*, WASH. POST, July 17, 1996, at A19.

194. *See WMD Hearings Part I, supra* note 8, at 23 (testimony of John Sopko).

195. *See* Stern, *supra* note 193.

196. *See id.*; *see also* Schumer, *supra* note 8, at 2.

197. *See generally,* Laqueur, *supra* note 16. Former CIA Director John Deutch has pointed out that the nuclear option is the least likely WMD route for a terrorist, with chemical weaponry being the most likely. *See WMD Hearings Part II, supra* note 18, at 75 (testimony of John Deutch).

198. *See WMD Hearings Part II, supra* note 18, at 15 (testimony of Alan Edelman).

199. *See id.* at 16.

200. *See id.* at 69, 70 (comments of Senator Richard Lugar).

201. *See id.* at 58 (testimony of Joshua Handler).

were instead content to convey a message of credibility to the Russian government.[202] The overall tenor of these incidents convey an additional message: at least some terrorists will go to significant lengths to acquire a nuclear option.

2. Demand at the State Sponsor Level

The evidence of demand for fissile material by potential state sponsors of terrorism is even more compelling. Iraq is a good example. According to former Director of Central Intelligence John Deutch, Iraq has explored the possibility of purchasing illicit fissile material as a means of acquiring nuclear weapons capacity.[203] This should not be a surprise considering the expense Baghdad has incurred in both its pre-war domestic fissile material production program and its post-war efforts to maintain a residual WMD capacity.[204] Prior to the Gulf War, Iraq was engaged in a crash program to develop at least one nuclear device, deliverable by SCUD missile.[205] For over ten years, 15,000 Iraqi's were involved in the $10 *billion* dollar program,[206] which went into overdrive in 1990.[207] Had the war not intervened, Iraq would have possessed an actual nuclear weapon by the end of 1991.[208]

Since the war's end, Iraq has refused to cooperate with the U.N. Special Commission, which is responsible for identifying and destroying Iraq's WMD capacity.[209] Due in part to Iraq's resistance, U.N. sanctions, such as the oil embargo, have continued to strangle the Iraqi economy, costing Iraq $75 billion over a five year period.[210] It is the consensus of the intelligence community that the Hussein regime is committed to preserving residual WMD capacity despite these consequences.[211]

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202. *See id.* at 69, 70 (comments of Senator Richard Lugar).

203. *See id.* at 74 (testimony of John Deutch).

204. *See generally id.* at 90-104 (testimony of Ambassador Rolf Ekeus).

205. *See id.* at 91.

206. *See id.* at 105 (testimony of David A. Kay, Senior Vice President, Hicks & Assocs.). Amazingly, 19 of 25 facilities involved in this program were unknown prior to the Gulf War. *See id.*

207. *See id.* at 98 (testimony of Ambassador Rolf Ekeus). The Iraqis were fabricating an implosion device. *See id.*

208. *See id.* at 105 (testimony of David A. Kay).

209. *See id.* at 90 (testimony of Ambassador Rolf Ekeus).

210. *See id.* at 91.

211. *See id.* at 79 (testimony of John Deutch); *see also National Security Hearing, supra* note 57 (testimony of Toby T. Gati).

In light of the close scrutiny already being applied to Iraq, however, there may be more need to focus on Iran. There is considerable concern that Iran is currently engaged in an indigenous program of fissile material development,[212] similar to the program attempted by Iraq.[213] Iran is already oriented towards the FSU in its pursuit of indigenous production capacity. For example, Iran negotiated the purchase of a reactor from Russia,[214] made numerous efforts to recruit the assistance of nuclear experts from the various states of the FSU, including Georgia,[215] Kazakhstan, and Uzbekistan,[216] and it may even be sending its own scientists to Russia for training.[217] In 1995, then-Secretary of Defense William Perry warned that Iran will have nuclear weapons capacity within seven to fifteen years.[218]

As in the case of Iraq, it is difficult to persuasively argue that a country willing to engage in expensive, time-consuming programs of covert indigenous fissile material development would not enthusiastically avail itself of relatively inexpensive and readily available black market fissile material. In fact, it is known that Iran was interested in purchasing the HEU that the United States eventually removed from Kazakhstan in Project Sapphire.[219] This is significant from a terrorism prevention perspective because the connection between Iran and state-sponsorship of terrorism is well-established: "Iran remains foremost among the states which sponsor terrorism."[220] Unfortunately for the United States, the government of Iran considers the U.S. to be its "principal global

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212. *See WMD Hearings Part II, supra* note 18, at 74 (testimony of John Deutch).

213. *See id.* at 113 (testimony of Gary Milhollin, Dir., Wis. Project on Nuclear Arms Control).

214. A light water reactor in Bushehr is due to be completed by the year 2000, at a cost of $780 million. A second reactor purchase, for southern Iran, is also under consideration. *See Government to Increase Defense Supplies to Iran*, (Foreign Broadcast Information Service, February 14, 1996) FBIS-SOV-96-032; *see also Mikhaylov: Russia May Train Iranian Nuclear Specialists*, (Foreign Broadcast Information Service, March 6, 1996) FBIS-SOV-96-046; Charles J. Ball, *A Weapons Policy Like An Old Sieve*, WASH. POST, Oct. 18, 1996, at A23.

215. *See WMD Hearings Part II, supra* note 18, at 65 (testimony of Glenn E. Schweitzer).

216. *See id.* at 138 (testimony of Alan Edelman).

217. *See Mikhaylov: Russia May Train Iranian Nuclear Specialists, supra* note 214.

218. *See* Peter Waldman, *Egypt Confronts Israel on Nuclear Arms; Pressure to Sign Non-Proliferation Pact Strains Ties*, WALL ST. J., Jan. 11, 1995, at A10.

219. *See* ALLISON ET AL., *supra* note 38, at 44.

220. *National Security Hearing, supra* note 57 (testimony of Toby T. Gati).

adversary."[221] The threat was symbolically captured recently by Iran's own parliament, which celebrated passage of an $8.3 million fund to fight "U.S. government plots against Iran" with 270 legislators rising to their feet and chanting "Death to America!"[222]

The focus on Iraq and Iran is not meant to imply that other countries are not involved in, or capable of, nuclear proliferation. North Korea[223] and China[224] have each demonstrated a willingness to contribute to the spread of fissile material production technology without regard to the recipient.[225] However, it is important to note that the Department of Energy predicts that rising world oil demand will infuse an additional $1 *trillion* into the economies of the Middle East's oil-producing nations by 2010.[226]

The demand side of the potential nuclear black market has thus taken on the following dimensions. Terrorist groups are increasingly willing to use weapons of mass destruction, and they are willing to use them against the United States.[227] Even if a willing terrorist group is either financially or logistically unable to directly access the fissile material supply of the FSU, potential state sponsors may be able to overcome this obstacle for them.[228] Several states have already demonstrated that it is worth billions of dollars, as well as international approbation, to pursue their own fissile material production capacity.[229] These states will logically turn to the black market in order to save both time and money. Any of these states, if willing to sponsor terrorism, could provide the necessary connection between a willing terrorist group otherwise lacking access to the fissile material market. Thus, although fissile material demand should, as a matter of anti-terrorism policy de-

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221. *Id.*

222. *Iranian Parliament OK's Anti-U.S. Fund*, SAN ANTONIO EXPRESS-NEWS, Jan. 23, 1997, at A4, *available in* 1997 WL 3158322.

223. *See National Security Hearing, supra* note 57 (testimony of Toby T. Gati); *see also WMD Hearings Part II, supra* note 18, at 66 (testimony of Glenn E. Schweitzer).

224. Gary Milhollin reports that China has sold nuclear-related technology to Algeria, Iran, Iraq, Syria, and Pakistan. *See WMD Hearings Part II, supra* note 18, at 111; *see also* A.M. Rosenthal, *The Nuclear Gamble*, N.Y. TIMES, Oct. 11, 1996, at A39.

225. *See National Security Hearing, supra* note 57 (testimony of Toby T. Gati).

226. *See WMD Hearings Part II, supra* note 18, at 161 (testimony of Charles B. Curtis).

227. *See* Schumer, *supra* note 8 at 2.

228. *See WMD Hearings Part II, supra* note 18, at 91 (testimony of Ambassador Rolf Ekeus).

229. *See id.* at 79 (testimony of John Deutch).

velopment, be assumed in this analysis,[230] there are in fact abundant reasons to believe that this demand does or soon will exist.

C. The Black Market in Practice: Incidents of Fissile Material Smuggling

In light of the supply of available fissile material and the likelihood of demand for it, it is not surprising that a nascent nuclear black market has already begun to reveal itself.[231] A series of chilling, but verified, incidents have combined with an ocean of investigations and rumors to give flesh to the black market. A flood of fissile material smuggling investigations have been conducted in Europe over the past six years, particularly in Germany. In 1990, only four such investigations took place; by 1992, the total grew to 158, and then to 241 in 1993.[232] By 1994, the total number of investigations over the preceding three years exceeded 700.[233] It does appear that many of these cases were not actual proliferation threats[234] as some involved false claims of fissile material possession or access.[235] Not all of these incidents, however, fall into the false alarm category. At least sixty seizures of nuclear materials took place between 1994 and 1996.[236] In at least seven of these cases, weapons-usable U-235 and Pu-239 were involved.[237] These incidents provide indisputable evidence that the gaps in the FSU fissile material security system pose more than a theoretical danger. Rather, these gaps provide a real opportunity for would-be nuclear terrorists to surmount the only substantial obstacle to the creation of a nuclear device.

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230. It would be a poor attempt at a prevention strategy that relied on the terrorists themselves not to choose a particular means to achieve their ends. There is always the possibility, however remote, that a particular means will be employed; where, as here, the harm associated with that means is of significant magnitude, it becomes well worth the effort of developing and implementing an effective prevention strategy, so long as there is any reasonable possibility that the uncertain, the unthinkable, will occur.

231. *See* Mirsky, *supra* note 5, at 751.

232. *See* Kellman & Gualtieri, *supra* note 187, at 671.

233. *See WMD Hearings Part II, supra* note 18, at 70 (comments of Senator Richard Lugar).

234. *See id.*

235. *See id.* at 25-29 (testimony of William C. Potter).

236. *See id.*

237. *See id.*

1. Established Incidents

The first well-established case of fissile material smuggling, occurring in 1992, graphically demonstrated the insider-theft risk and its economic antecedents.[238] Leonid Smirnov, a chemical engineer at the Luch Scientific Production Association near Moscow, spent five months gradually accumulating approximately 1.5 kilograms of HEU.[239] Inspired by a newspaper article discussing the money to be made on the nuclear black market,[240] Smirnov succeeded on over twenty separate occasions in walking out of Luch with a fifty to seventy gram jar full of HEU (ninety percent enriched),[241] which he then added to a growing cache in a glass jar on his balcony.[242] Smirnov eventually attempted to take the HEU to Moscow in search of a buyer, but was arrested prior to his departure.[243] This law enforcement victory, however, was short-lived. Smirnov was sentenced only to probation.[244]

Within a year, another HEU theft occurred, this time drawing on fissile material from the Russian naval fuel cycle, demonstrating the potential role of military personnel. In July, 1993, two Russian Navy servicemen successfully stole 1.8 kilograms of uranium (enriched to the thirty-five percent level) from reactor assemblies stored at a North Fleet Naval base near the Norwegian border.[245] These men were captured and convicted, but again, the sentences imposed bore little relation to the seriousness of the crime: four and five years respectively.[246] The servicemen had insisted that they were acting on the orders of their superiors, but their superiors were found not guilty.[247] In an ominous twist, a possible connection between the theft and a Murmansk-St. Petersburg organized crime group has fueled an ongoing investigation.[248]

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238. *See id.*
239. *See id.*
240. *See id.*
241. *See id.*
242. *See id.*
243. *See id.*
244. *See* Lou Kilzer & Ann Imse, *The New Nuclear Threat; Economic Pressures Hinder U.S. Efforts to Secure Loosely Guarded Russian Stockpiles*, ROCKY MOUNTAIN NEWS, Sept. 22, 1996, *available in* 1996 WL 12347382.
245. *See WMD Hearings Part II, supra* note 18, at 26 (testimony of William C. Potter)
246. *See id.*
247. *See id.*
248. *See id.*

A second naval fuel incident occurred only a few months later, at the Sevmorput shipyard outside Murmansk.[249] The theft was committed by Russian Navy Captain Alexei Tikhomirov, who was briefed on the scant security measures by his own brother, the shipyard's civilian chief of refueling.[250] Reactor fuel at Sevmorput was kept in a building secured only by a padlock and a perimeter fence with gaping holes.[251] The shipyard itself was fenced in, but several gates were unguarded. Slipping easily into the building, Tikhomirov took ten pounds worth of twenty percent enriched uranium. If he had not left the door open when he left, no one would have known of the theft. Fortunately, when the thieves attempted to sell their cache the next year, for $50,000, they were arrested.[252]

In 1994, the proliferation problem took on a new dimension. Confirmed cases of theft no longer included only in-country diversions. For the first time, it was known that stolen fissile material was being successfully smuggled across borders. In a purely accidental discovery in May of 1994, German police in Tengen, Bavaria discovered a vial containing 5.6 grams of nearly pure Pu-239.[253] Police searching the home of Adolf Jakle found the material in the course of an unrelated counterfeiting investigation. It is possible that a Bulgarian organized crime group was linked to this incident.[254]

Central Europe continues to be a fertile locale for fissile material smuggling incidents. Only a few months after the Tengen seizure, German police conducted a sting operation in Laundshut, Bavaria that netted 800 milligrams of HEU (87.5%).[255] Then, in December of 1994, officers in Prague seized 2.72 kilograms (6 pounds) of Russian HEU (87.5%).[256] The latter seizure resulted from an anonymous phone tip that directed police to a parked car containing the HEU.[257] In addition, a Czech, a Belarussian, and a Ukrainian, all with nuclear industry backgrounds, were arrested

249. *See id.*

250. *See* ALLISON ET AL., *supra* note 38, at 25.

251. *See WMD Hearings Part II, supra* note 18, at 26 (testimony of William C. Potter).

252. *See id.* at 27.

253. *See id.* at 26-27.

254. *See* ALLISON ET AL., *supra* note 38, at 25-26.

255. *See id.*

256. The material was brought into the Czech Republic by train from Russia. *See WMD Hearings Part II, supra* note 18, at 136 (testimony of Alan Edelman).

257. *See id.*

while sitting in the car. The Czech defendant in this case claimed that his Russian source was willing to provide up to forty kilograms of HEU in the near future, and eventually would provide up to one ton.[258]

Rounding out this survey of well-established fissile material thefts is a controversial incident that occurred at the Munich airport in August of 1994. Undercover German police had previously met with a suspected smuggler who had sold them a small sample of plutonium.[259] Then, in August, the smuggler and his accomplice boarded a commercial Lufthansa flight in Moscow, checking a suitcase containing nearly one pound of Pu-239 (363 grams). The police arrested both men and a third individual who met them at the airport.[260] The smugglers were to provide eleven pounds of plutonium under the original deal, but their inability to raise sufficient cash to purchase that much from their Russian source forced the smugglers to provide the smaller amount.[261]

This last incident has provoked serious friction between Germany and Russia, as well as within Germany itself. When Bavarian officials admitted that they knew prior to the flight's departure that the fissile material was on board, they were criticized in Germany for risking public safety in order to stage a dramatic law enforcement and intelligence "success" in Germany.[262] Some Russian officials picked up on this theme, arguing that German sting operations, and not FSU fissile material security shortfalls, are responsible for fissile material leakage.[263] Furthermore, despite an early acknowledgment by the Russian Foreign Intelligence Service that the Munich material was from the Obninsk research facility,[264] MinAtom has subsequently denied the loss of any material.[265] This reversal happens to make the argument that German security agencies are manufacturing the "leakage" in order to

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258. *See id.* at 136 (testimony of Alan Edelman).

259. *See* ALLISON ET AL., *supra* note 38, at 26.

260. *See WMD Hearings Part II, supra* note 18, at 27 (testimony of William C. Potter).

261. One of the smugglers apparently sold his own car to finance the initial delivery. *See id.* at 136-37 (testimony of Alan Edelman).

262. *See Back From Hades: Germany*, THE ECONOMIST, Apr. 29, 1995, at 59, *available in* 1995 WL 9568934.

263. *See U.S. Report on Nuclear Trafficking Scored*, (Foreign Broadcast Information Service, Sept. 12, 1996) FBIS-SOV-96-210-S.

264. *See WMD Hearings Part II, supra* note 18, at 27 (testimony of William C. Potter).

265. *See Russia Says It Can Account For All Nuclear Materials* (National Public Radio, Aug. 23, 1994), *available in* 1994 WL 8690990.

score political points at home more plausible, of course.[266] The Bundestag has formed a formal committee of inquiry to investigate this matter.[267] A conclusion that German stings have somehow contributed to fissile material smuggling would not, however, explain away the weapons-grade Pu-239 discovered by pure fortune in Adolf Jakle's garage.[268] Rather, this only tends to suggest that aside from sting operations, European law enforcement is largely unable to identify or impede the nascent fissile material black market.

2. Suspected and Related Incidents

In addition to the seven confirmed incidents, there have been several incidents which either lack the same indicia of reliability, or only indirectly concern fissile material, but are still of significant concern. For example, in a widely-reported investigation, Lithuanian police discovered a large amount of beryllium, and some beryllium-uranium alloy, in the basement of a Vilnius bank.[269] Beryllium has significant uses in nuclear weapon design.[270]

In another incident, 3.05 kilograms of HEU, stolen from the Electrostal facility near Moscow, may have been discovered in St. Petersburg in June of 1994.[271] In 1995, there may have been a diversion of a small amount of plutonium from Electrostal.[272] Though the material was never recovered, this incident is most significant as a revelation that there is plutonium at Electrostal at all.[273] Also in 1995, six kilograms of stolen twenty percent U-235 may have been found in Kiev, Ukraine.[274] This seizure involved two former Russian soldiers, and was perhaps the fourth in a series of Ukrainian HEU seizures.[275] In October of 1996, Lithuanian police recovered 10 kilograms from a 100 kilogram uranium cache

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266. *See U.S. Report on Nuclear Trafficking Scored*, *supra* note 263.

267. *See Back From Hades: Germany*, *supra* note 262.

268. *See WMD Hearings Part II*, *supra* note 18, at 27 (testimony of William C. Potter).

269. *See id.*

270. For example, a simple design might employ beryllium, which emits neutrons when stimulated by alpha particles, as the "trigger" for the nuclear explosion. *See Fissile Material Primer*, *supra* note 25, at 212.

271. *See WMD Hearings Part II*, *supra* note 18, at 28 (testimony of William C. Potter).

272. *See id.*

273. *See id.*

274. *See id.*

275. *See* Kellman & Gualtieri, *supra* note 187, at 672-73.

which had been stolen from a local nuclear reactor in 1992.[276] In addition, teenagers in Moscow, on a prank, have actually been able to enter an HEU-containing facility through an unalarmed window.[277]

These reports are legion, but they may in fact be most significant for what they do not include. In general, smuggling activities, by their nature covert, defy discovery. Thus, "inferring the magnitude of the flow or the intentions of the actors from the small slice of the known picture very likely is misleading."[278] This is particularly true in the case of FSU fissile material because with a few exceptions, reports of smuggling activity in the "southern tier" of the FSU do not exist. In light of the greater likelihood of success for smugglers who choose the southern route, this is a disturbing but perhaps inevitable development.[279] It is virtually certain that the lack of smuggling reports from outside the European theater "represents an information gap rather than a lack of illicit activity."[280]

3. The Potential Role of Organized Crime

These reports of smuggling do not contain more than an occasional suggestion of the involvement of organized crime. In fact, "to date, there have been no cases in which a definitive proof of organized crime involvement exists."[281] Rather, the known and alleged smuggling incidents overwhelmingly tend to involve either relatively inconsequential "flim-flam artists" peddling non-fissile materials,[282] or, in the more serious cases, amateurs with inside access but without the criminal sophistication of organized crime.[283] If organized crime does become involved, however, "the nuclear black market threat would increase dramatically" as "far-flung in-

276. It is important to note that the small portion of uranium recovered left nearly 90 kilograms unrecovered. *See Police Find Some of Nuclear Fuel Stolen From Ignalina*, (Foreign Broadcast Information Service, Oct. 31, 1996) FBIS-SOV-96-212.

277. *See* Hoffman, *supra* note 86.

278. Kellman & Gualtieri, *supra* note 187, at 677.

279. *See WMD Hearings Part II, supra* note 18, at 137 (testimony of Alan Edelman).

280. *Id.* at 32 (testimony of Sarah Mullen).

281. *Id.* at 151 (testimony of Robert M. Blitzer, Section Chief, Domestic Terrorism/Counterterrorism, FBI).

282. *Id.* at 151 (testimony of Thomas E. McNamara, Assistant Secretary, Bureau of Political-Military Affairs, Dep't of State).

283. *See id.* at 165.

ternational connections" come into play.[284]

It appears that organized crime is already involved in sub-fissile material level nuclear-related crime, but experts disagree as to whether criminal organizations will take the next step.[285] But, to the degree that organized crime in Russia has become an integral part of the fabric of economic life,[286] it may be inevitable that these criminal networks will join and lend structure, reach, and capital to the budding market.

The United States has been fortunate so far. According to the Federal Bureau of Investigation (FBI), "[t]o date, there have been no known instances of nuclear weapons or weapons-grade materials being illegally brought into or purchased in the U.S."[287] The Central Intelligence Agency (CIA) adds that to the best of its knowledge, no weapons-grade material has yet been smuggled to any terrorist group or rogue nation.[288] These hopeful assurances, however, are neither iron-clad nor guaranteed against changing circumstances, and it would be a mistake to completely rely on these assumptions in the face of our current knowledge.

The foregoing analysis identifies the elements necessary for a terrorist group to develop a nuclear weapon. The knowledge is in the open literature. The funding requirements are reasonable. The intangibles can be confidently assumed. Fissile material represents the only necessary element subject to any useful degree of reasonable preventive disruption. But the former Soviet Union contains a massive supply of fissile material under inadequate lock and key, in the custody of individuals subject to tidal economic forces. Through a broken lens, trained only on the less likely of the possible smuggling routes, we can already observe abundant evidence that this supply is being offered in black market fashion; we can only speculate as to the true magnitude of the worldwide market for fissile material.

Each day, terrorists and their state sponsors are more likely to learn of this opportunity. More likely to seek it out. More likely to make the necessary connection with an insider. More likely to meet the sole effective criterion for membership in that most ex-

284. *Id.* at 33.

285. *See id.* at 32.

286. *See* Mirsky, *supra* note 5, at 749.

287. *See WMD Hearings Part II, supra* note 18, at 165 (testimony of Robert M. Blitzer).

288. *See id.* at 173 (testimony of Gordon C. Oehler).

clusive of circles, the nuclear weapon powers.

It is beyond rational debate that the national security of the United States demands an immediate and comprehensive response to this state of affairs. The situation could not be more critical, despite public perceptions to the contrary.[289] The existing U.S. response must be measured in light of this sense of urgency.

IV. U.S. RESPONSE TO THE THREAT OF NUCLEAR TERRORISM

The United States has attempted to prevent the emergence of a nuclear black market with an array of measures, each with its own particular advantages and limitations. The overall U.S. "program" was closely analyzed by the Senate's Permanent Subcommittee on Investigations in March of 1996,[290] revealing a consensus that existing U.S. efforts were neither proceeding fast enough, nor far enough, to adequately address the problem.[291] This effect, spearheaded by Senators Richard Lugar and Sam Nunn, identified specific and significant flaws in the U.S. program.[292] However, the fundamental barrier preventing the U.S. response from reaching a level commensurate with the true scope of the national security risk is the lack of political impetus, and this cannot be addressed by legislation alone.[293] Rather, the power of the Presidency is needed to effectively communicate the danger to the public at large.[294] Broad appreciation of the danger would generate the political conditions in Congress necessary for passage of legislation on a significantly greater scale than is currently possible. Of course, in the absence of these measures, it is possible that political pressure will be generated anyway. For example, there would be no shortage of legislative willpower the morning after the detonation of a crude nuclear device in lower Manhattan.

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289. *See id.* at 24 (testimony of Graham T. Allison).

290. *See generally WMD Hearings Part I, supra* note 8; *WMD Hearings Part II, supra* note 18.

291. *See WMD Hearings Part II, supra* note 18.

292. *See id.*

293. *See id.*

294. *See id.*

A. A Piecemeal Approach, Slowly Refined

Existing programs intended to prevent the formation of a black market in fissile material are a subset of the overall U.S. counter-proliferation effort. These programs can be grouped into the following loose categories: stanching the flow of fissile material from facilities in the FSU; enhancing border security at home and abroad; bringing intelligence and law enforcement to bear; increasing the economic well-being of the FSU's scientists; and directly acquiring and disposing of the FSU's fissile material.[295] This multi-front approach has been implemented through several different agencies, with an uncertain degree of coordination and variable degrees of success. "Unfortunately, so far U.S. policies and programs have not produced a dramatic reduction in the risk of nuclear leakage . . . at the current rate of progress, substantial risk of nuclear leakage will persist for years to come."[296]

1. Stanching the Flow of Fissile Material

Until 1996, the U.S. employed a two-track strategy to address the core problem of poor fissile material security in the FSU: government-to-government diplomacy, combined with lab-to-lab agreements between American nuclear weapons labs and their counterparts in the FSU.[297] The first track, conducted at the government-to-government level, involves a series of specific agreements with the governments of Russia, Ukraine, Kazakhstan, and Belarus.[298] The Cooperative Threat Reduction (CTR) program,[299] which was the basis for U.S. funding of FSU disarmament programs, also funded these efforts, with the Department of Defense as the executive agent.[300]

Government-to-government programs have not had a successful history.[301] The first project was an MPC&A upgrade at Elec-

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295. *See* ALLISON ET AL., *supra* note 38, at 79-80.

296. *Id.* at 74.

297. *See WMD Hearings Part II, supra* note 18, at 18 (testimony of Harold J. Johnson, Jr.).

298. *See generally* Jack M. Beard, *A New Legal Regime for Bilateral Assistance Programs: International Agreements Governing the "Nunn-Lugar" Demilitarization Program in the Former Soviet Union*, 35 VA. J. INT'L L. 895, 900 (1995).

299. The CTR program is also known as "Nunn-Lugar." *See id.*

300. *See WMD Hearings Part II, supra* note 18, at 18 (testimony of Harold J. Johnson, Jr.).

301. *See* ALLISON ET AL., *supra* note 38, at 83.

trostal, but the upgrades were applied only to low-enrichment uranium production. This $10 million expenditure had negligible counter-proliferation impact.[302] The next project was intended to upgrade MPC&A at Sverdlovsk, but MinAtom's refusal to cooperate at that location led instead to a series of alternate upgrades at Electrostal (HEU production), Mayak, and Obninsk.[303] MinAtom stalled even these projects until, coincidentally, an unrelated financial dispute was settled.[304] The government-to-government approach, requiring prolonged, frustrating negotiations with repeated delays and obstructions, was soon perceived as inadequate for the task at hand.[305]

The failure of the government-to-government approach can be traced to several problems. First, MinAtom has been extremely uncooperative in many instances,[306] reflecting efforts to preserve MinAtom's institutional interest in promoting the Russian nuclear industry,[307] distrust of the United States,[308] and dissatisfaction with the terms of the proposed agreements.[309] Second, the use of the Department of Defense as the executive agency imported strict auditing and examination requirements for the use of CTR funds that contributed to Russian suspicions of American motives, and thereby decreased the range of installations that the Russians would allow to participate.[310] Third, the routing of funds through the Department of Defense also imported purchasing and spending requirements that forced program funds to be spent at home, rather than in Russia.[311] Although this gave the program the domestic political palatability of a boondoggle, it also had two unfor-

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302. *See id.*

303. *See id.* at 81.

304. *See id.* at 82.

305. *See id.*

306. *See WMD Hearings Part II, supra* note 18, at 151 (testimony of Thomas E. McNamara), 19 (testimony of Harold J. Johnson, Jr.).

307. *See* ALLISON ET AL., *supra* note 38, at 24.

308. *See WMD Hearings Part II, supra* note 18, at 156 (testimony of Frank Miller); *see also Morning Edition: Nuclear Safety and Security in Russia, Part 3* (National Public Radio, Apr. 18, 1996), *available in* 1996 WL 2814508.

309. *See WMD Hearings Part II, supra* note 18, at 19 (testimony of Harold J. Johnson, Jr.).

310. *See id.*

311. *See id.*; *see also* ALLISON ET AL., *supra* note 38, at 82-83. In fact, under CTR, funds cannot be directly transferred. Misuse of funds is thought to be prevented by providing only for the transfer of equipment and services. *See* Beard, *supra* note 298, at 908-09.

tunate consequences: it decreased the political acceptability of the program on the Russian end, while at the same time missing an opportunity to increase Russia's indigenous MPC&A capacity. To avoid these problems, the Department of Energy now administers CTR funds, instead of the Department of Defense.[312]

The Department of Energy has been in charge of the second track of American MPC&A strategy, the lab-to-lab program, all along. These efforts involve cooperation between American nuclear weapons labs, such as Los Alamos, and their counterparts in the FSU. From the beginning, the lab-to-lab approach has been more successful than the government-to-government approach, in terms of both speed and coverage.[313] For example, with lab-to-lab funding administered by Energy, the Los Alamos and Lawrence Livermore laboratories have cooperated with Obninsk's Institute of Physics in creating a real time fissile material tracking system,[314] MPC&A at Kurchatov has been vastly improved, and an indigenous MPC&A system has been devised at Arzamas-16.[315]

The lab-to-lab approach is thought to work because it is "politically savvy,"[316] whereas the Defense-funded programs required equipment to be purchased from American suppliers. The lab-to-lab program encourages the purchase of Russian goods and services, bolstering Russian political support for participation in the program.[317] Similarly, the lack of stringent audit-and-exam requirements decreases Russian suspicions of American "spying," allowing the participation of a greater number of facilities.[318] In short, lab-to-lab succeeds because the general tenor of the Department of Energy approach is to convince the Russians that these programs are in fact in their own best interest.

It is hoped that by consolidating the CTR funds with Energy's appropriations for Nuclear Material Security Upgrades, the overall MPC&A effort will proceed far more effectively.[319] At least forty

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312. *See* ALLISON ET AL., *supra* note 38, at 83.

313. *See WMD Hearings Part II, supra* note 18, at 19 (testimony of Harold J. Johnson, Jr.).

314. *See Russian, U.S. Physicists to Devise New Nuclear Control*, (Foreign Broadcast Information Service, Apr. 8, 1996) FBIS-SOV-96-069.

315. *See* ALLISON ET AL., *supra* note 38, at 83.

316. *See id.* at 86.

317. *See id.* at 87.

318. *See id.*

319. *See WMD Hearings Part II, supra* note 18, at 19 (testimony of Harold J. Johnson, Jr.), 147 (testimony of Thomas E. McNamara).

facilities are now participating, or have participated, to some degree in these security upgrades.[320] Unfortunately, this may still leave as many as ninety-five facilities still uncovered;[321] reaching these additional facilities will require both additional funding, in the range of $1 billion,[322] and political persuasion, since some core number of facilities will be considered particularly sensitive, and thus will not be made readily available.

The security of fissile material within Russian Navy custody is an additional area of MPC&A concern, deserving special mention. Due to the U.S. Navy's powerful desire to preserve secrecy concerning propulsion technology, extraordinarily little help has been offered to the FSU regarding the safe storage and disposition of naval reactor fuel.[323] Because this material constitutes a significant, but underappreciated, threat,[324] some degree of cooperation seems to be necessary. The failure to remedy this particular subset of the MPC&A problem could ultimately prove fatal.

With the exception of Russian naval fuel, the existing MPC&A upgrade program is on the right track. In deference to paramount considerations of national security, the available funds have now been completely allocated to the channel proven most effective, the Department of Energy. If time were not of the essence, and if the only facilities to be concerned with were in Russia, Ukraine, Kazakhstan, and Belarus, then the matter could probably rest there. But time is crucial; accordingly, the time it will take to secure all of the relevant facilities, wherever they are, must be reduced to the absolute minimum. Every day that can be eliminated is one less day in which a nuclear black market connection can be made. Similarly, efforts to address MPC&A concerns must be extended to all states of the FSU, rather than just to the four that happened to have custody of the U.S.S.R.'s nuclear weaponry at the time of the Soviet collapse.

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320. *See National Security Hearing, supra* note 57 (testimony of Toby T. Gati).

321. There are approximately 135 facilities with fissile material security relevance. *See WMD Hearings Part II, supra* note 18, at 19 (testimony of Harold J. Johnson, Jr.).

322. This estimate contemplates 95 additional upgraded facilities at a cost of approximately $5-10 million per upgrade, which is a relatively pessimistic assessment of potential costs. *See id.*

323. *See id.* at 154 (testimony of Frank Miller).

324. *See id.* at 29 (testimony of William C. Potter).

2. Enhancing Border Security

Efforts to decrease the fissile material-permeability of the FSU's borders have involved numerous agencies, but relatively small amounts of funding. Perhaps this results from the daunting nature of the task—the FSU has 40,000 miles of border.[325] While it is true that every incremental improvement raises the bar a bit more—and thereby decreases the odds of a successful exportation of fissile material—the overall efficacy of U.S. border enhancement efforts has been limited from the outset by the failure to include the most at-risk nations in these programs.[326]

Efforts to increase border security in the FSU have been divided between the underlying legal regimes and the actual border control systems. CTR funds have been channeled to a few states of the FSU in order to enhance export controls, provide training in interdiction and investigation skills, and provide detection equipment.[327] The three states receiving the most funds—Kazakhstan, $7.26 million; Ukraine, $13.26 million; and Belarus, $16.26 million—certainly were in need of this aid as they generally lacked both the resources for effective border control and the underlying legal framework of export control laws.[328] Unfortunately, the United States has had less success in aiding Russia itself: only $2.26 million in aid, essentially for seminars and exchanges, has been approved for Russia.[329]

Through the U.S. State Department's Non-Proliferation and Disarmament Fund, the Baltic states[330] obtained detection equipment and established ties to the U.S. Customs Service (Customs).[331] In addition, Customs provided a training program involving Eastern European and Baltic nations, complementing existing training programs provided under the Coordinating Committee for Export Controls.[332] Recently, Customs took significant steps to increase its training capacities,[333] as well as its in-

325. *See id.* at 36-37 (testimony of Gary Bertsch).

326. *See id.* at 138 (testimony of Alan Edelman).

327. *See id.* at 166 (testimony of Connie Fenchel, Dir., Strategic Investigations Division, U.S. Customs Service).

328. *See* ALLISON ET AL., *supra* note 38, at 95.

329. *See id.*

330. *See WMD Hearings Part II, supra* note 18, at 167 (testimony of Connie Fenchel).

331. *See* ALLISON ET AL., *supra* note 38, at 95.

332. *See WMD Hearings Part II, supra* note 18, at 166-67 (testimony of Connie Fenchel).

333. In addition to a "training team" consisting of a professional trainer, a customs

formation gathering capabilities.[334]

None of these measures, however, address the southern tier, an area that may prove to be the most significant border security problem in the FSU.[335] The absence of programs designed to improve the security of the borders that lie along the direct route between fissile material-containing facilities in the FSU and nations such as Iran and Iraq is a gaping hole in the U.S. border security enhancement effort. Because of this omission, it is hard to dispute Professor Allison's characterization of these programs as "little effort" generating "little progress."[336]

3. Intelligence and Law Enforcement—Cooperation and Conflict

In the 1990s, the American intelligence community has been confronted with an identity crisis of sorts, as the end of the Cold War has called traditional collection priorities into question.[337] Fortunately, the intelligence community has already begun to respond to the threat which succeeded to the position formerly occupied by the Soviet military threat. WMD intelligence gathering has now become a "matter of extraordinarily high priority in [CIA] collection efforts, and [CIA] analytic efforts."[338] A series of Presidential Decision Directives provide the guiding principles for the intelligence community: prevent WMD acquisition, roll-back existing WMD capacity, deter WMD use, and enhance military and emergency assets' ability to respond to a WMD threat.[339] The CIA coordinates these efforts through its Non-Proliferation Center,[340] which the Director established to assure "an all-source multi-agency approach" to WMD issues.[341] In addition, the CIA

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inspector, a customs special agent, an attorney, and a Department of Energy expert, the Customs Investigative Workforce has individuals trained in WMD investigations. *See id.* at 168-69.

334. Customs has 24 overseas offices, and recently received permission to place two officials in Moscow to improve cooperation with Russian customs and law enforcement. Customs also has 26 Customs Mutual Assistance Agreements (executive agreements), providing for law enforcement cooperation. Current agreements exist with Russia, Belarus, and Ukraine, and new ones are being negotiated with Kazakhstan and Kyrgyzstan. *See id.*

335. *See* ALLISON ET AL., *supra* note 38, at 96.

336. *Id.* at 93.

337. *See WMD Hearings Part II, supra* note 18, at 109 (testimony of David A. Kay).

338. *Id.* at 77 (testimony of John Deutch).

339. *See id.* at 171 (testimony of Gordon C. Oehler).

340. *See id.* at 172.

341. *See WMD Hearings Part II, supra* note 18, at 81 (testimony of John Deutch).

has begun to address the information gap[342] in the southern tier area.[343]

The coordination of intelligence and law enforcement activities, however, presents a problem. The FBI has begun rapid overseas expansion programs in response to the increasingly international nature of the crimes within its jurisdiction.[344] In particular, organized crime, narcotics trafficking, and terrorism have all contributed to the need to develop a significant overseas presence for the first time in the Bureau's history.[345] The National Security Act of 1947[346] theoretically restrains the FBI's expansion, but despite this restriction, the FBI has gone forward with plans to double the number of overseas offices from twenty-three to forty-six.[347] After some initial resistance, both the CIA and the Department of State appear to have acquiesced in this expansion.[348] With a presence in Moscow,[349] and a planned presence in Kiev specifically targeting nuclear smuggling,[350] these developments bode well for future U.S. counter-proliferation law enforcement efforts in the FSU, which currently cannot be based closer than Vienna or Athens.[351] And yet, "[i]ntelligence that is not shared is intelligence that will not be used"[352] and it appears the CIA and FBI have not yet mastered the art of working together effectively.[353] A Presidential Commission (Commission) co-chaired by Harold Brown, and first, Les Aspin, and later, Warren Rudman, concluded that significantly greater cooperation is needed.[354] Recently, however, strides have

342. U.S. intelligence and law enforcement authorities have traditionally lacked a presence in the Caucuses and Central Asia. *See id.* at 32 (testimony of Sarah Mullen).

343. *See id.* at 172 (testimony of Gordon C. Oehler).

344. *See* Jeffrey Smith & Thomas W. Lippman, *FBI Plans to Expand Overseas: 23 New Offices Slated, Raising Some Criticism at State Department*, WASH. POST, Aug. 20, 1996, at A1.

345. *See id.*

346. 50 U.S.C. § 401 (1988). The FBI is confined to domestic investigations unless it obtains specific permission and cooperation for an international investigation from the CIA. *See* Shoshana V. Asnis, Comment, *Controlling the Russian Mafia: Russian Legal Confusion and U.S. Jurisdictional Power-Play*, 11 CONN. J. INT'L L. 299, 316 (1996).

347. *See* Smith & Lippman, *supra* note 344.

348. *See id.*

349. *See* Asnis, *supra* note 346.

350. *See* Smith & Lippman, *supra* note 344.

351. *See WMD Hearings Part II, supra* note 18, at 164 (testimony of Robert M. Blitzer).

352. *See id.* at 109 (testimony David A. Kay).

353. *See id.* at 34 (testimony of Sarah Mullen).

354. *See WMD Hearings Part I, supra* note 8, at 82 (testimony of Senator Sam Nunn).

been made: regular meetings were established between then-Director of Central Intelligence Deutch (DCI) and Director Freeh of the FBI, and between then-Deputy Director of Intelligence (and current DCI-nominee) George Tenet and Deputy Attorney General Jamie Gorelick. Moreover, officers from both agencies have been cross-assigned.[355] Whether these steps have been sufficiently institutionalized, however, remains to be seen.

The challenge of international terrorism has further blurred the artificial line between intelligence and law enforcement activities. Left to their own devices to achieve their respective missions, the FBI and the CIA have moved independently to address the WMD challenge, and they have only just begun to coordinate and economize their efforts. This process would be enhanced by specific guidance to compel institutionalized cooperation, with the comparative advantages of each organization[356] employed to maximum advantage as part of the overall counter-proliferation, counter-terrorism effort.

4. Addressing the Economics of Insider Theft and "Brain Drain"

The economic plight of scientists in the FSU is as much a part of the fissile material theft risk as is inadequate MPC&A.[357] These scientists were once relatively well-paid, and provided with ample research facilities and tasks. Now they are underpaid, if paid at all, and have little or no work or research resources.[358] This combination of economic deprivation and idleness greatly enhances the possibility that these individuals will either "drain" to a proliferant state or organization, or worse, steal fissile material from their own facilities to sell on the black market.[359] The United States has attempted to alleviate these causal factors by funding the International Science and Technology Center (ISTC), as well as a cluster of defense conversion projects.[360]

ISTC, a cooperatively-funded venture of the United States, the European Union, Japan, Sweden, and Switzerland, began in

355. *See WMD Hearings Part II, supra* note 18, at 82 (testimony of John Deutch).

356. For example, although the United States has cooperative law enforcement relationships with many nations, there are many other nations with whom no such ties exist. In some of the latter cases, the intelligence community does have good ties. *See id.* at 84 (testimony of Senator Sam Nunn).

357. *See* ALLISON ET AL., *supra* note 38, at 80.

358. *See supra* Part III.A.3.

359. *See WMD Hearings Part II, supra* note 18, at 33 (testimony of Sarah Mullen).

360. *See* ALLISON ET AL., *supra* note 38, at 89-92.

1994.[361] It has provided non-military work for approximately 11,000 of the FSU's weapons scientists[362] at facilities in Moscow and Kiev.[363] In 1994, the U.S. provided $25 million for ISTC, followed by $24 million in 1995. By the year 2000, however, the program will be funded on an entirely private basis.[364]

For all its good intentions, ISTC is fundamentally limited by its inability to fund every scientist of proliferation concern[365] and by the uncertainty of its annual funding, which decreases the "lure" of ISTC work.[366] Moreover, increasing the magnitude and certainty of U.S. funding is a task that runs counter to the general political currents in Congress, which misperceives ISTC as a foreign aid measure rather than a national security program.[367]

Defense conversion programs have even worse political problems. The original attempts to use CTR funds to convert FSU military facilities provoked "severe political criticism."[368] A more successful program is the Defense Enterprise Fund of the Department of Energy, which provides grants to U.S. firms for joint ventures involving the conversion of FSU facilities.[369] More important from a fissile material security perspective, the Industrial Partnering Program (IPP) provides funds for private U.S. firms to conduct joint ventures with facilities and scientists from the FSU nuclear weapons complex.[370] Thus far, IPP has employed approximately 2000 additional scientists,[371] complementing the ISTC effort.

Despite these successes, the domestic political vulnerability of these programs runs high in an era of tight budgets and generalized hostility to foreign affairs spending.[372] These programs are national security measures, not foreign aid, and thus deserve to fall

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361. *See id.* at 90.

362. *See WMD Hearings Part II, supra* note 18, at 142 (testimony of Alan Edelman).

363. *See id.* at 155 (testimony of Frank Miller).

364. *See id.* at 177 (testimony of Thomas E. McNamara).

365. *See* ALLISON ET AL., *supra* note 38, at 91.

366. *See WMD Hearings Part II, supra* note 18, at 142 (testimony of Alan Edelman).

367. *See WMD Hearings Part I, supra* note 8, at 145 (testimony of Senator Sam Nunn); *see also WMD Hearings Part II, supra* note 18, at 90 (testimony of Graham T. Allison).

368. *See* ALLISON ET AL., *supra* note 38, at 92.

369. *See id.*

370. *See id.*

371. *See WMD Hearings Part II, supra* note 18, at 142 (testimony of Alan Edelman).

372. *See generally* Stephen S. Rosenfeld, *Nickel-and-Diming Foreign Policy*, WASH. POST, Jan. 17, 1997, at A21.

under the heading "defense by other means."[373] Until a wider appreciation of the real stakes is generated, however, the necessary political willpower will continue to lack.

5. Policies of Acquisition and Elimination

The foregoing security enhancement measures, no matter how extensively they are implemented, can never provide an absolute guarantee against fissile material theft. So long as this material exists in weapons-usable form, it remains subject to some risk of theft. Therefore, it makes good policy sense from a national security perspective for the United States to purchase as much of the fissile material in the FSU as possible and then either burn it or store it under maximum security conditions. Actual U.S. efforts to pursue an acquisition policy have been inconsistent, however, and hindered by inadequate prioritization.[374]

HEU has been the primary focus of U.S. acquisition efforts.[375] During the Bush administration, Russia and the United States reached a remarkable agreement. Russia would sell 500 tons of HEU, approximately half of the entire Russian stockpile, to the United States in exchange for hard currency (HEU Deal).[376] This HEU would first be blended with low-enrichment uranium in Russia, then shipped to the United States to be burned as fuel in civilian reactors.[377] Securing material sufficient to create 40,000 nuclear weapons, some saw the agreement as a dramatic national security victory.[378] Notwithstanding this perception, the HEU Deal has been dominated from the beginning by commercial, not national security, interests and has in practice failed to significantly impact the fissile material security issue.[379]

The source of the problem is the vesting of authority for implementation of the HEU deal in a semi-public company known as the United States Enrichment Corporation (USEC). USEC was created in 1993 to take over the United States' two civilian ura-

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373. *See WMD Hearings Part II, supra* note 18, at 152 (testimony of Frank Miller).

374. *See* ALLISON ET AL., *supra* note 38, at 81.

375. *See generally* Richard A. Falkenrath, *Appendix C: The HEU Deal, in* Avoiding Nuclear Anarchy: Containing the Threat of Loose Russian Nuclear Weapons and Fissile Material 229 (1996).

376. *See id.*

377. *See id.*

378. *See All Things Considered: Troubled Uranium Deal With Russia on Gore Agenda* (National Public Radio, June 27, 1995), *available in* 1995 WL 2918599.

379. *See* Falkenrath, *supra* note 375, at 231.

nium enrichment facilities, formerly run by the Department of Energy.[380] With substantial government support, USEC's production costs are highly competitive. It costs USEC approximately $50 to $68 per Separative Work Units (SWU), the measure of the work of enrichment.[381] In contrast, the SWU purchase price under the HEU Deal is $82.10 per SWU, giving USEC an incentive to take as little of the Russian HEU as possible.[382]

Not surprisingly, the U.S. has acquired extraordinarily few of the 500 tons of HEU thus far, and U.S. reactors have burned only 13 tons.[383] Worse, the term of implementation is 20 years, despite the risk that Russian willingness to participate in the agreement may change.[384] In short, the "narrow commercial interests of the domestic uranium enrichment industry [have] cripple[d] the implementation of the HEU deal," to the detriment of national security.[385] USEC recognizes, but disregards, the conflict. As one USEC official put it, "I don't conduct national security here . . . I actually run a business."[386] From a national security perspective, this is intolerable; the HEU Deal should not be subject to the discretion of an entity with contrary incentives.[387]

The United States has acted far more assertively, on another occasion, to acquire unsecured fissile material. In Project Sapphire, the U.S. removed more than 1000 pounds of HEU from Kazakhstan.[388] This was sufficient material for at least twenty weapons, at a cost of approximately $20 million.[389] In this case,

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380. *See id.* at 232.

381. *See* Kilzer & Imse, *supra* note 244.

382. *See id.* The existence of trade agreements restricting FSU access to the U.S. uranium market further complicate the situation. In the early 1990's, imports of FSU uranium skyrocketed, sending down prices, and triggering an anti-dumping investigation that was only halted by the signing of market access "suspension agreements." *See* Falkenrath, *supra* note 375, at 232.

383. *See* Kilzer & Imse, *supra* note 244; *see also* Thomas Elleman, *Without Notice, Power Industry is Turning "Kilotons to Kilowatts" Plants Are Using Fuel Derived From Weapons-Grade Uranium*, GREENSBORO NEWS & RECORDS, Jan. 26, 1997, at F3, *available in* 1997 WL 4569532.

384. *See* Kilzer & Imse, *supra* note 244.

385. Falkenrath, *supra* note 375, at 233.

386. Kilzer & Imse, *supra* note 244.

387. If necessary, the domestic uranium market can be protected while still enhancing national security. For example, the Russian HEU could be stockpiled, and only released into the market slowly, over the long-term. In the meantime, it should be acquired as quickly and as completely as possible. *See* ALLISON ET AL., *supra* note 38, at 43.

388. *See id.* at 44.

389. *See id.*

decisive U.S. intervention may have prevented proliferation, as both Pakistan[390] and Iran[391] had previously expressed interest in acquiring this cache. In late 1995, a second cache of Kazak HEU was discovered, containing approximately 440 pounds of material.[392] Negotiations to acquire this HEU have floundered, in part due to Russia's assertion of ownership over the material.[393] In the meantime, the HEU remains in highly unsecured conditions.[394] A similar impasse exists regarding a Georgian cache, and further caches are likely to be discovered in the other states of the FSU.[395]

The U.S. experience with HEU acquisition has thus been a matter of multiple opportunities with only isolated success. This is an unfortunate record, since the most effective means of preventing the formation of a fissile material black market is to control or destroy the material itself. The failure of the U.S. to completely embrace a strategy of acquisition at all costs is largely the result of the inclusion of commercial perspectives within the decision process. These perspectives are included, it appears, in order to enhance the political palatability of acquisition programs, by enlisting potential opponents such as the domestic uranium industry. In combination with a general lack of public support for international spending, however, these interests have effectively prevented acquisition efforts from being fast-tracked on a systematic scale, despite the national security interest of the United States.

Acquisition of plutonium is even more restricted by commercial sensibilities.[396] With HEU, the political support for acquisition has been greatly enhanced by the fact that the material can be burned as fuel in civilian reactors, thus providing a domestic benefit in addition to the national security purpose. With plutonium, however, the national security purpose stands alone. Unlike most nations with nuclear industries, the U.S. has traditionally eschewed the use of plutonium as fuel because of a combination of economic concerns, proliferation concerns, and general political opposition to the expansion of the nuclear industry.[397] From a national secu-

390. *See WMD Hearings Part II, supra* note 18, at 138 (testimony of Alan Edelman).

391. *See* ALLISON ET AL., *supra* note 38, at 44.

392. *See Unguarded Nuclear Material, supra* note 105.

393. *See id.*

394. *See WMD Hearings Part II, supra* note 18, at 29 (testimony of William C. Potter).

395. *See id.*; *see also Unguarded Nuclear Material, supra* note 105.

396. *See* ALLISON ET AL., *supra* note 38, at 44.

397. *See* Peter Passell, *U.S. Set to Allow Reactors to use Plutonium from Disarmed Bombs*, N.Y. TIMES, Nov. 22, 1996, at A1.

rity perspective, these concerns should be irrelevant. Rather than spending millions of dollars upgrading security at a given FSU facility, the U.S. should, when it has the option, seek outright acquisition of the material. Without the additional support of a commercial benefit, however, the political momentum to achieve this sensible goal seems to be inadequate. A recent policy shift by the Clinton Administration may, however, provide the foundation for the introduction of such an interest.[398]

Building on the conclusions of an expert panel of the National Academy of Science, the Department of Energy announced a two-track plutonium policy in December of 1996. Previously, the most likely long-term plutonium disposition option for the U.S. was glass vitrification and burial.[399] The new policy would, for the first time, allow existing plutonium in nuclear weapons to be burned as mixed-oxide fuel (MOX), while maintaining the policy of vitrification for the disposal of plutonium generated incidental to ongoing production.[400] This decision "launched a national debate,"[401] with nuclear industry opponents perceiving this to be a significant setback in their efforts to decrease the use of nuclear energy.[402]

The MOX option, however, is expensive; it may cost as much as $2.3 billion dollars,[403] a large part of which will be devoted to subsidizing the extra expenses associated with handling MOX fuel.[404] Utility companies have, however, expressed substantial interest in the program and recognize the potential benefits of the MOX option;[405] the combined plutonium stockpiles of the United States and Russia would generate 500 partial reloads of MOX, an amount equivalent to the electrical output of 8 billion barrels of oil, worth approximately $500 billion.[406] The MOX decision thus opens the door to utilization of commercial incentives to buttress

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398. *Id.*

399. *See* Russian Nuclear Archipelago, *supra* note 77, at 198.

400. *See* Passell, *supra* note 397.

401. *Nuclear Nightmare: Pantex Could Play a Major Role in Disposal*, DALLAS MORNING NEWS, Jan. 19, 1997, at A14, *available in* 1997 WL 2640593.

402. *See* Mary L. Walker, *The U.S. Should Cooperate With Russia On Plutonium; Anti-Nuclear Groups Opposed to Converting Excess Warhead Material Are Misguided*, CHRISTIAN SCI. MONITOR, Jan. 16, 1997, at 19, *available in* 1997 WL 2798737.

403. *See Some U.S. Plutonium Will Power Plants*, B. GLOBE, Dec. 10, 1996, at A10.

404. *See* Passell, *supra* note 397.

405. As many as 17 utilities have already indicated an interest in MOX fuel. *See* Walker, *supra* note 402.

406. *See* Barclay G. Jones, *Atomic Terrorism: The Real Threat*, CHI. TRIB., Dec. 12, 1996, at 31.

the national security argument in favor of acquiring FSU plutonium.[407] To the degree that this melding of interests allows plutonium acquisition to take place, it is a step in the right direction. As seen in the uranium context, though, this can lead to counterproductive incentives from a security perspective. In an ideal world, it would not be necessary to use an economic carrot to generate the political momentum necessary to establish a policy that directly addresses a clear and present danger to the national security of the United States.

6. Developing a Coordinated Approach

A broader concern regarding the U.S. response to the nuclear terrorism threat is the possibility of inadequate coordination at the highest levels of government. In 1995, the President's Council of Advisors in Science & Technology issued a report that inspired a Presidential Decision Directive providing for coordination of the general counter-proliferation effort.[408] This Directive delineated the responsibilities of different agencies, and called for coordination of the inter-agency effort through a working group headed by a representative of the National Security Council.[409] It included representatives from State, Defense, Energy, Commerce, Customs, the Nuclear Regulatory Commission, the intelligence community, and the FBI.[410] Despite this framework, the hearings of the Permanent Subcommittee on Investigations revealed significant concerns regarding inadequate organization of the counter-WMD effort.[411]

B. Flaws and Limitations of the Existing Approach

Manifest in the wake of the Permanent Subcommittee's hearings were the flaws in the existing approach. Programs designed to increase MPC&A have been improved substantially by consolidation within the Department of Energy, but are still not

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407. *See id.*

408. *See WMD Hearings Part II, supra* note 18, at 174 (testimony of Thomas E. McNamara).

409. *See id.*

410. *See id.* at 162 (testimony of Robert M. Blitzer).

411. For example, Senator Nunn observed that over 100 different offices had some degree of involvement with the issue, and that there appeared to be insufficient coordination of their efforts. No mention was made of the NSC-chaired committee later described by Blitzer and McNamara. *See WMD Hearing Part I, supra* note 8, at 83 (testimony of Senator Sam Nunn).

moving at maximum speed, are not reaching naval facilities, and in any event, are not assured of receiving the funding necessary to complete upgrades at every facility.[412] Border security enhancement programs are demonstrably inadequate in their failure to focus on the southern tier of the FSU, although individually they are effective in contributing to the gradual improvement of systems practically non-existent in some states.[413] The intelligence community, on the other hand, appears to have recognized the importance of the southern tier and has taken steps to remedy the information gap therein. At the same time, however, the growing overlap between intelligence and FBI activities abroad cries out for institutionalized coordination.[414] Programs designed to decrease the incentives for insider theft and "brain drain" have been limited by domestic political opposition premised on fundamental misconceptions regarding the nature of the aid being rendered.[415] This problem is even more pronounced in the context of fissile material acquisition programs, in which the paramount national security interests have been subordinated to relatively inconsequential commercial concerns.[416]

These flaws have a common thread: they all flow from the fact that there has been no comprehensive effort to generate a widespread appreciation for the true magnitude of the fissile material crisis among both policymakers and the public. Despite the best efforts of concerned legislators, such as Senators Lugar and Nunn, there is simply no impression of urgency, as there was, for example, behind the Marshall Plan, or the Manhattan Project.[417] Nonetheless, those who do appreciate the stakes continue to work within existing constraints to improve U.S. efforts. The most recent effort to prevent the acquisition and use of mass destruction weapons by terrorists and rogue nations,[418] sponsored by Senators Nunn, Lugar, and Pete Domenici (R-NM), is entitled the Defense

412. *See supra* Part IV.A.1.

413. *See supra* Part IV.A.2.

414. *See supra* Part IV.A.3.

415. *See supra* Part IV.A.4.

416. *See supra* Part IV.A.5.

417. Senator Lugar has called for a "Manhattan Project II." *See* Senator Richard Lugar, Remarks before the Nuclear Roundtable, *Weapons of Mass Destruction and Cooperative Threat Reduction*, Apr. 29, 1996, (visited on Sept. 5, 1997) <http://www.stimson.org/rd-table/lugar.htm> [hereinafter Lugar Remarks].

418. *See id.*

Against Weapons of Mass Destruction Act of 1996 (DAWMD).[419]

V. A RECENT LEGISLATIVE ATTEMPT TO CORRECT OUR COURSE

DAWMD sought to address, to the greatest extent possible, the issues raised during the Permanent Subcommittee hearings on the threat of nuclear proliferation and terrorism.[420] Loosely grouped into the categories of domestic preparedness, interdiction of WMD material, and coordination, DAWMD constitutes a significant improvement over the status quo in marshaling the resources of the United States to fight nuclear terrorism, its precursors, and its consequences. The new law does not go far enough, however, nor could it, at least not without an alteration of the political landscape sufficient to create enhanced political willpower throughout government and society. Such an awakening of the national consciousness is likely to be brought about in only two ways: either from the sharp shock of a dramatic, tragic event, or from a broad-based commitment to action resulting from a decisive and comprehensive program of persuasion emanating from the highest levels of government. It is probably that the latter course will depend on the commitment of the persuasive powers of the Presidency itself.

A. DAWMD: A Small Step in the Right Direction

DAWMD is indisputably an improvement over the array of existing U.S. responses to the WMD threat. For the first time, the ability of the United States to deal with the gruesome aftermath of WMD terrorism has been addressed and enhanced. DAWMD bolsters border security measures in the FSU and the United States, enhances MPC&A efforts, and compels top-level coordination of the overall effort.[421] Furthermore, DAWMD contains a series of "Sense of Congress" messages that directly address specific concerns raised in the hearings. DAWMD may not suffice to constitute a "Manhattan Project II," but it will measurably improve the national security posture of the United States.

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419. 50 U.S.C. § 2301 et seq. (1996).

420. *See* Lugar Remarks, *supra* note 417.

421. Richard Lugar, Press Release, *Indianapolis Selected To Establish Terrorism Response Program,* Fed. Doc. Clearing House, Feb. 7, 1997, *available in* 1997 WL 4429400.

1. Domestic Preparedness

The goal of the domestic preparedness section of DAWMD is not to prevent WMD terrorism; rather, it is to "allow the Department of Defense and other federal agencies to transfer their knowledge of chemical, biological and nuclear warfare to civilian forces," thus enhancing the capabilities of emergency response assets.[422] In furtherance of this goal, §2311 requires that the President take immediate steps to enhance the response capabilities of federal, state, and local governments.[423] These steps must include a report to Congress assessing existing capabilities and making recommendations for improvements, including new legislation.[424] Rather than await the outcome of this report, however, DAWMD enacts several measures designed to bring about immediate improvements in domestic preparedness. Specifically, it creates a two-part framework for training personnel to deal with the aftermath of a WMD attack, and for organizing emergency resources.[425]

The training regime centers around § 2312, which creates the Emergency Response Assistance Program (ERAP), a $35 million effort to enhance response capabilities at the federal, state, and local levels.[426] Administered by the Secretary of Defense (until 1999, at which point another agency may be appointed as lead agency), ERAP draws on the expertise of the Departments of Defense, Energy, the Federal Emergency Management Agency (FEMA), and any other federal, state, or local agencies with relevant expertise.[427] ERAP must include: (1) training in the use and maintenance of equipment designed to detect WMD-material and equipment used in protection and decontamination; (2) a "hotline" for state and local authorities to obtain advice and data in the event of an emergency; (3) equipment loans; and (4) National Guard assistance.[428] Furthermore, § 2312 specifically provides that $10.5 million of the $35 million be used by the Secretary of Defense with the cooperation of the Secretary of Health and Human Services to create Metropolitan Medical Strike Force

422. *See id.*
423. 50 U.S.C. § 2311 (1991 & Supp. 1997).
424. *Id.* § 2311(b).
425. *See id.* § 2312(a)-(b).
426. *See id.* § 2312(h).
427. *See id.* § 2312 (a)–(b).
428. *See id.* § 2312 (e).

Teams.[429] These teams, to be deployed in twenty-six cities, will receive specialized training, and will be "optimally equipped" to respond to a WMD attack.[430] Further transfers of knowledge are promoted by § 2316, which requires that the President act to decrease civilian law enforcement reliance on Department of Defense expertise in the counter-WMD area.[431]

In order to facilitate ERAP, the Departments of Defense and Energy must each nominate an official as the "Program Coordinator" in charge of coordinating that Department's training efforts.[432] The improvement brought about by these efforts will be tracked by annual testing of federal, state, and local response capabilities.[433]

Section 2317 complements the training regime by requiring that FEMA develop a master inventory of assets available to state and local officials in the event of an emergency.[434] Every Federal Response Plan agency must submit to FEMA an inventory of equipment and other assets available in an emergency.[435] FEMA must then incorporate these inventories into the relevant emergency programs, including equipment usage guidance.[436] FEMA must also create a hotline in order to facilitate state and local access to this information.[437]

2. Interdiction of WMD Material

DAWMD also seeks to address the border security concerns identified in the 1996 hearings of the Permanent Subcommittee. Section 2333 provides $15 million for border security assistance programs throughout the FSU, the Baltics, and Eastern Europe.[438] Administered cooperatively between the Departments of Defense and Customs, this assistance can include training, advice, and equipment loans.[439] The law also exempts this aid from the effects of any other prohibitions on aid to the FSU, so long as the Presi-

429. *See id.* § 2312 (h)(2).
430. *See* Lugar Remarks, *supra* note 417.
431. *See* 50 U.S.C. § 2316.
432. *See id.* § 2313.
433. *See id.* § 2315.
434. *See id.* § 2317(e).
435. *See id.* § 2317(a).
436. *See id.* § 2317(b)–(c).
437. *See id.* § 2317(e).
438. *See id.* § 2333(a)–(b).
439. *See id.* § 2333(a).

dent certifies to Congress that this particular aid furthers the national interest of the United States.[440] Some degree of overlap between this Defense/Customs program and the existing training program run by the FBI and the Department of Defense is both expected and approved.[441] DAWMD also provides $15 million for the purchase of detection and interdiction equipment for U.S. border security,[442] and urges the U.S. Sentencing Commission to consider enhanced sentences for WMD import and export offenses.[443]

3. MPC&A Measures

DAWMD contains a mix of MPC&A enhancement measures, as do related sections of the CTR program. In four separate "Sense of the Congress" provisions, DAWMD directly confronts problems inherent in the existing U.S. approach. Section 2361 urges the Departments of Defense, Energy, Treasury and State to contract directly with entities in the FSU when implementing the fissile material control measures contained in § 2341.[444] Section 2341 in turn requires the Secretaries of Energy and Defense to cooperatively develop a plan to modify or replace the reactor cores at Tomsk-7 and Krasnoyarsk-26 with cores less suitable to the production of weapons-grade material.[445] Section 2363 urges the expansion of CTR programs to include other FSU states, besides Russia, Ukraine, Belarus, and Kazakhstan.[446] A pair of provisions recommend a policy of fissile material acquisition: in general, fissile material at risk of theft should be purchased and imported when no reasonable alternatives to secure it exist,[447] and specifically, blended-down HEU from Russian weapons should be purchased in all circumstances.[448] Additional provisions encourage other nations to help in efforts to acquire and eliminate stockpiles of fissile material.[449] This last provision may contribute to U.S. approval of a potential agreement to send Russian plutonium to

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440. *See id.* § 2333(c).

441. *See* H.R. CONF. REP. NO. 104-724, at 820 (1996) [hereinafter CONFERENCE REPORT].

442. *See* 50 U.S.C. § 2331.

443. *See id.* § 2332.

444. *See id.* § 2361.

445. *See id.* § 2341.

446. *See id.* § 2363.

447. *See id.* § 2365.

448. *See id.* § 2364.

449. *See id.*

Germany to be burned as MOX fuel in a new, but currently dormant, facility in Hesse.[450] An additional measure, § 2362, authorizes CTR funds to be transferred between CTR programs when necessary to "maximize the effectiveness" of the programs.[451]

In terms of the actual dollars allocated to MPC&A related programs, Congress did move aggressively in the direction of more sufficient funding, despite continued reluctance by the House of Representatives.[452] This move was fostered by the leadership of the conferees reconciling the competing versions of the National Defense Authorization Act, which contained both CTR and DAWMD.[453] The House version actually dropped $25 million from the CTR budget request of $327.9 million, while the Senate approved full funding for CTR and provided extra funds for DAWMD.[454] The conferees, explicitly recognizing the importance of these programs, approved an extra $37 million on top of the original CTR budget request, for a total funding level of $365 million.[455] Furthermore, an additional $164 million beyond the initial budget request was approved for non-CTR counter-proliferation programs, such as the Department of Energy's MPC&A program and DAWMD.[456]

4. Enhanced Coordination

DAWMD attempts to resolve the problem of inter-agency coordination by designating a single official to head a coordinating committee within the National Security Council (NSC). Specifically, § 2351 creates the Executive Office position of National Coordinator on Nonproliferation (NCN).[457] The NCN, supervised by the NSC, has three responsibilities. First, the NCN serves as an advisor to the President on the WMD aspects of terrorism, arms control, and international organized crime.[458] Second, the NCN chairs an NSC committee (discussed below).[459] Third, the NCN

450. *See* Mathews, *supra* note 63.

451. 50 U.S.C. § 2362.

452. CTR funding, for example, was cut 20% in the preceding year. *WMD Hearings Part II, supra* note 18, at 153 (testimony of Frank Miller).

453. *See* CONFERENCE REPORT, *supra* note 441, at 816.

454. *See id.* at 816-17.

455. *See id.*

456. *See id.*

457. *See* 50 U.S.C. § 2351(a).

458. *See id.* § 2351(b)(1).

459. *See id.* § 2351(b)(2).

coordinates nonproliferation research efforts conducted by, or funded by, the federal government.[460]

The NCN chairs the NSC Committee on Nonproliferation (CON), established by § 2352.[461] CON has a variety of responsibilities and includes representatives from State, Defense, CIA, Justice, Energy, FEMA, Treasury, Commerce, and others designated by the President.[462] CON must "review and coordinate" all federal efforts concerning WMD proliferation.[463] CON also must give recommendations to the President, via the NSC, concerning the integration of these efforts,[464] the integration of related federal budget items,[465] and the progress and status of efforts to enhance federal, state, and local crisis management capabilities.[466] CON is also responsible for making recommendations designed to enhance cooperation and coordination of programs addressing the following WMD-proliferation subjects: smuggling prevention, law enforcement, the role of organized crime, WMD-material and technology security, coordination of law enforcement, intelligence, and agency efforts, enhancement of export controls, and general proliferation reduction.[467] The final coordination measure contained in DAWMD is the requirement that the President, through CON, develop a comprehensive program to execute the entirety of DAWMD.[468]

B. Persistent Flaws and Limitations: The Impact of Political Constraints

Both the NCN office and CON are subject to dissolution at the President's discretion after September 30, 1999.[469] This perhaps reflects an optimistic hope that the problems compelling the enactment of DAWMD will by then be on the decline. Unfortunately, such optimism would not be well-founded. Although DAWMD and the related increases in funding of CTR and En-

460. *See id.* § 2351(b)(3). In addition, § 2351(c) provides $2 million for the Department of Defense to conduct this research. *See id.* § 2351(c).

461. *See id.* § 2352(a).

462. *See id.* § 2352(b).

463. *See id.* § 2352(c)(1).

464. *See id.* § 2352(c)(2)(A).

465. *See id.* § 2352(c)(2)(B).

466. *See id.* § 2352(c)(2)(C).

467. *See id.* § 2352(c)(2)(D).

468. *See id.* § 2353(a).

469. *See id.* § 2354.

ergy-sponsored MPC&A programs constitute a significant step forward in the effort to fix the flaws in the existing U.S. approach, the changes they embody do not fully achieve that goal. This is not meant to downplay the tremendous success achieved by the congressional leaders who led the fight for these measures. Realistically, the 1996 legislation probably represents the most progress achievable in an atmosphere of political hostility towards foreign affairs spending and inadequate appreciation of the national security interest involved.

Due to these political constraints, a variety of problems with the U.S. efforts remain. For example, MPC&A and border security programs both require still greater levels of funding, and the Russian Naval fuel cycle remains unaddressed. Further, it remains to be seen whether the United States will actually take aggressive action to promote a policy of acquisition without regard to commercial interests. There have been no significant changes in U.S. policies designed to ameliorate the economic pressures on FSU scientists. This list could go on, but after a time it becomes obvious that many of these difficulties are beyond legislative reach altogether; instead, they are matters which require Executive action, though this in turn requires the political willpower to address them. The ultimate lesson of the government's various attempts to confront this problem is that a truly effective range of responses cannot be implemented until that political momentum is generated. In the meantime, a gaping window of opportunity exists for terrorist organizations or their sponsor states to acquire fissile material.

VI. CONCLUSION

This Article demonstrates the existence of a clear and present danger to the national security of the United States. Although the United States has remained ever-vigilant against terrorist activity, never before has the prevention of a particular type of terrorist attack been appropriately considered a paramount national security interest. In part, this reflects the fundamental cohesiveness of U.S. society; we simply lack the type of foundational divisions which undermine some other societies. The unique power of a nuclear weapon, however, would enable a terrorist group to overcome these natural defenses, and strike a forceful blow against the same societal stability that has until now protected the United States. It is a danger of the highest order, but it is not yet understood as

such.

There is an overwhelming consensus that the only hard part about building a nuclear weapon is obtaining fissile material.[470] There is also widespread agreement that, due to the disintegration of the Soviet Union, an abundant supply of this material has recently become extraordinarily vulnerable to theft.[471] Economic pressures on those in a position to facilitate an "insider" theft, and a lack of anything more than rudimentary export and border controls, exacerbate the problem. It is also extremely likely that at least a subset of terrorist groups and their sponsor states desire this material. Thus, it is not surprising to learn that several attempts at fissile material smuggling are known to have taken place, and that a host of others are suspected. Significantly, this information is almost exclusively derived from experience in Europe; almost nothing is known of potential fissile material trafficking in the southern tier of the former Soviet Union.

In response to this situation, the U.S. developed multiple programs and policies, implemented by numerous agencies. Over the years, the flaws inherent in these approaches have become readily identifiable, as have the gaps in coverage. Unfortunately, despite assertive leadership by some legislators, the political willpower to deal with this problem in a manner that effectively overcomes those flaws and fills those gaps within Congress as a whole seems nonexistent. Furthermore, there are aspects of these flaws and gaps that are beyond the reach of Congress in any event, particularly to the degree that they require diplomatic pressure on the former Soviet Union to cooperate in our efforts.

In conclusion, the national security interest of the United States cannot tolerate the status quo. There is simply too much at stake not to make additional efforts to accelerate, and expand the scope of, the counter-proliferation effort. At the same time, it is clear that inadequate appreciation of this danger by some politicians, and most of the public, constitutes an effective check upon the ability of any branch of government to proceed much further beyond existing measures. That check must be removed. This can be achieved through the energetic engagement of the Presidency, communicating to the nation the nature of the nuclear terrorism risk. An effective use of the "bully pulpit" might generate the po-

470. *See Fissile Material Primer*, *supra* note 25, at 225.

471. *See* Mirsky, *supra* note 5, at 751.

litical momentum necessary to allow the federal government to act with maximum speed, resource dedication, and comprehensiveness.

There is, on the other hand, the possibility that public opinion will be aroused without such active intervention; when a credible threat of nuclear terrorism against the United States is finally made, or if, God forbid, a nuclear device is detonated, there will be political pressure the likes of which have never been seen before. It is incumbent upon lawmakers and executive officials to act with all haste to prevent this nightmare from happening. We must not be left asking ourselves why we did not do more when we had the chance.