

## REVIEW ESSAY

### **Nuclear Terrorism: Exaggerating the Threat?**

Allison, Graham. *Nuclear Terrorism: The Ultimate Preventable Catastrophe*. New York: Henry Holt and Company, LLC, 2005.

Charles D. Ferguson, William C. Potter, et al., *The Four Faces of Nuclear Terrorism* (New York: Routledge, 2005).

### **INTRODUCTION**

The 11 September terrorist attacks on the World Trade Center and Pentagon were a devastating “wake-up call” for the United States, bringing home to Americans as never before the dangers of transnational terrorism. It also opened the eyes of many to the risk of a far more perilous danger — the threat of nuclear terrorist attack. As the *National Security Strategy of the United States of America* warned in March 2006, “[t]here are few greater threats than a terrorist attack with WMD.”<sup>1</sup>

In 2005, two comprehensive studies of the nuclear terrorist threat were published: Graham Allison’s *Nuclear Terrorism: The Ultimate Preventable Catastrophe*, and Charles Ferguson, et al.’s *The Four Faces of Nuclear Terrorism*. These two studies examine the threat that nuclear terrorism poses in the post-11 September world and then set out a series of policy recommendations intended to reduce if not eliminate altogether the risk of a catastrophic nuclear terrorist attack. The theme of these two studies is the same. In *Nuclear Terrorism*, Allison argues bluntly that a terrorist attack against a US city using a nuclear weapon is inevitable but also preventable if essential measures to safeguard nuclear weapons and materials are urgently taken.<sup>2</sup> Though not as categorical as Allison, Ferguson, et al. in *The Four Faces* agree that, while nuclear terrorism has threatened the US for many years, “this peril looms larger today than ever before.”<sup>3</sup>

As these studies point out, the threat of nuclear terrorism is multi-faceted. Ferguson, et al. highlight the four growing threats — or “four faces” — of nuclear terrorism (with which Allison concurs):

- The theft and detonation of an intact nuclear weapon.
- The theft or purchase of fissile material leading to the fabrication and detonation of a crude nuclear weapon — an improvised nuclear device (IND).
- Attacks against and sabotage of nuclear facilities, in particular nuclear power plants causing the release of large amounts of radioactivity.

- The unauthorized acquisition of radioactive materials contributing to the fabrication and detonation of a radiological dispersion device (RDD) — a “dirty bomb” — or radiation emission device (RED).<sup>4</sup>

This review essay will focus on the second of the “four faces” of the threat — the acquisition of fissile material and expertise that would enable a terrorist organization to build a crude nuclear weapon or IND from scratch. The argument of this essay is, basically, that the threat of this particular strand of nuclear terrorism as presented in these two studies is greatly exaggerated.<sup>5</sup>

One must hasten to strongly emphasize that this does *not* mean that the threat is insignificant, nor that it is one that can be casually ignored or dismissed. This author agrees wholeheartedly with Allison and Ferguson, et al. that there is no room for complacency regarding the nuclear terrorist threat. The acquisition or construction of a nuclear weapon by terrorists is a sufficiently serious prospect — if only because of the catastrophic consequences should such a device be used — to warrant urgent action to reduce the danger. Nevertheless, their tendency to exaggerate the magnitude of the threat — in order to pierce the complacency that they argue permeates US government actions when it comes to instituting needed national and international nuclear control measures — has the unintended consequence of distracting attention from the very measures that need to be taken. Extreme threats beget extreme solutions. Rather than prompting government officials to act with dispatch on the more mundane but essential policy actions needed to secure nuclear materials and weapons worldwide, the exaggerated threat of nuclear terrorism only encourages and sustains more extreme domestic and international policies in the global war on terror, such as warrantless domestic wiretapping and preventive counterproliferation war. In the final analysis, exaggeration does more harm than good.

## THE “FOUR M’S”

There are four necessary elements for a terrorist IND attack, that can be described as the “four M’s”: *motivation* (otherwise referred to as *Intentions* in threat assessments), *material*, *mind-power*, and *movement* (the latter three subsumed under the category of *Capabilities*). First, the terrorists must have the inclination or motivation to use a nuclear weapons device as a means to achieve their ends, however those ends might be defined. Second, they must acquire sufficient fissile material, either highly enriched uranium or plutonium, in order to construct a workable nuclear explosive device. Third, they must have the detailed design information and necessary scientific and technical expertise — the mind-power — to assemble a crude nuclear device. Finally, they must infiltrate or move that device to the chosen target, wherever that may be located.

This essay will examine the first three of the “four M’s.” The analysis of these “M’s” suggests that the threat as portrayed in *Nuclear Terrorism and The Four Faces* is exaggerated. More specifically, Allison presents a dubious list of

potential perpetrators of nuclear terrorism. As well, the authors of both studies understate the difficulties a terrorist organization faces in acquiring the necessary fissile material and constructing an IND from scratch.

## **Intentions — Who Wants It?**

### *The First “M” — Motivation*

Who might engage in nuclear terrorism? Ferguson, et al. provide a largely theoretical examination of the incentives and disincentives that could motivate terrorist groups to seek to construct and use an IND.<sup>6</sup> They describe these motivations in the context of four archetypal terrorist groups:

- Apocalyptic groups — groups striving to precipitate the end of the world through catalytic, catastrophic violence, e.g., *Aum Shinrikyo*.
- Politico-religious groups — hybrid groups combining political and religious motivations, e.g., *al-Qaeda* and *Hezbollah*.
- Traditional national/separatist groups — groups focusing on achieving political objectives for a specific ethnic or tribal group, e.g., the IRA and Tamil Tigers.
- Single-issue groups — groups opposing clearly defined social or political policies, e.g., animal liberation, anti-abortion and anti-nuclear groups.

One motivation for building an IND common to virtually all these terrorist groups, the authors maintain, would be the acquisition of a capability with which to blackmail or deter their opponents. The threat or use of such a capability would demonstrate a group’s capability and power, and tremendously enhance its prestige both among its allies and enemies. Beyond that, Ferguson, et al. argue that the incentives depend upon the type of terrorist organization. An apocalyptic group, for example, might see an IND as the means to spark a nuclear conflagration that would bring about the end of the world. A politico-religious group might view an IND as an ideal weapon with which to carry out its strategy of inflicting maximum harm — physical, economic, and psychological — upon the enemy. A traditional national/separatist group, on the other hand, might consider the possession rather than the actual use of an IND as most useful in terms of enhancing its prestige, potentially bringing it international recognition, and allowing it to feign the attributes of statehood. Conversely, a single-issue anti-nuclear group is unlikely, in their estimation, to find an IND useful as such a group’s focus would not be on mass destruction but on exposing the dangers of nuclear technology.

The authors recognize that the balance sheet on nuclear terrorism is not all positive from the terrorists’ standpoint. Implementation challenges, e.g., acquiring the fissile material and retaining the technological expertise needed to construct an IND (discussed below), might dissuade some terrorist groups from pur-

suing this avenue. Moreover, nuclear terrorism itself presents new problems, challenges, and demands on terrorist organizations, requiring an organizational culture of innovation and individual initiative. However, most terrorist groups, they note, tend to be conservative in orientation, staying with conventional methods of attack that are “tried and true.”

Taking all these incentives and disincentives into account, Ferguson, et al. conclude that few terrorist groups have the motivation or capabilities to attempt some form of nuclear terrorism. In their estimation, *al-Qaeda* is likely the only network with the requisite characteristics to pursue extreme nuclear terror either by acquiring or developing a nuclear weapon.<sup>7</sup>

The theoretical analysis presented in *The Four Faces* is a good starting point for producing a balanced assessment of the threat of nuclear terrorism. However, it is only a starting point. The analysis must then go one step further to determine whether the considerations the authors identify shape the motivations of actual terrorist groups operating in the real world. On this Ferguson, et al. are largely silent. They do not systematically extend their analysis of motivation to existing terrorist groups, apart from some anecdotal references principally to *Aum Shinrikyo* and, to a lesser extent, *al-Qaeda* through the course of the discussion.

Allison, on the other hand, takes up the challenge in *Nuclear Terrorism*.<sup>8</sup> He insists that “[t]here exists a rogues’ gallery of other terrorist groups that have actively explored nuclear options or, on current trend lines, could do so in the next few years.”<sup>9</sup> He then proceeds to “name names.” First on the list is *al-Qaeda*, followed by such diverse groups as *Jemaah Islamiyah* in Southeast Asia, Chechen separatists in the Caucasus, *Hezbollah* in Lebanon, and terrorist and Islamist groups operating in Pakistan. Added to the mix are a handful of doomsday cults “not on anybody’s radar screen,”<sup>10</sup> such as *Aum Shinrikyo* in Japan before it gained widespread notoriety with its sarin nerve gas attack on the Tokyo subway system in 1995.

It is beyond the scope of this essay to examine the motivation of each and every one of Allison’s potential perpetrators. But let us briefly consider the case of *Hezbollah*, the so-called “A-team of terrorists.”<sup>11</sup> Though giving a perfunctory nod to indications that *Hezbollah* has moved in recent years in a more political direction within Lebanon, Allison builds the case that the organization could still pose a nuclear threat to the US. He notes that the group’s 1985 manifesto calls for the destruction of Israel, and observes that this hatred of Israel extends to the US, for which *Hezbollah* sees Israel acting as vanguard in the Islamic world. Given *Hezbollah*’s unrelenting hostility to these two countries, Allison sketches out several superficial scenarios setting out the circumstances in which, he maintains, the group could resort to nuclear terrorism. He cites the Senate testimony of former CIA Director George Tenet that *Hezbollah* could attack US or Israeli targets worldwide if there are attacks against it or its Syrian or Iranian

allies. More specifically, Iran could use *Hezbollah*, armed with a “suit-case” nuclear bomb from the former Soviet Union, as a means to deter an Israeli attack against its nuclear facilities. Additionally, a militant splinter faction of the group could threaten nuclear devastation in order to compel Israel to withdraw from the Occupied Palestinian Territories. Finally, he says, *Hezbollah* could join with *al-Qaeda* to attack the US in revenge for Washington’s support of Israel or because American policy threatens the group’s vital interests. As Allison concludes, “With its unrivaled technical terror expertise,<sup>12</sup> *Hezbollah* would be well positioned to escalate to nuclear terrorism.”<sup>13</sup>

Allison’s conclusion flows logically from an overly simplistic and uninformed view of *Hezbollah*. *Hezbollah* is not a uni-dimensional organization whose sole *raison d’être* is to destroy the US and Israel. As Rami G. Khouri, a noted commentator for Lebanon’s *The Daily Star*, recently wrote, the group has played many roles throughout its history and these roles have evolved over time. Even now, he says, it is in a process of change: “Hizbullah seems to recognize that it must continue the transition it has been making in recent years — from primarily an armed resistance to Israeli occupation and a service-delivery body operating in the South, to a national political organization, sitting in [the Lebanese] Parliament and the Cabinet and operating on a national political stage.”<sup>14</sup> To reduce *Hezbollah* to exclusively or primarily a terrorist organization, though recognizing that it has, without question, engaged in terrorist tactics in the past, is simply wrong. To suggest that the organization is merely biding its time before it carries out a nuclear terrorist attack against the US is absurd.

Moreover, Allison’s own speculative scenarios highlight essentially defensive motivations for *Hezbollah*’s possible resort to nuclear terrorism. Indeed, the best he can come up with is that the group may consider the nuclear terrorist option if it perceives the US as “threatening its most vital interests.”<sup>15</sup> The solution to this conundrum would seem to be straightforward: if Allison is afraid that *Hezbollah* might resort to nuclear terrorism if the US backs it into a corner, then *don’t back Hezbollah into a corner*. Approaching this from a slightly different angle, the question Allison leaves unanswered is this: why pursue aggressive policy designs against *Hezbollah* — that is, “threaten its most vital interests” — if to do so places hundreds of thousands of American lives at risk of a nuclear terrorist attack in retaliation? The benefits of such a strategy would have to be astronomical to outweigh the risk of nuclear terrorist retaliation it could call forth.

Allison’s arguments for an expansive “rogue’s gallery” of potential nuclear terrorism perpetrators, at least in the case of *Hezbollah*, are unpersuasive. He fails to demonstrate that, apart from *al-Qaeda*, there are other terrorist groups who live only to kill Americans and are “chomping at the bit” to acquire and use nuclear weapons against US targets. Ferguson, et al.’s conclusion that *al-Qaeda* is likely the only terrorist network with the motivation to carry out such an attack is much more realistic. Indeed, it is enough to know that *al-Qaeda* has demonstrated an active interest in acquiring nuclear weapons to drive home the magni-

tude of the nuclear terrorist threat. There is no need to exaggerate the list of potential perpetrators in order to make the point that there are terrorists out there with a deeply troubling interest in nuclear weapons.

## **CAPABILITIES — IS BUILDING THE BOMB REALLY AS EASY AS “1, 2, 3”?**

Intentions are only one half of the threat assessment equation. The second critical and, more often than not, limiting factor is capabilities. A terrorist group's reach can often far exceed its grasp. Though *al-Qaeda* may desperately want a nuclear weapons capability, that does not mean that its wishes have been or inevitably will be realized. The problem in *Nuclear Terrorism* and *The Four Faces* is that they inflate the nuclear threat by playing up *al-Qaeda*'s offensive intentions while downplaying the obstacles that hamper its acquisition or development of a nuclear capability. Yet, capabilities are an equally if not more important piece in the threat assessment puzzle than are intentions, which are notoriously volatile. Accordingly, the next sections in this essay will address the question of capabilities, focusing on the two “M's” of *material* and *mind-power*, both prerequisites to the construction of an improvised nuclear device (IND).

### ***The Second “M” — Material***

Acquiring sufficient fissile material — highly-enriched uranium (HEU) or plutonium<sup>16</sup> — is the major obstacle to building an IND.<sup>17</sup> Allison and Ferguson, et al. paint a disturbing picture of a world awash in unsecured fissile material that is just “there for the taking” by terrorists via a thriving black market in nuclear materials. Allison maintains that acquiring such material is easier than stealing an intact nuclear weapon.<sup>18</sup> It is smaller, lighter, more abundant, and less protected than the weapons themselves. But where could terrorists get it from? Allison identifies four sources of concern for illicit fissile material: Russia, Pakistan, North Korea, and 20-plus research reactors worldwide with quantities of HEU sufficient for one or more nuclear devices. Of these, Russia is the source of greatest concern in his view. According to US estimates, Russia possesses over two million pounds of weapons-usable material, enough for more than 80,000 weapons. More importantly, much of this stockpile is “dangerously insecure.”<sup>19</sup> Allison points out that, in the first three years following the collapse of the former Soviet Union (FSU), the German government recorded more than 700 attempted nuclear sales from the successor countries, including 60 involving the seizure of nuclear materials. He proceeds to list seven instances of nuclear smuggling over the period between November 1993 and November 2003, giving the impression that these represent just a sampling of a much wider phenomenon of illicit trade in fissile material from the FSU.

Allison strives to create the impression that terrorists interested in building an IND have access to a virtual cornucopia of unsecured nuclear material. He

maintains that acquiring 100 pounds of HEU — an amount needed to construct a crude IND (see below) — “is a large amount to acquire through theft or smuggling. But that is only a modest barrier for a determined nuclear terrorist.”<sup>20</sup>

Ferguson, et al. agree in general with Allison’s contention that there are massive amounts of dangerously unsecured fissile material “there for the taking” by terrorists.<sup>21</sup> They acknowledge that acquisition of fissile material is the most difficult challenge in the chain of causation leading to a nuclear terrorist attack. Nevertheless, they maintain that it is less of a challenge than acquiring an actual nuclear weapon.<sup>22</sup> Apart from fissile material already used in weapons, there are many hundreds of tons of HEU and plutonium dispersed at hundreds of inadequately secured sites worldwide. Moreover, this material is more difficult to control than actual nuclear weapons. It is handled in difficult-to-measure bulk form, and measurement uncertainties can mask diversion of small quantities of the material. This relative difficulty in control of material, the authors contend, is confirmed in so far as there have been a number of cases of illicit trafficking in fissile material but none (thus far) in nuclear weapons. Ferguson, et al. admit that the amount of material involved in the known illegal traffic to date is insufficient for a bomb. However, they speculate — and it must be emphasized that this is sheer conjecture on their part with no supporting evidence offered — “it is conceivable that such transactions have occurred without detection and that a terrorist organization might currently be in possession of such a quantity of material and in the process of developing a nuclear device.”<sup>23</sup>

Ferguson, et al. assess the global stocks of fissile material and note that the amount that “might theoretically be accessible to terrorists is staggering,”<sup>24</sup> sufficient for “tens of thousands” of INDs.<sup>25</sup> In particular, they identify three “settings of concern” that overlap with those of Allison. Russia again tops the list, followed by Pakistan, and research reactors, with other sites including some in the US thrown in for good measure.

What should we make of the arguments in these two studies? Allison and Ferguson, et al. give the impression that there exists a thriving black market in nuclear material, a virtual “Home Depot” for “do-it-yourself” nuclear bomb makers. In fact, the black market in fissile material is tiny and undeveloped. In 1995, the International Atomic Energy Agency (IAEA) established the Illicit Trafficking Database (ITDB) in order to track the “unauthorized acquisition, provision, possession, use, transfer, or disposal of nuclear materials and other radioactive materials, whether intentional or unintentional and with or without crossing international borders, including unsuccessful and thwarted events.”<sup>26</sup> According to the ITDB, as of 31 December 2004, there were 662 confirmed incidents of trafficking in radioactive sources. Of these, only 18 involved nuclear materials that “could be a shortcut to nuclear proliferation and to nuclear terrorism.”<sup>27</sup> The ITDB notes that, of these 18, only a few involved more than small quantities of weapons-grade material. Indeed, the cumulative amounts of highly enriched uranium and plutonium involved in all 18 incidents total only 8.521 kg

and .373 kg, respectively. To put this in perspective, Ferguson, et al. estimate that terrorists would need 40 to 50 kg of weapons-grade HEU to have reasonable confidence that a simple gun-type IND would work.<sup>28</sup> They could cut back on the required amount of fissile material if they can master the more technically challenging implosion-type design. In such a design, roughly 25 kg of weapons-grade HEU or 8 kg of plutonium are needed.<sup>29</sup> Tallying up all the weapons-grade fissile material that has “flooded” onto the nuclear black market from 1993 to 2004, we find that this material amounts to 17 percent to 21 percent of the HEU needed to build a gun-type IND, and 34 percent and 5 percent of the material needed to build, respectively, an HEU or plutonium implosion-type bomb.

On this basis it is difficult to argue convincingly that there is a “thriving” market in fissile material just waiting to supply terrorists with their nuclear material needs. Of course, what is of greatest concern is what we do not know about the nuclear black market. Testifying before the House Subcommittee on Prevention of Nuclear and Biological Attack, Rensselaer Lee, an author on the nuclear black market in the FSU and Europe, observed that “[l]ittle nuclear material of significance and no nuclear warheads appear to circulate in the black market; buyers are elusive; and arrest and seizure statistics provide little evidence of participation in the market by rogue states, terrorists, and major transnational crime formations.”<sup>30</sup> However, Lee warns, this may be a “misleading guide” to the true dimensions of the nuclear market. Like the illicit drug trade, what we see may be only the tip of the black market iceberg. He argues that “some significant incidents go unreported, particularly in the former Soviet states. Also, it stands to reason that sophisticated and well-connected smugglers are far less likely to get caught than the amateur criminals and scam artists who dominate the known incidents.”<sup>31</sup>

Critics do not find Lee’s arguments convincing. Robin Frost, a Canadian government analyst specializing in nuclear proliferation, maintains that “[t]o argue that a large black market exists, and that the failure to detect it is proof of the fiendish cunning of those who operate it, is sophistry of the least persuasive kind.”<sup>32</sup> He dismisses Lee’s argument that “significant incidents” go unreported as “simply fatuous: if these incidents go unreported or undetected, Lee could not know about them or assert their existence.”<sup>33</sup> Moreover, while granting the self-evident truth of Lee’s argument that technically sophisticated smugglers are less likely to get caught than amateurish bumbler, Frost makes the point that this “has nothing to say about the actual market and activities therein.”<sup>34</sup> Thus far, he rightly notes, there has been no evidence that amounts of weapons-usable fissile material needed to construct an IND have passed through the nuclear black market.

Contrary to the impression Allison and Ferguson, et al. seek to give, it is not a simple matter for terrorists to acquire the nuclear material for an IND. From the aspiring nuclear terrorist’s standpoint, the illicit market in fissile materials is still woefully underdeveloped:

[T]he nuclear weapons and materials market is a difficult and dangerous place to negotiate. The market is contaminated with police and intelligence sting operations, and charlatans and fraudulent persons claiming to have nuclear weapons and materials for sale. It is difficult for sincere buyers and sellers to identify each other and conclude a transaction.<sup>35</sup>

Again, this is not to counsel complacency with regard to the illegal trade in fissile material. Allison and Ferguson, et al. are right in insisting that governments act to clamp down on this nascent market. Nevertheless, there is no evidence that, as yet, the market has supplied terrorists with any where near the fissile material needed to build even one nuclear device.

### *The Third “M” — Mind-power*

Allison and Ferguson, et al. add another chilling piece to the nuclear terrorism puzzle: put simply, building an IND is, in their view, child’s play. Indeed, Allison maintains that, given the relative ease of the task, terrorists are more likely to build an IND than to steal an intact nuclear weapon.<sup>36</sup> In his estimation, with sufficient fissile material on hand, it is feasible to build a nuclear weapon in less than a year.

Why is it so easy, in Allison’s opinion, to design a nuclear bomb? First, the “secret” of nuclear weapons design is no longer secret. In this context Allison cites the 1979 article, appropriately titled “The H-Bomb Secret,” published in the left-wing *Progressive* magazine that describes the physics of the hydrogen bomb, complete with schematics. In Allison’s view this article would have been classified “Top Secret” had it been a government document. In the event the US government tried to prevent publication of the article but failed in its court bid. The article is currently accessible on the Internet (at <http://progressive.org/images/pdf/1179.pdf>). Allison also notes that recent revelations that Libya had received a bomb design from the A.Q. Khan network<sup>37</sup> — what an IAEA official described as “a sweet little bomb . . . too big and too heavy for a Scud, but it’ll go into a family car . . . a terrorist’s dream”<sup>38</sup> — showed that complete fission bomb designs are now available on the black market.

Moreover, Allison insists that the basic designs are simple and reliable: if a terrorist group has enough HEU (approximately 50 kg), it is “simple to plan, build, and detonate” a gun-type device.<sup>39</sup> This design — the type of bomb used in the Hiroshima attack — involves “shooting” one sub-critical mass of fissile material at another located at the end of a gun barrel to create the supercritical mass needed for a nuclear explosion. Alternatively, if terrorists fall short of the amount of fissile material needed for a gun-type device, they could build an implosion-type device — the type used in the Nagasaki bombing. This design, Allison notes, poses a greater technical challenge: high explosive lenses must be detonated simultaneously to create symmetrical compression that squeezes a

subcritical core of fissile material beyond supercriticality. Though challenging, constructing such an explosives package is not impossible according to Allison, and the shaped explosive lenses needed are easily acquired.

Ferguson, et al. are slightly more sceptical than Allison about the ease with which a terrorist group could build a nuclear weapon.<sup>40</sup> They recognize that constructing an IND is a far more complex undertaking than building an improvised explosive device (or IED, the infamous “roadside” bombs). In their opinion these technical barriers alone dissuade most terrorist groups from the attempt to build a nuclear explosive device.

Nevertheless, they agree with Allison that aspiring nuclear terrorists would likely favor a nuclear weapons design based on first-generation, well-proven technology, i.e., either a gun-type or implosion-type device. According to the authors, most physicists and nuclear weapons analysts agree that a gun-type IND would pose few technical barriers to what Ferguson, et al. term “*technically competent* [emphasis added] terrorists.”<sup>41</sup> Its design is relatively straightforward given its simplicity. Terrorists would need a safe area in which to test the non-nuclear parts of the device. However, assuming that they had such a haven and, further, that they had acquired sufficient HEU in an appropriate form, terrorists could have a moderate degree of confidence that a crude gun-type IND would explode with a substantial yield, without the need for a full-scale test prior to its use.

An implosion-type weapon, on the other hand, would pose much greater design and construction challenges. The authors point out that Iraqi scientists needed several years to achieve a workable nuclear weapons design based on implosion. Even with a workable design at hand, the manufacture and assembly of such a device is a daunting technical challenge involving considerable time and testing of the non-nuclear “trigger package.” Consequently, without full-scale testing terrorists could not be confident that such a device would work.

To surmount the technical challenges in designing and assembling an IND a terrorist group would have to bring together a small team knowledgeable in nuclear physics or engineering, metallurgy, machining, draftsmanship, conventional explosives, and chemical processing. A well-financed terrorist network such as *al-Qaeda*, the authors assert, would probably have little difficulty in recruiting people with the required skills. For example, it could attract sympathetic scientists from Pakistan, Iran, Iraq, and/or Russia, though in the case of Russia there is no evidence to date that it has succeeded in this effort. The authors concur with Allison’s assessment that a team of a dozen specialists would take roughly one year to assemble a workable device. Again, like Allison, they consider the greater challenge for aspiring nuclear terrorists to be acquiring the requisite fissile material, not the actual construction of a gun-type nuclear device, which they describe as “relatively simple.”<sup>42</sup>

Are Allison and Ferguson, et al. correct in their assertion that the recipe for

a crude but workable IND is “out there”? A closer look at some of the information that Allison and Ferguson, et al. maintain is readily available to aspiring nuclear terrorists through the Internet and other sources<sup>43</sup> reveals that these sources present the *basic design principles* of nuclear weapons. They do not provide precise details on the construction of such weapons. For example, Allison observes that “The H-Bomb Secret” published in *Progressive* magazine<sup>44</sup> describes the physics of the hydrogen bomb in detail, complete with schematics of a thermonuclear weapon. The article does, in fact, provide such schematics. However, these schematics are only simplified diagrams illustrating the basic design principles of such a weapon. As J. Carson Mark and four co-authors, all former US nuclear weapons designers, noted in a 1986 article, “[s]chematic drawings of fission explosive devices of the earliest types showing in a qualitative way the principles used in achieving the first fission explosions are widely available. However, the detailed design drawings and specifications that are essential before it is possible to plan the fabrication of actual parts are not available.”<sup>45</sup> These basic design schematics are not the blueprints for a bomb.

However, Mark, et al. wrote their seminal article over 20 years ago. Has the situation changed since then? In particular, do the disclosures regarding Libya’s WMD program suggest that detailed blueprints for a nuclear weapon are now circulating on the black market? These blueprints appear to be the most complete design information available outside of official state nuclear establishments. The documents, which Tripoli turned over to US officials in November 2003, “contained detailed, step-by-step instructions for assembling [a 1,000-lb.] implosion-type nuclear bomb that could fit atop a large ballistic missile. They also included technical instructions for manufacturing components for the device.”<sup>46</sup> However, even these extensive blueprints were apparently incomplete. While they included most essential design elements, officials and experts who examined the “hodgepodge” of documents noted that “*a few key parts were missing* [emphasis added] . . . Some investigators have speculated that the missing papers could have been lost, or hadn’t yet been provided — possibly they were being withheld pending additional payments.”<sup>47</sup> It would seem that Mark, et al.’s conclusion from 20 years still holds true today: a *complete* recipe detailing the steps from A to Z for building an IND is not available in the public domain.

In other words working with the basic design information that is already available terrorists would still need to “take it to the next level” in terms of preparing detailed blueprints for a workable IND. But is this such a challenging task? Allison highlights the case of a Princeton aerospace major, John Aristotle Phillips, who over a period of *five months* in 1977, designed an implosion-type bomb from publicly available information for his senior thesis. According to Allison, “the resulting design was a perfect terrorist weapon: a bomb the size of a beach ball, with a ten-kiloton yield and a price tag of \$2,000.”<sup>48</sup> The physics faculty at the university concluded that the design would work and the US government subsequently classified the thesis as “secret.” This suggests that design-

ing a nuclear device is a relatively simple matter, well within the capabilities of even a university undergraduate student. And yet, Ferguson, et al. note that Iraqi nuclear weapons scientists required *several years* to develop a workable nuclear weapon design based on the same implosion principle.<sup>49</sup>

What are we to make of this apparent discrepancy? Is it possible that the “native ingenuity” of an American undergraduate student so far exceeds the skills and expertise of Iraqi nuclear scientists that he was able to come up with a workable weapons design on his own in a fraction of the time that a team of professional scientists needed over three years to produce? More likely, Phillips’s thesis presented broad design principles which, though a major step forward on the path to a workable nuclear device, fell well short of the precise engineering specifications needed to actually construct such a weapon. Or it could be that his design was basically wrong.<sup>50</sup> Whatever the case, Allison’s claim that “the implosion design now lies within the grasp of undergraduate science majors”<sup>51</sup> is a gross overstatement that only perpetuates the mythology that has sprung up around the Phillips case.

To prepare the blueprints for and ultimately to fabricate an IND requires specialized skill and knowledge sets.<sup>52</sup> As Mark, et al. observe, the preparation of advanced design drawings for an IND requires expertise in several distinct areas: “the physical, chemical, and metallurgical properties of the various materials to be used, as well as the characteristics affecting their fabrication; neutronic properties; radiation effects, both nuclear and biological; technology concerning high explosives and/or chemical propellants; some hydrodynamics; electrical circuitry; and others.”<sup>53</sup> Moreover, these skill and knowledge sets are beyond the capabilities of any one individual. Mark, et al. estimate that an expert team numbering no less than three or four and probably more would need to be assembled. These team members “would have to be chosen not only on the basis of their technical knowledge, experience, and skills but also on their willingness to apply their talents to such a project, although their susceptibility to coercion or considerations of personal gain could be factors. In any event, the necessary attributes would be quite distinct from the paramilitary capability most often supposed to typify terrorists.”<sup>54</sup> Nobel laureate Luis Alvarez’s comment, quoted approvingly in *The Four Faces*, that “even a high school kid could make a bomb in short order,”<sup>55</sup> is utter nonsense.

Mark, et al. raise an important point: do terrorist groups typically have within their organizations the range of expertise needed to undertake such a technically challenging endeavor as building an IND from scratch? This is the assumption that underlies many assessments of the nuclear terrorist threat. The question of technical competence is simply assumed away, thereby reducing the IND construction problem to one of acquiring fissile material. In *The Four Faces*, for example, Ferguson, et al. start from the premise that aspiring nuclear terrorists are “reasonably technically competent.”<sup>56</sup> But can we so easily “assume away” the competency question? Is the garden-variety terrorist capable

of designing and fabricating a nuclear bomb? It is safe to say that terrorists tend not to be “rocket scientists” in the literal sense of the term. Indeed, as both Allison and Ferguson, et al. recognize, these organizations must reach beyond their core groups in order to attract outside expertise for their WMD programs.<sup>57</sup>

Here, the authors of these studies perform another feat of semantic *legerdemain*. The individuals the terrorist groups would seek out are described as “scientists,” “specialists,” and “technicians.” These terms in themselves convey a very particular and not necessarily accurate impression of the people terrorist groups might attract. They suggest individuals with a high degree of technical training and professional competence, for whom the technical demands of building an IND would be well within their abilities. The reality, however, may be somewhat less impressive. The pool of talent from which a terrorist organization is likely to draw is not that of Nobel laureates but, rather, the dregs of the scientific community. A 2005 RAND report noted that the Japanese terrorist group, *Aum Shinrikyo*,

recruited highly educated followers, including more than 300 scientists . . . Many Aum scientists, however, were second-rate. Even though they graduated from some of Japan’s best schools, they typically were not leaders in their fields. Aum gave them a second chance at their careers . . . Aum’s offer was quite attractive because these individuals did not have many opportunities to conduct their own research and writing. In the real world, these scientists were often just cogs in a wheel.<sup>58</sup>

What about the nuclear competency of *al-Qaeda*, the terrorist organization most dedicated to acquiring a nuclear weapons capability? Has it been successful in obtaining or preparing the designs for an IND, or in recruiting the well-trained scientists and experts needed to build such a device? Allison maintains that *al-Qaeda* has, in fact, obtained the blueprints for a nuclear weapon. He recounts the connection between the group’s senior leadership and two former officials from Pakistan’s nuclear establishment, Sultan Bashiruddin Mahmood and Abdul Majeed. He pays particular attention to this link, devoting four pages to its description.<sup>59</sup> He cites without challenge the conclusion of US intelligence that the two men provided *al-Qaeda* with the blueprint for constructing a nuclear weapon.<sup>60</sup> Once again, this may, in fact, be an overstatement. According to the RAND report, in their extensive discussions with bin Laden and his senior lieutenant, al-Zawahiri, the Pakistani scientists “may have given *al-Qaeda* a “road map” for building a nuclear weapon, e.g., identifying key technology and suppliers.”<sup>61</sup> But it is unlikely that they provided a blueprint for such a weapon. As the report continues, “Mahmood may have shared classified information with bin Laden, but unlikely [sic] that he possessed the specialized knowledge to build nuclear weapons.”<sup>62</sup>

If, in fact, *al-Qaeda* had obtained the blueprint for an IND, whether from

the Pakistani scientists or from some other source, it was not among the thousands of documents recovered after the US invasion of Afghanistan. Allison refers to these documents to demonstrate how far *al-Qaeda* had advanced along the path to constructing an IND. In particular, he cites one document, a 25-page essay entitled “Superbomb,” which, he claims, “included information on types of nuclear weapons, the physics and effects of nuclear explosions, and the properties of nuclear materials.”<sup>63</sup> He then quotes David Albright, a physicist and president of the Institute for Science and International Security in Washington, DC who had an opportunity to examine this document, who concluded, “the author [of the Superbomb document] understood shortcuts to making crude nuclear explosives.”<sup>64</sup> Allison continues, “[c]ombined with other documents diagramming and describing the manufacture of nuclear weapons and their effects, the essay led Albright to conclude that ‘Al Qaeda was intensifying its long-term goal to acquire nuclear weapons and would likely have succeeded, if it had remained powerful in Afghanistan for several more years.’”<sup>65</sup>

As with much of his analysis, Allison is selective in his references to Albright’s assessment. Albright did, in fact, note that there were some sections of the “Superbomb” document that were “relatively sophisticated” and that suggested that “the author understood short cuts to making crude nuclear explosives,”<sup>66</sup> as Allison correctly reported. However, Albright also said that there were sections of the document that were “remarkably inaccurate or naive,”<sup>67</sup> a point which Allison for some reason fails to mention. Albright summarized the “Superbomb” document in the following terms:

Over 25 neatly hand-written pages, the author [whose identity and background are unknown] discusses various types of nuclear weapons, the physics of nuclear explosions, properties of nuclear materials needed to make them, and the effects of nuclear weapons. It is not systematic in its coverage and the author sometimes covers some subjects in depth and others superficially and incorrectly. Nor is it a cookbook for making nuclear weapons, as many critical steps to make a nuclear weapon are missing from the document.<sup>68</sup>

Such information is disturbing without question, but not indicative of an advanced nuclear competency as Allison would have us believe.

Moreover, *al-Qaeda* operatives seem to have stumbled through the nuclear black market much like bumbling amateurs in their futile attempts to purchase nuclear materials. According to terrorism specialist Stefan Leader, in the 1990s, Mamdouh Mahmud Salim was *al-Qaeda*’s lead agent in efforts to buy illicit nuclear materials for an IND. Apparently, he had no scientific training whatsoever, a deficiency which became all too evident as he fell victim to several nuclear scams.<sup>69</sup> In late 1993, for instance, he approved the purchase of low-grade reactor fuel (enriched to less than 20 percent U-235) from sellers claiming the material was weapons-usable HEU. He may also have fallen for the long-run-

ning “Red Mercury” scam, where peddlers claim the material they are selling is a critical weapons component when it is, in fact, nothing more than “nuclear junk.” Additionally, Rohan Gunaratna, an expert on the *al-Qaeda* organization, recounts that “[i]ntelligence sources now believe that criminals sold *al-Qaeda* irradiated canisters purporting to contain uranium stolen from Russian army bases, whereas in fact the contents would have no military value whatsoever had it been passed to rogue nuclear scientists.”<sup>70</sup> These examples seem to confirm Leader’s conclusion that bin Laden’s agents “have been nuclear novices. Apparently, they have lacked the most fundamental expertise and have quickly become targets of nuclear scams of the sort that have victimised others for many years.”<sup>71</sup>

Where, then, does this leave us with respect to the third “M” of *mind-power*? First, while the basic design principles for a crude IND are widely known, it does not appear that a *complete, precisely-detailed blueprint* for the fabrication and assembly of a nuclear bomb is yet available either through open sources or the nuclear black market. To build upon the information that is publicly available in order to prepare a workable IND design requires a small team of scientifically and technically sophisticated experts not typically found in the membership of terrorist groups. Even *al-Qaeda*, the terrorist network best positioned in terms of motivation, organization, and financial resources to pursue the nuclear option, has demonstrated a pronounced lack of expertise in nuclear matters. Contrary to Allison’s and Ferguson, et al.’s contention, the building of an IND is not quite as simple as “1, 2, 3.”

## CONCLUSION

Allison and Ferguson, et al. present the reader with a terrifying assessment of the threat of nuclear terrorism. They paint a picture in which a wide array of terrorist groups, foremost among them the *al-Qaeda* network, are relentlessly pursuing the nuclear option in their fanatical eagerness to incinerate a US city at the first opportunity. Moreover, in their view opportunity is knocking for aspiring nuclear terrorists. They maintain that the world is awash in poorly secured weapons-usable material there for the taking. And with sufficient material, they argue, it is a relatively simple matter for even minimally competent terrorists to fabricate and assemble a crude but workable nuclear device based on design principles that are readily available from unclassified public sources. In short, in terms of the three “M’s”, the motivation is there, the material is readily at hand, and the mind-power is straightforward. Little wonder that Allison concludes that nuclear terrorism is “inevitable.”

Yet, the authors do not wish to leave the reader mired in a world without hope. As Allison maintains, nuclear terrorism, though inevitable, is preventable, a rather strange statement that defies basic logic. First, no event that depends upon human agency for its realization is inevitable. Hurricanes, earthquakes,

pandemics, or other natural catastrophies may be inevitable, but nothing within the power of man to effect is inevitable. Moreover, if nuclear terrorism is inevitable — that is, impossible to avoid — then it is, by definition, not preventable. There is nothing that can be done to stop something from happening that is inevitable. Clearly, Allison is not arguing that nothing can be done to prevent a terrorist nuclear attack. Indeed, both *Nuclear Terrorism* and *The Four Faces* devote much of their discussion to a series of policy prescriptions outlining how the risks of such an attack can be minimized. What Allison properly means to say is that a terrorist nuclear attack is *highly probable* in his estimation if appropriate steps are not urgently taken to contain if not eliminate the danger.

Even if we were to grant Allison's contention that a nuclear terrorist attack is inevitable, this still leaves one nagging question that both studies conspicuously fail to address. If terrorists are fanatically committed to acquiring and using a nuclear weapon, if fissile material for a bomb is easily available, and if construction of a crude IND is so simple, why have they not built and used a nuclear device before now? With respect to *al-Qaeda*, the conditions for such an endeavor would seem to have been ideal during the 1990s. As the RAND report points out, *al-Qaeda* had a number of advantages working in its favor during this period:

- Financial — possibly hundreds of millions of US\$;
- Sanctuary — Sudan, then Afghanistan;
- Organizational capacity — front companies endowed him [bin Laden] with seemingly legitimate logistical and financial means;
- Demonstrated operational capacities by simultaneously attacking separate targets in different countries;
- Some technical expertise.<sup>72</sup>

Why, then, did *al-Qaeda* not capitalize on these advantages to construct an IND? More importantly, why did it fritter away the element of strategic surprise with the 11 September attacks? *Al-Qaeda* has demonstrated an impressive degree of organizational patience, inserting sleeper cells in target societies to be activated years down the road, and patiently planning terrorist attacks over periods of months and years. It publicly acknowledges that it is in this battle with the “infidel” for the long run. Why, then, did it not wait until it had completed construction of an IND before awakening the US “sleeping giant” and losing many of these advantages in Washington's retaliatory action following 11 September?

Possibly, it was a case of miscalculation on the part of *al-Qaeda's* leadership. From an operational standpoint bin Laden and his cohorts may not have anticipated the dramatic destruction that the 11 September attacks would inflict.<sup>73</sup> From a strategic standpoint bin Laden may also have underestimated the reaction of the Bush administration to the attacks. The lukewarm response of the

Clinton administration to previous terrorist attacks during the 1990s may have led him to believe that Washington would refrain once again from severe and sustained retaliation in response to the attack. On the other hand Washington's response in striking back against the *umma* with the invasion and occupation of Afghanistan and Iraq may have been the exact response that bin Laden was hoping to provoke in order to mobilize the Islamic masses against the West and its client apostate regimes, and to facilitate attacks against the elements of US power.<sup>74</sup>

However, it could very well be that the "premature" attacks on 11 September were carried out because the prospects for developing a practical nuclear terrorist option in the near future were practically nil. Contrary to the arguments in *Nuclear Terrorism* and *The Four Faces*, essential fissile material may not be so readily available on the black market, and building an IND from basic design principles may be harder than is thought, especially for a terrorist network that lacks the essential scientific and technical expertise needed to execute the project. Though Allison and Ferguson, et al. may see the perpetration of nuclear terrorism as inevitable, the view may be very different from the terrorist's "side of the fence."

Why, then, do they overstate the threat in this fashion? Quite simply, Allison and Ferguson, et al. are trying to break through what they rightly see as governmental complacency regarding the terrorist nuclear threat. They seem to be tailoring their threat assessment in line with the belief that only if the threat is portrayed in the darkest terms will Washington be moved to act with any urgency on this important problem.

At first blush there seems to be little need to convince the Bush administration of the seriousness of the threat. One need only refer to the dire warnings from senior officials, such as former Deputy Secretary of Defense Paul Wolfowitz and Vice-President Dick Cheney,<sup>75</sup> to see that the administration appears to have already gotten the message. Nevertheless, it would seem that Allison and Ferguson, et al. believe that it cannot hurt to reinforce this appreciation of the threat. They may, in fact, overstate the nuclear terrorist threat to a degree. But, if in so doing, they move Washington to take measures that minimize the threat, what is the harm?

The danger with exaggerating the threat is that it will produce policy responses different from — and quite possibly worse than — the ones intended. Extreme problems tend to beget extreme solutions. Rather than prompting Washington to act with urgency to secure "loose" nuclear weapons and fissile material, an exaggeration of the terrorist nuclear threat may only reinforce the administration in its proactive counterproliferation strategy of preventive war (misleadingly termed "preemptive war" by the administration). As the recently released *National Security Strategy of the United States of America* states, "[w]hen the consequences of an attack with WMD are potentially so devastating,

we cannot afford to stand idly by as grave dangers materialize. This is the principle and logic of preemption.”<sup>76</sup>

Under international law the principles of *necessity* and *proportionality* govern any defensive use of force, including prevention/preemption. *Necessity* includes two elements. First, the use of force in self-defence must be the last resort after all other reasonable non-forcible measures have been exhausted. Second, the element of *immediacy* requires that anticipatory defensive force be used only to thwart an imminent<sup>77</sup> attack that poses a clear and overwhelming danger; further, there must not be an inordinate time-lag between the attack and the defensive use of force taken in response. The second principle governing the anticipatory use of force is *proportionality*. This means that the force used in self-defence must be in due proportion to that used in the predicate armed attack.

Exaggerating the nuclear terrorist threat has the effect of undermining the restraining influence of both these principles on the defensive use of force.<sup>78</sup> A hypothetical catastrophic nuclear terrorist attack can be used to justify virtually any level of preventive/preemptive action, even that which causes extremely high collateral civilian deaths and property damage in the state in which preventive action is taken. In this “Tom Clancy” school of threat assessment to which Allison and Ferguson, et al. subscribe, whatever worst-case scenario one can imagine becomes the baseline threat against which preventive military action is measured. At first glance the logic of the argument that falls out from such extreme threat assessments seems unassailable. What action can possibly be out of bounds to a state when faced with an alleged threat to the lives of millions of its citizens, indeed, to the very survival of the state itself? Upon more careful consideration, however, it becomes clear that this argument renders the concepts of necessity and proportionality meaningless. A state can justify whatever preventive measures it wants simply by positing a suitably catastrophic threat, regardless of its likelihood.

Allison and Ferguson, et al. inadvertently feed into this “no-holds-barred” policy approach through their exaggeration of the nuclear terrorist threat. Though with the best of intentions, in so far as they are trying to prompt Washington to move with despatch on a threat of undeniable concern, the authors’ efforts may ultimately do more harm than good.

**James W. Moore** is a Senior Strategic Analyst with the Directorate of Strategic Analysis, Department of National Defence, Ottawa, Canada. This Review Essay is an abridged version of a larger study the author has recently completed on nuclear terrorism. It represents the personal views of the author and does not reflect the official position of the Department of National Defence nor the Government of Canada.

## ENDNOTES

1. US, White House, *The National Security Strategy of the United States of America* (Washington, DC, 2006), p. 18, at <http://www.whitehouse.gov/nsc/nss/2006/nss2006.pdf>; accessed March 2006.
2. Graham Allison, *Nuclear Terrorism: The Ultimate Preventable Catastrophe* (New York: Henry Holt, 2005), pp. 14-15.
3. Charles D. Ferguson, William C. Potter, et al., *The Four Faces of Nuclear Terrorism* (New York: Routledge, 2005), p. 1. In March 2006, Ferguson produced a report for the Council on Foreign Relations that restated in very general terms the threat assessment presented in *The Four Faces*. See Charles D. Ferguson, *Preventing Catastrophic Nuclear Terrorism*, CSR No.11 (New York: Council on Foreign Relations, 2006). Other prominent nuclear proliferation analysts echo this same theme. See, for example, Matthew Bunn and Anthony Wier, "Updating the Threat," in *Securing the Bomb: An Agenda for Action* (Washington, DC: Nuclear Threat Initiative and the Project on Managing the Atom, Harvard University, 2004), p. 9. For an overview of the nuclear terrorist threat and the US government's response, see Jonathan Medalia, *Nuclear Terrorism: A Brief Review of Threats and Responses*, CRS Report for Congress RL32595 (Washington, DC, September 2004).
4. Ferguson, et al., *The Four Faces*, p. 3.
5. A growing number of "voices in the wilderness" are struggling to put the nuclear terrorist threat in its proper perspective. Foremost among these is Robin M. Frost, *Nuclear Terrorism After 9/11*, Adelphi Paper No.378 (London: International Institute for Strategic Studies, December 2005).
6. Ferguson, et al., *The Four Faces*, pp. 18-34.
7. *Ibid.*, p. 37.
8. Allison, *Nuclear Terrorism*, pp. 19-42.
9. *Ibid.*, p. 29.
10. *Ibid.*, p. 40.
11. *Ibid.*, pp. 34-37.
12. Despite the cleverly implied meaning here, "technical terror expertise" does not mean the group necessarily has the technical *nuclear* expertise needed to build an IND.
13. Allison, *Nuclear Terrorism*, p. 37.
14. Rami G. Khouri, "Don't Reduce Hizbullah to One Dimension," *The Daily Star*, 28 December 2005.
15. Allison, *Nuclear Terrorism*, p. 37.
16. To build a nuclear explosive device, it is best to use uranium or plutonium as pure in the U-235 or Pu-239 isotopes as possible. Weapons-usable material is any uranium enriched to over 20 percent U-235; this is also known as highly enriched uranium or HEU. Plutonium of any isotopic content is considered weapons-usable. The term weapons-grade represents the optimum standard for fissile material used in nuclear weapons. In the US this standard is 93 percent U-235 in HEU and 94 percent Pu-239 in plutonium. See Owen R. Coté, Jr., "A Primer on Fissile Materials and Nuclear Weapon Design," in Graham T. Allison, Owen R. Coté, Jr., Richard A. Falkenrath, and Steven E. Miller, eds., *Avoiding Nuclear Anarchy: Containing the Threat of Loose Russian Nuclear Weapons and Fissile Material* (Cambridge: The MIT Press, 1996), online p.11, at <http://www.pbs.org/wgbh/pages/frontline/shows/nukes/readings/appendixb.html>, accessed March 2006.
17. *Ibid.*, online p.16.
18. The following discussion is a summary of the arguments found in Allison, *Nuclear Terrorism*, pp. 67-86.

## Summer 2006

19. Ibid., p. 74.
20. Ibid., pp. 96-97.
21. The following discussion is a summary of the arguments found in Ferguson, et al., *The Four Faces*, pp. 106-11.
22. This would seem to be the opposite conclusion to that reached by *al-Qaeda*. The group initially sought to acquire the components, including fissile material, to construct an IND, but after several years of frustration gave up on the effort, concluding that it was, in fact, easier to procure an actual weapon than to make one from scratch. See Sara Daly, John Parachini, and William Rosenau, *Aum Shinrikyo, Al Qaeda, and the Kinshasa Reactor: Implications of Three Case Studies for Combating Nuclear Terrorism*, RAND Project Air Force Documented Briefing (Santa Monica, CA: RAND Corporation, 2005), p. 40.
23. Ferguson, et al., *The Four Faces*, p. 107.
24. Ibid.
25. Ibid., p. 108.
26. International Atomic Energy Agency, "IAEA Illicit Trafficking Database (ITDB)," *IAEA.org* (December 2004), online p. 1, at [http://www.iaea.org/NewsCenter/Features/RadSources/PDF/itdb\\_31122004.pdf](http://www.iaea.org/NewsCenter/Features/RadSources/PDF/itdb_31122004.pdf), accessed March 2006.
27. Ibid., online p. 2.
28. Ferguson, et al., *The Four Faces*, p. 132.
29. Ibid., p. 135.
30. US Congress, House, Committee on Homeland Security, Subcommittee on Prevention of Nuclear and Biological Attack, *The Dark Side of the Nuclear Smuggling Business*, Statement of Rensselaer Lee, President, Global Advisory Services, 109th Cong., 1st Sess., 22 September 2005, online p. 1, at <http://homeland.house.gov/files/TestimonyLee.pdf>, accessed March 2006.
31. Ibid.
32. Frost, *Nuclear Terrorism After 9/11*, p. 16.
33. Ibid.
34. Ibid., pp. 16-17.
35. Daly, et al., *Aum Shinrikyo, Al Qaeda, and the Kinshasa Reactor*, pp. 50-51.
36. The following discussion is a summary of the arguments found in Allison, *Nuclear Terrorism*, pp. 92-98.
37. For a discussion of the A.Q. Khan network, see David Albright and Corey Hinderstein, "Unraveling the A.Q. Khan and Future Proliferation Networks," *The Washington Quarterly* 28 (Spring 2005), p. 111; William Langewiesche, "The Wrath of Khan," *The Atlantic Monthly*, November 2005, p. 62; and William Langewiesche, "The Point of No Return," *The Atlantic Monthly*, January/February 2006, p. 96.
38. Allison, *Nuclear Terrorism*, p. 93.
39. Ibid., p. 95.
40. The following discussion is a summary of the arguments found in Ferguson, et al., *The Four Faces*, pp. 131-38.
41. Ibid., p. 132.
42. Ibid., Table 4.5, p. 139.
43. See, for example, Carey Sublette, "Nuclear Weapons Frequently Asked Questions," *The Nuclear Weapon Archive: A Guide to Nuclear Weapons* (August 2001), at <http://www.nuclear-weaponarchive.org/Nwfaq/Nfaq0.html>, accessed March 2006. Also Coté, Jr., "A Primer on Fissile Materials and Nuclear Weapon Design."

44. Howard Morland, "The H-bomb Secret: To Know How is to Ask Why," *The Progressive*, November 1979, p. 3, at <http://progressive.org/images/pdf/1179.pdf>, accessed March 2006.
45. Carson Mark, Theodore Taylor, Eugene Eyster, William Maraman, and Jacob Wechsler, *Can Terrorists Build Nuclear Weapons?* (Washington, DC: Nuclear Control Institute, 1986), online p. 4, at <http://www.nci.org/k-m/makeab.htm>, accessed March 2006.
46. Joby Warrick and Peter Slevin, "Libyan Arms Designs Traced Back to China," *The Washington Post*, 15 February 2004.
47. Ibid.
48. Allison, *Nuclear Terrorism*, p. 88.
49. Ferguson, et al., *The Four Faces*, p. 137.
50. See Frost, *Nuclear Terrorism After 9/11*, p. 33.
51. Allison, *Nuclear Terrorism*, p. 97.
52. For an excellent summary of the technical challenges confronting would-be nuclear terrorists in designing and fabricating an IND, see Frost, *Nuclear Terrorism After 9/11*, pp. 25-40.
53. Mark, et al., *Can Terrorists Build Nuclear Weapons?*, online p. 4.
54. Ibid., online p. 5.
55. Ferguson, et al., *The Four Faces*, p. 133.
56. Ibid., p. 137.
57. Allison, *Nuclear Terrorism*, p. 28; and Ferguson, et al., *The Four Faces*, p. 116.
58. Daly, et al., *Aum Shinrikyo, Al Qaeda, and the Kinshasa Reactor*, pp. 10-11.
59. Allison, *Nuclear Terrorism*, pp. 20-24.
60. Ibid., p. 24.
61. Daly, et al., *Aum Shinrikyo, Al Qaeda, and the Kinshasa Reactor*, p. 35.
62. Ibid.
63. Allison, *Nuclear Terrorism*, p. 26.
64. Ibid.
65. Ibid.
66. David Albright, *Al Qaeda's Nuclear Program: Through the Window of Seized Documents*, Policy Forum Online: Special Forum 47, (6 November 2002), online p. 4, at [http://www.nautilus.org/archives/fora/Special-Policy-Forum/47\\_Albright.html](http://www.nautilus.org/archives/fora/Special-Policy-Forum/47_Albright.html), accessed March 2006.
67. Ibid., online p. 5.
68. Ibid.
69. Leader's assessment of Salim and the two examples reported here of the nuclear scams of which he was the target are found in Stefan Leader, "Osama Bin Laden and the Terrorist Search for WMD," *Jane's Intelligence Review*, 1 June 1999, at [http://jir.janes.com/docs/jir/search\\_results.jsp?](http://jir.janes.com/docs/jir/search_results.jsp?), accessed March 2006.
70. Rohan Gunaratna, *Inside Al Qaeda: Global Network of Terror* (New York: Columbia University Press, 2002), p. 15.
71. Leader, "Osama Bin Laden and the Terrorist Search for WMD," online p. 4.
72. Daly, et al., *Aum Shinrikyo, Al Qaeda, and the Kinshasa Reactor*, p. 28.
73. See "Bin Laden On Tape: Attacks 'Benefited Islam Greatly,'" *CNN.com*, 14 December 2001, at <http://archives.cnn.com/2001/US/12/13/ret.bin.laden.videotape/>, accessed March 2006.
74. Christopher M. Blanchard, *Al Qaeda: Statements and Evolving Ideology*, CRS Report for Congress RL32759 (Washington, DC, January 2006), CRS-5.
75. See, for example, "Wolfowitz on Turkey and the EU, Iraq, NATO and Terrorism," *United States*

*Mission to the European Union*, 2 December 2002, online p. 11, at <http://www.useu.be/Categories/US&EUEnlargement/Dec0202WolfowitzTurkeyEUIraqNATO.html>, accessed March 2006. See also Vice President Richard Cheney, "Vice President and Mrs. Cheney's Remarks and Q&A in Carroll, Ohio," 19 October 2004, at <http://www.whitehouse.gov/news/releases/2004/10/20041020-2.html>, accessed March 2006.

76. White House, *National Security Strategy 2006*, p. 23.

77. Webster's Revised Unabridged Dictionary provides a useful distinction between the terms imminent, impending, and threatening:

Imminent is the strongest: it denotes that something is ready to fall or happen on the instant; as, in imminent danger of one's life. Impending denotes that something hangs suspended over us, and may so remain indefinitely; as, the impending evils of war. Threatening supposes some danger in prospect, but more remote; as, threatening indications for the future.

See "Definition: Imminent," in *Webster's Revised Unabridged Dictionary* (1913), at <http://dict.die.net/imminent/>, accessed March 2006.

78. It also downplays higher-probability conventional mass-casualty terrorist attacks and can lead to a misallocation of scarce counterterrorism resources. See John Parachini, "Putting WMD Terrorism into Perspective," *The Washington Quarterly* 26 (2003), p. 48.