

Alexander Kelle / Annette Schaper

Terrorism using biological and nuclear weapons

A critical analysis of risks
after 11 September 2001

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Correspondence to:

PRIF • Leimenrode 29 • 60322 Frankfurt am Main • Germany

Telephone: (069) 95 91 04-0 • Fax: (069) 55 84 81

E-Mail: a.kelle@bradford.ac.uk • schaper@hsfk.de

Internet: <http://www.hsfk.de>

Translation: Dr Diane Spiedel, Edge Translations, Manchester

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Summary

Ever since the Aum sect carried out a nerve gas attack in the Tokyo underground in March 1995, the likelihood of terrorist attacks with biological weapons (BW's) has been a topic of public debate. In the weeks following the September 11th attacks in New York and Washington, D.C. in 2001, the occurrence of a number of cases of anthrax seemed to strongly support those who regarded the issue of *whether* terrorists would use biological weapons as already settled, leaving open only the questions of *when* and *how* such attacks were going to happen.

In fact, this use of anthrax leads to the question of whether a paradigm change has occurred in the strategies and methods of terrorists, with biological weapons becoming a standard tool in the terrorist's repertoire.

Reviewed critically, the attack by the Aum Shinrikyo in Tokyo reveals two facts: on the one hand, the Japanese sect failed utterly in their attempts to produce biological agents and to use them as a weapon; on the other hand, none of the obstacles that were considered to affect the motivation of groups like Aum to obtain BW's had any effect. The old worldview that terrorists are unlikely to use biological weapons has been thrown into question.

The nature and the course of the terrorist attacks in the US can still be interpreted in a number of ways, however, all interpretations agree on two factors that are of key importance. Firstly, not only are Osama bin Laden and his organisation prepared to allow the death of thousands, they even make such multiple deaths a central element in the planning of their attacks. In this way, the old 'rule' of terrorism research, which maintains that terrorists are interested in creating large numbers of spectators but not of victims of their attacks, is challenged. Secondly, the use of pathogens in biological weapons, in the way seen recently, adds a new string to the terrorist's bow. However in this case, BW's were not used for mass destruction, nor is there evidence linking the attacks of September 11th and the anthrax letters. Talk of a new paradigm would only be justified if one of these were the case. The claim of a new way of thinking is, at best, premature and, at worst, leads to inappropriate political reactions.

The Biological Weapons Convention (BWC) could be one of the first and, at same time, most dramatic, victims of the current focusing of the international public debate over the risk of biological weapons. The most recent review of this, which took place in Geneva between November 19th and December 7th 2001, was blatantly sabotaged by the US. The inevitable collapse of the review process could only be prevented by an adjournment until November 2002. The Biological Weapons Convention is the most useful multilateral instrument currently available for the formation of a line of defence against the threat of bioterrorism, amongst others. Failure would, therefore, be disastrous.

In the past, it has been thought impossible that terrorists could build nuclear weapons. This assessment must, however, be reviewed. The theoretical principles are widely accessible to the public, with such information even being available on the Internet. However, at an engineering level, many technical details remain secret. The specialist capability and the techniques necessary for the ignition of nuclear weapons can only be acquired through several years of experimentation, which could not be hidden from the public. Therefore, a terrorist organisation would need the cover and protection of a state like Afghanistan. Given such protection, it would then be possible, in principle, for a terrorist organisation to develop the ignition technology, even without nuclear material.

The most difficult hurdle for a terrorist organisation is the procurement of nuclear fuel – plutonium or highly enriched uranium (HEU). In countries that are subject to the control of the International Atomic Energy Agency (IAEA), an illegal attempt to siphon off some nuclear fuel is likely to be detected at an early stage. The same is not true of those states that possess nuclear weapons but are not internationally controlled, Particularly in Russia, the national instruments for protecting and recording nuclear material are unsatisfactory. A few thefts have occurred and it is possible that terrorists have already got hold of nuclear material. That a terrorist group has the capability to produce this material can be ruled out. However, there are a few countries that have been or currently are suspected of developing nuclear weapons. They could possibly have supported or could in future support a terrorist organisation. Here, we discuss Iraq, North Korea, South Africa and Iran. A whole section is dedicated to Pakistan. Pakistan has always stressed that it does not pass on its nuclear weapons. However, little is known about Pakistani national security measures. It is not known whether religious fanatics could have access to nuclear material and could pass it on to terrorists. Cooperation with Pakistan should be considered as a means to achieve the physical protection of nuclear material.

For several years, there have been growing indications that bin Laden is attempting to get hold of weapons of mass destruction. He has explicitly declared his wish to procure nuclear weapons and has tried to buy HEU on the black market. It is said that he also attempted to procure complete small nuclear weapons, so called “rucksack bombs”, originating from former Soviet stocks. A few years ago, a warning was issued that the stock of these weapons may no longer be complete.

Terrorists could transport nuclear weapons by sea or by land. Such transport would probably not be discovered. A variant of nuclear terrorism that is technically much less challenging would be the use of a *radiological weapon*. Such a weapon is detonated by a conventional explosion and distributes highly radioactive material. Whole regions can, thus, be made uninhabitable. Another widely discussed scenario involves a passenger plane, with full fuel tanks, being crashed into a nuclear power station. However, the terrorists would have to be capable of hitting the shield vertically, in a nosedive, and not just scrape against it from the side. This is far more difficult than directing a plane into a high building.

Several strategies exist that could reduce the risks of nuclear terrorism. These encompass, first and foremost, international cooperation to improve the security of nuclear material in Russia. It will also be necessary to cooperate with the three *de facto* nuclear weapon states, India, Pakistan and Israel, to increase the security of their nuclear facilities and materials. Current risk scenarios have to be reviewed, as they do not take into account the possibility that terrorists could aim for mass murder and are prepared to commit suicide. It would be appropriate to cooperate with the IAEA, which is involved in a variety of activities that aim to reduce the risks. The disposal of plutonium from disarmed nuclear weapons should be pushed forward. A further problem is the lack of an overview of the nuclear weapons currently in existence. An arms control treaty that includes the registration and disarmament of tactical nuclear weapons could reduce the risk of theft.

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1. Introduction

The smoke over Manhattan did not quite reach the size of a mushroom cloud. Nevertheless, the number of casualties was of the order that would be caused by a minor nuclear explosion. The idea that terrorists have access to weapons of mass destruction is a nightmare that is occasionally discussed in the media. It is also an idea that governments and international organisations take seriously. The American president, George Bush, regards terror with weapons of mass destruction as possible¹ as does the director general of the International Atomic Energy Agency (IAEA) Mohamed ElBaradei.²

The September 11th terrorists aimed to maximise the death toll they inflicted. Future attacks will always be compared to this one, therefore, the ambition of successive assassins might be to beat this death toll. Acquiring the means of mass destruction, including biological, chemical and nuclear weapons, would thus be the next step. Until now, terrorist attacks involving weapons of mass destruction have been considered as unlikely for two reasons: the perpetrators' motivation for such acts has been underestimated; and their technical abilities have been regarded as insufficient. The events of September 11th have finally made it clear that mass murder can be a terrorist's objective. The extent to which they have the technical ability is another question.

In the history of terrorist attacks, examples of the use of biological and chemical weapons can be found. Of those, the most prominent is the nerve gas attack in the Tokyo underground carried out by the apocalyptic Aum Shinrikyo sect in March 1995, which led to over 1000 casualties and 12 fatalities. Although the terrorists were unsuccessful for technical reasons, there is no doubt that mass murder was intended. There are also examples of attacks with nuclear material. Chechnyan terrorists placed a container of radioactive Caesium-137 at the entrance to a Moscow park in 1995.³ The radiation was not high enough to harm passers-by, however, if the terrorists had detonated the container with conventional explosives, the area would have been strongly contaminated. A nuclear weapon has not yet been produced by terrorists but it is uncertain whether this will continue to be the case.

The aim of this report is to assess realistically the possibilities terrorists have to carry out attacks with biological or nuclear weapons. Consequently, the question is raised as to the means available to combat such attacks. In this context, informal technical cooperation, as well as broad political coalitions, will be essential. This report is divided into two parts, the first of which is dedicated to the subject of biological weapons, the second dealing with nuclear terrorism.

1 President George Bush, No Nation Can Be Neutral in This Conflict, remarks by the president to the Warsaw Conference on Combating Terrorism, 6/11/2001, <http://www.whitehouse.gov/news/releases/2001/11/20011106-2.html>.

2 Mohamed ElBaradei, Some Major Challenges: Nuclear Non-Proliferation, Nuclear Arms Control and Nuclear Terrorism, statement to the Symposium on International Safeguards: Verification and Nuclear Material Security, Vienna, 29/10/2001, <http://www.iaea.org/worldatom/Press/Statements/2001/ebsp2001n011.shtml>.

3 Jim Puzanghera: "New fear emerges: possible threat of nuclear warfare", *Mercury News*, 2001.

2. The (new) terrorists and the (old) biological weapons – time for a new paradigm?

Since the mid 90's, the possible acquisition and use of biological weapons by terrorists has increasingly become a subject of discussion at a political level and in the media. At the same time, the scientific debate has also grown, particularly in the United States. The anthrax cases that followed the terrorist attacks in New York and Washington, D.C., seemed to confirm dramatically the views of those who regard the question of *whether* terrorists can use biological weapons as closed and who are only prepared to think about *when* and *how* such attacks are going to happen.

In a seminal essay, the former American senator Sam Nunn described this new terrorism and the increased danger of the use of biological weapons by sub-national groups as the inevitable convergence of two long-known threats that appeared after the end of the East-West conflict: terrorism and the proliferation of weapons of mass destruction.⁴

According to Nunn, this convergence is promoted by three developments that have reinforced one another: Firstly, the collapse of the Soviet Union led to a situation in which client states of the former U.S.S.R. that were involved in terrorist activities in the past are now free of constraints once imposed by the superpower. Secondly, the collapse of the Soviet Union has released an enormous reserve of scientists, know-how, technology and materials that, due to poor control and a lack of resources, can be accessed by interested states or sub-national parties. Thirdly, the Internet facilitates distribution of information that is relevant to NBC (Nuclear, Biological and Chemical) weapons and is of great assistance to potential terrorists wishing to use biological weapons. The spectrum of interested parties, as identified in the worst-case scenarios of those believing in the rise of this new terrorism, comprises several 'rogue' states, traditional terrorist groups, "ideologically motivated sects and dissatisfied political groups", as well as individual assassins who want to use biological weapons to influence "the development of global history".⁵ It is argued that, for such groups, the political and moral, as well as the technological and organisational, barriers that stand in the way of the acquisition and use of biological weapons for terrorist purposes have decreased.

The nerve gas attack in the Tokyo underground in March 1995 has often been called a 'wake-up call,' refocusing political, journalistic and academic interests. In this incident, members of the apocalyptic sect Aum Shinrikyo released the nerve gas sarin in several underground trains. The nerve gas attack killed 12 people and injured over a thousand.⁶ The terrorist attacks on the World Trade Centre in 1993⁷ and on the government building in Oklahoma City in April 1995⁸ reinforced

4 Sam Nunn, Terrorism Meets Proliferation: A Post-Cold War Convergence of Threats, in: *The Monitor. Nonproliferation, Demilitarization and Arms Control*, Vol. 3, No. 2, 1997, p.1, p. 3 f.

5 *Ibid.*, p. 3.

6 See David E. Kaplan, *The Cult at the End of the World*, 1998; Milton Leitenberg, The Experience of the Japanese Aum Shinrikyo Group and Biological Agents, in: Brad Roberts (ed.): *Hype or Reality: The "New Terrorism" and Mass Casualty Attacks*, Alexandria, VA: CBACI, 2000, pp.159-170.

7 See John V. Parachini, The World Trade Center Bombers, in: Jonathan B. Tucker (ed.): *Toxic Terror. Assessing Terrorist Use of Chemical and Biological Weapons*, Cambridge, MA: MIT Press, 2000, pp. 185-206.

8 See Jessica E. Stern, Larry Wayne Harris, in: Jonathan B. Tucker (ed.): *Toxic Terror. Assessing Terrorist Use of Chemical and Biological Weapons*, Cambridge, MA: MIT Press, 2000, pp.227-246.

the perception in the US that modern societies – particularly US society – are increasingly vulnerable to terrorist attacks. Today, with regard to the use of the anthrax bacterium, the question is raised whether a change of paradigm has occurred in the field of terrorist strategy and methods, towards the idea that biological weapons are becoming standard tools of the terrorist repertoire.

2.1. The old paradigm

Looking back over the history of terrorism, the use of biological weapons has only been considered in a minute fraction of all terrorist acts.⁹ The terrorists' classical repertoire consists of attacks on individuals or groups, including kidnapping, murder, bomb attacks, hijacking of planes, taking of hostages and others. Various intertwined causes can be identified in the literature, which explain the terrorists' reluctance to use or to threaten to use biological weapons.¹⁰

- The effects occurring after the release of biological weapons cannot be controlled. This is true for non-contagious pathogens like *Bacillus anthracis*, the organism that causes anthrax and even more so for pathogens causing contagious diseases, like, for example, *Variola major*, the virus that causes small pox. Instead of having an overwhelming efficiency, the effects of such bioweapons could just 'fizzle out' (see the example of Aum Shinrikyo below).
- Terrorists may be afraid of infecting themselves with the pathogen.
- Terrorists usually have an aversion to producing large numbers of casualties.
- There is an additional moral barrier, as the mass use of biological weapons would hit the ill, the old and children the hardest. These are not, however, the primary targets of terrorist activities.
- The use of biological weapons might undermine support for the group by members or sympathisers and might provoke a reaction from the government attacked. Together, these might endanger the survival of the terrorist group.
- 'Classic' terrorist aims can be achieved without the use of biological weapons. As a matter of fact, terrorists claims have not yet been made that are on a scale for which biological weapons would appear a proportionate or adequate threat.
- It is possible that government sponsors request that the terrorist groups they support restrain their activities regarding biological weapons. The reasoning behind this is the idea that whilst terrorist groups cannot easily be located and so make poor targets for retaliatory strikes, the same is not true for the territory and infrastructure of a sponsor state.

9 See review and case studies in Jonathan B. Tucker (ed.): *Toxic Terror. Assessing Terrorist Use of Chemical and Biological Weapons*, Cambridge, MA: MIT Press, 2000.

10 According to Ron Purver, Understanding Past Non-Use of CBW by Terrorists, in: Brad Roberts (ed.): *Terrorisms with Chemical and Biological Weapons. Calibrating Risks and Responses*, Alexandria, VA: CBACI, 1997, pp. 65-73. See also the detailed documentation by Purver: *Chemical and Biological Terrorism: The Threat According to the Open Literature*, Ottawa: Canadian Security Intelligence Service, June 1995.

- A further factor explaining the lack of interest in biological weapons shown by terrorists is the complexity of biological weapons programmes, as compared to traditional terrorist means, such as car bombs.
- The properties of pathogens pose two problems with respect to terrorist aims: On the one hand, an attack with biological weapons could be regarded as a natural outbreak of an illness – therefore, the terror group might have problems claiming responsibility for it. On the other hand, the incubation phase between the release of the pathogen and the occurrence of the first victims might destroy the link between cause and effect, an idea that goes against traditional terrorist patterns of behaviour and might thwart an ‘optimal’ response by the media.

These factors have been and still are being debated by experts. Nevertheless, until the 1990’s, a combination of the factors listed above was widely accepted as sufficient explanation for the absence of terrorist acts involving biological weapons as a means of mass destruction.

2.2. Aum Shinrikyo – The old world view is jeopardised

With the nerve gas attack in the Tokyo underground on 20th March 1995, the worldview described in the previous section was shaken. Twelve people were assassinated and more than one thousand were injured and required medical treatment. The investigations that followed revealed that the use of sarin was merely the sad culmination of a series of attempts by the Aum sect to use biological weapons. This dramatic event marked a turning point, which caused the assessment of the probability of terrorists using chemical and biological weapons to achieve their goals in future to change fundamentally. However, one central element is regularly ignored when reference is made to this attack: the complete failure of Aum’s bioweapon programme. However, analysis of the extent of the BW programme and the reasons for its failure is essential for an adequate assessment of the event’s importance.

The origin of Aum’s bioweapon programme can be dated back to the year 1990, when Aum scientists tried to procure a culture of the pathogen *Clostridium botulinum*, which causes botulism. At the same time, procurement programmes were started, to obtain laboratory equipment and growth media, e.g. peptone. Three laboratories, or rather production plants, were equipped.

Despite the practically unlimited financial resources that were dedicated to the sect’s bioweapon programme, all attempts to produce and use biological weapons failed. Shortly after the attempt to get hold of *Clostridium botulinum*, tests were carried out to confirm the efficiency of the toxin produced. Three vehicles were equipped with aerosol generators and driven through Tokyo to the international airport in Narita and to US naval bases in Yokohama and Yokosaka.¹¹ However, no effect

11 The following is based on Amy Smithson and Leslie-Ann Levy: *Ataxia: The Chemical and Biological Terrorism Threat and the US Response*, Report No. 35, Washington, D.C.: The Henry L. Stimson Center, October 2000, pp.75-91; William Rosenau, Aum Shinrikyo’s Biological Weapons Program: Why Did it Fail?, in *Studies in Conflict & Terrorism*, Vol. 24, 2001, pp.289-301; Milton Leitenberg, The Experience of the Japanese Aum Shinrikyo Group and Biological Agents, in: Brad Roberts (ed.): *Hype or Reality: The “New Terrorism” and Mass Casualty Attacks*, Alexandria, VA: CBACI, 2000

of these actions could be observed. Previously, Aum had carried out laboratory tests with rats, which proved negative. This leads to the conclusion that either the Aum scientists were unable to isolate or culture *Clostridium botulinum*, or the amounts of toxin produced were insufficient to cause harm.¹²

Similar conclusions can be drawn about Aum's attempt to cultivate and spread *Bacillus anthracis*. Aum was only able to get hold of a non-virulent strain of the pathogen, used for the production of vaccine. After a certain amount of the bacterium had been produced – the exact amount is still unknown – a first attempt was made to distribute the supposed pathogen from the roof of a tower block in Tokyo. Reports about this event can only lead to the conclusion that the production of an aerosol from the solution of anthrax bacteria failed completely – nobody was infected with the pathogen. Two further attempts to distribute the anthrax pathogen, by means of the same spraying vehicles used previously for the botulinus toxin, also failed.

Moreover, Leitenberg destroys some other myths formed in the reporting of the Aum's bioweapon programme. He demonstrates, for example, that Aum's dabblings with *Coxiella burnetii*, the pathogen causing Q fever, consisted of nothing more than the procurement of a diagnosis test kit from Australia. Also, it is more than doubtful whether Aum members were capable of isolating the Ebola virus. Reports about a software application that allegedly enabled Aum to construct genetically modified pathogens turned out to be a hoax.¹³

Nevertheless, it has to be emphasized that none of the moral, psychological or potentially operative barriers for the production and distribution of BW'S described above played a role in preventing Aum from attempting to isolate and produce pathogens, transform them into a weapon-suitable form and finally distribute them. This dealt a blow to the widespread 'knowledge' of terrorist groups' aversion to bioweapons.

At the same time, Aum's complete failure at an operative level, that is the procurement of virulent pathogens, their mass production and distribution, is an important indication that the technical barriers for all these steps towards a working bioweapon are higher than some sensational media reports would suggest. On the contrary, the Aum example demonstrates clearly, that a simple university degree in biology and practically unlimited financial means for the procurement of the materials and infrastructure required are not sufficient for the production and use of biological weapons.

Finally, it should also be noted that the attack with the nerve agent sarin was not imitated immediately, as was feared. Traditional terrorist organisations remained true to their traditional means and procedures and movements believing that the end of the world is near, like the Aum Shinrikyo sect, apparently did not consider the Aum an example worth imitating. In fact, it took over six years until a terror group or individual distributed pathogens as biological weapon in a 'successful' way, in October 2001.¹⁴

12 For the latter see W. Seth Carus: *Bioterrorism and Biocrimes: The Illicit Use of Biological Agents in the 20th Century*, Washington, D.C.: National Defense University, July 1999, p.57.

13 See Milton Leitenberg, The Experience of the Japanese Aum Shinrikyo Group and Biological Agents, in: Brad Roberts (ed.): *Hype or Reality: The "New Terrorism" and Mass Casualty Attacks*, Alexandria, VA: CBACI, 2000, in particular pp. 164-167.

14 The disruptive potential of hoax bioweapon attacks and even of procurement attempts by criminal and terrorist individuals or groups and opportunistic attempts to gain attention should not underestimated, see the statistics by the Cen-

2.3. The events of September 11th and the distribution of anthrax pathogens in the US – a basis for a new paradigm?

The events in New York and in Washington, D.C., and the distribution of the anthrax pathogen in half a dozen US states have undoubtedly ‘changed the world’. The question is, to what extent? After the event, do we finally have to lay to rest the paradigm that says that terrorists are unlikely to use biological weapons? Alternatively, do the anthrax cases represent an exception proving a still valid rule?

Between October 4 and November 20, 2001 a total of 22 cases of infection with anthrax occurred.¹⁵ Half of the total were of the inhaled form - that is infection occurred via the respiratory tract while the other eleven cases were of a skin infection with anthrax. Five of the patients suffering from the inhaled form of anthrax died. The letters that contained the anthrax were addressed to media companies – American Media in Florida, NBC News, CBS News and the New York Post in New York – or to representatives of the political system in Washington, D.C., that is to their staff. In addition to these, post office staff who came into contact with the letters or simply worked at the sites where the letters were sorted or forwarded were affected by anthrax. Finally, two individuals were infected with anthrax and died for whom no link could be established to the anthrax letters. It is assumed that in both cases, a member of hospital staff in New York and an elderly lady in Connecticut, their mail came into direct contact with the anthrax letters or crossed the same distribution path.

According to the Centers for Disease Control and Prevention (CDC) and other US government authorities, all anthrax spores found were identical and were curable with antibiotics. This leads to the conclusion that all the spores had the same origin and the strain from which they came was not genetically modified to alter its resistance to antibiotics. Also, in all cases, the anthrax spores used were in the form of a very fine powder, the particles of which had a size under 5 micrometers. It has now been confirmed that the anthrax pathogen used belongs to the Ames strain, which was first isolated in a laboratory in Ames, Iowa.¹⁶

This, however, is all that has been confirmed about the pathogen, its source and identity or indeed about those who used it. Speculation and contradictory statements dominate the debate about the identity of the culprit. In principle, four different and more or less plausible scenarios can be identified.

ter for Nonproliferation Studies, e.g. Gavin Cameron et al.: 1999 WMD Terrorism Chronology: Incidents Involving Sub-National Actors and Chemical, Biological, Radiological, and Nuclear Materials, in: *The Nonproliferation Review*, Vol. 7, No. 2, Summer 2000, pp.157-174.

15 Data come from: Daniel E Jernigan et.al.: Investigation of Bioterrorism-Related Anthrax, United States, 2001: Epidemiologic Findings, in: *Emerging Infectious Diseases*, Vol.8, No.10, October 2002, pp.1019-1028.

16 See Alex R. Hoffmaster et.al.: Molecular Subtyping of *Bacillus anthracis* and the 2001 Bioterrorism Associated Anthrax Outbreak, United States, in: *Emerging Infectious Diseases*, Vol.8, No.10, October 2002, pp.1111-1116.

2.3.1. Scenario 1: a repeat of Oklahoma – American terrorists are responsible for the anthrax attacks

Immediately after the events became known, it was considered unlikely that an American terrorist group or an individual – possibly from the extreme right – could be responsible for the outbreaks of anthrax amongst politicians and commentators.¹⁷ However, this would not have been the first case of American terrorists trying to get hold of biological warfare agents. The most prominent case of this kind happened in February 1995, when the right-wing extremist, Larry Wayne Harris from Ohio, ordered three vials of plague pathogen from the *American Type Culture Collection*, one of the largest collections of microorganisms in the world.¹⁸ In the same year, the extreme right-winger Timothy McVeigh carried out a bomb attack against a government building in Oklahoma City, killing more than 150 people. At the time, this was the most ‘successful’ terrorist attack ever on American territory.

Indications supporting the hypothesis of American terrorists being involved in the anthrax attacks can be found on the websites of several groups, such as, for example, that of *Aryan Action*, which expresses sympathy with the September 11th attacks (and *not* with their victims). In addition, it is on record that representatives of extremist militia movements have expressed interest in BW’s in the past. After all, religious fanatics, militant opponents of abortion and other ‘single issue terrorists’ have paved the way, at least psychologically, for an actual use of biological agents by an individual or a group from this camp, by sending a number of threatening letters, although these have not yet contained any pathogen.

The way anthrax was distributed speaks for the involvement of an American terrorist group: the targeting of representatives of the media as well as of the political system promised the largest possible amplification of the effect, spreading fear and provoking an overreaction from the American federal government. The helplessness increasingly displayed and the partly contradictory nature of governmental representatives’ statements are all grist to the mill for those in right-wing extremist groups who are inspired by the thought that the American political system does not serve the interests of the people. These groups do not want to kill a large number of citizens but want to undermine belief in the political leadership of the country and in the system of government in a way that an overthrow of the political establishment becomes possible. According to one representative of this camp, even the use of tiny amounts of biological weapons is likely to be sufficient to reach this goal.¹⁹

The amount of anthrax pathogen used so far leads to the suspicion that only small amounts were available to the sender of the letters, consistent with the idea that the pathogen might have been produced by a US terrorist group or was diverted from the US military biodefense program. The US government also takes this scenario seriously, as could be seen when the government declined a

17 Only a few suppositions were different initially. See *The Globe and Mail*, 25/10/2001: "Clues point to domestic culprits in mail case. Homegrown source most likely, experts say, since only timing implicates foreign group"; *New York Times*, 02/11/2001: "U.S. Groups Have Some Ties to Germ Warfare".

18 See case study by Jessica E. Stern: Larry Wayne Harris, in: Jonathan B. Tucker (ed.): *Toxic Terror. Assessing Terrorist Use of Chemical and Biological Weapons*, Cambridge, MA: MIT Press, 2000.

19 See "‘Loner’ Theory Is Offered in the Bioterror Attacks", *International Herald Tribune*, 6/11/2001.

resolution of the general meeting of the UN condemning the anthrax attacks, with the comment that it cannot be ruled out that these were carried out by an American group.²⁰ If the clues pointing towards an American source of the anthrax attacks grow stronger, then no official confirmation should be expected until the terrorists have been caught and deviced.

The „loner theory“, working on the assumption that a „lone, Western individual who has scientific expertise and access to anthrax samples and a well-equipped laboratory“ is behind the anthrax attacks seems to have been the most influential approach in the FBI-led anthrax investigation since the end of 2001. Yet, although a person on which the investigation was focussing was identified at the end of June 2002²¹, the FBI at the end of 2002 did not seem to be anywhere near an answer to the question of who was responsible for the anthrax letters sent out 15 months before. This performance has led to criticisms about the pace of the investigation being voiced and to conspiracy theories surfacing.²²

2.3.2. Scenario 2: American terrorists have access to a state programme

The second scenario complements the first, involving American terrorist groups or individuals, by including the possibility of a link to a state bioweapon programme. In this respect, the distinction has to be made between the terrorists having access to the programme of a foreign state, for example Iraq or the former Soviet Union, and their making use of the infrastructure of the former offensive US programme or more recent biodefense activities. Because of the structure and aims of these right-wing groups, the first variation of this scenario is considered very unlikely and can in practice be ignored.

The idea that American terrorist could have gained access to the remnants of the former American bioweapon programme, which was stopped by president Richard Nixon in the 60's and was wound up in the early 70's, does not strike one as very plausible. However, this could explain the highly processed state of the anthrax spores. In addition, the spores did not contain bentonite as a chemical additive, which would have pointed to the Iraqi programme, but silica, as used by the Americans. It is also rumoured that the method used for the production of the particles corresponds to that used in the US bioweapon programme, which was not a grinding procedure. Finally, the time that has elapsed since the end of the US programme, more than 30 years, is not in itself, conclusive: anthrax spores can survive for such a period of time if stored in suitable conditions. This can be demonstrated by, for example, the decontamination measures required on the British island of Gruinard, just off the Scottish coast.²³

20 See “Bush Team Rejects U.N. Plan to Condemn Anthrax Incidents”, *New York Times*, 1/11/2001.

21 See Guy Gugliotta and Dan Eggen: 'Biological Warfare Experts Questioned in Anthrax Probe', *The Washington Post*, June 28, 2002; Scott Shane: 'Scientist theorized anthrax mail attack', *Baltimore Sun*, June 27, 2002.

22 See for example Merryl Nass: The Anthrax Letters: More Disinformation? Were The Letters An Officially Approved Wake-Up Call To The Biowarfare Threat?, available on the internet at www.redflagsweekly.com/nass/2002_may13.html.

23 The British Army carried out field tests with anthrax on this island during the Second World War. The island had to be decontaminated in 1986 to make civilian use of the island possible again. See “Grossbritannien erinnert sich: Anthrax auf Gruinard”, *Frankfurter Allgemeine Zeitung*, 17/10/2001; and “Insel im Sturm. Die Bewohner der Gegend um die Milzbrand-Testinsel Gruinard fürchten um den Ruf der Bay”, *Frankfurter Allgemeine Zeitung*, 23/10/2001.

Meanwhile, however, a different variation on this theme has become more probable: it is suspected that a person with access to anthrax spores that have been produced recently in US laboratories is responsible for the anthrax attacks. The *Federation of American Scientists* clearly demonstrated the plausibility of this in a working paper, published at the end of November.²⁴ This possibility has since been publicly taken more seriously by government officials.²⁵ Both former and present members of US army staff and also clients in the US government and university laboratories have been included in the investigations.²⁶

In the middle of these extended investigations, exploded the news that anthrax has indeed been produced in a US military laboratory since 1992. Spores from this lab are identical to those sent in the anthrax letters.²⁷ This news followed on shortly from details, released in early September, about American biodefense activities, which are considered problematic, to say the least. Both of these lead to question of whether US behaviour conforms to the Biological Weapons Convention (BWC). The existence of anthrax pathogens of recent origin makes Scenario 2 significantly more plausible – particularly, if one bears in mind that the pathogens produced in Utah were regularly sent by courier across the continent to a different military facility in Maryland, without special security measures being in place. In Maryland, the pathogens were killed and sent back. Naturally, the US armed forces denied any ‘loss’ of pathogens. However, such a negligent handling of weapon-ready material opens the door to potential misuse.²⁸

2.3.3. Scenario 3: the attacks of September 11th and the anthrax attacks were carried out by the same people

In the third scenario, it is assumed that the same people were responsible for the anthrax attacks and the September 11th plane hijackings. The way the attacks were carried out and the number of fatal casualties arising from the hijacking of the planes leave all previous terrorist activities of this kind far behind. The use of BW’s represents a similar ‘quantum leap’ in the repertoire of terrorist attacks – particularly if Aum’s operative and technical difficulties described above are considered.

At first, media reports about Osama bin Laden, who was allegedly able to get hold of pathogens by mail, seemed to confirm Scenario 3.²⁹ However, this method of procurement, if it was successful at all, indicates that the big operational hurdles have possibly not yet been crossed, especially re-

24 See Barbara Hatch Rosenberg: A Compilation of Evidence and Comments on the Source of the Mailed Anthrax, 16/11/01, revised 29/11; “Anthrax I: Powder Produced Recently, Watchdog Says”, http://nti.org/d_newswire/issues/newswires/2001_12_04.html#8

25 See for example „FBI Fears ‘Inside Job’ on Anthrax Attacks“, *The Independent*, 4/12/2001, <http://www.independent.co.uk/story.jsp?dir=1&story=108217&host=1&printable=1>.

26 See for example “Campus labs eyed after anthrax scares”, *Christian Science Monitor*, 10/12/2001, <http://www.csmonitor.com/2001/1210/p1s3-ussc.html>, “Anthrax: U.S. Military May Have Ties to Incidents”, Nuclear Threat Initiative, 10/12/2001, http://www.nti.org/d_newswire/issues/newswires/2001_12_10.html, “University labs inspected for bioterror risks”, CNN.com, <http://www.cnn.com/2001/US/12/12/inv.university.biochem/index.html>.

27 See “Anthrax Matches Army Spores – Bioterror: Organisms made at a military laboratory in Utah are genetically identical to those mailed to members of Congress”, *Baltimore Sun*, 12/12/2001.

28 See “Army says lab not necessarily source of Hill spores”, <http://www.usatoday.com/news/washdc/dec01/2001-12-17-army-lab.htm>.

29 See for example *Daily Mirror*, 25/10/2001: “Bin Laden bought anthrax by mail order for £2 500”

garding the production of BW warfare agents and their processing to make functional biological weapons.

In view of how events have developed and with regard to the dichotomy of the number of casualties and the choice of means that is reflected in them, the hypothesis that Osama bin Laden and his organisation are the senders of the anthrax letters remains doubtful. After all, it should be noted in this context that the mass murder of September 11th was carried out by conventional terrorist means. The use of unconventional means, that is, in form of anthrax pathogens, claimed a number of victims that could easily have been created by conventional forms of terrorist aggression. The difference in logic applied in selecting the means to reach a particular goal leads to the suspicion that the culprits are not the same. In addition, the use of anthrax does not constitute a further escalating step in bin Laden's conflict with the US and regimes in the Middle East perceived to be US puppet states. The longer a massive use of biological weapons fails to take place, the more probable becomes the assumption that the anthrax attacks that have occurred so far were carried out by an opportunist individual or terrorist organisation and have an entirely different motivation.

A further indication of the extent to which Al-Qaeda has access to weapons of mass destruction can be taken from an interview Osama bin Laden himself gave to the Pakistani tabloid "Dawn" on the 9 September 2001, which evidently took place close to Kabul. In the course of this interview, Osama bin Laden declared

"if America used chemical or nuclear weapons against us, then we may retort with chemical and nuclear weapons. We have the weapons as deterrent."³⁰

The revealing point is that biological weapons are simply not mentioned. Thus this can be taken as a further circumstantial indication that bin Laden and his organisation are not responsible for the anthrax attacks in the US. Also, bin Laden's threat to use chemical weapons does not necessarily signify that the procurement activities of his organisation have actually been successful. In addition, a BBC report claims that the threat of retaliation with nuclear and chemical weapons only appears in the English version, not in the Urdu version of the interview.³¹ This would indicate that the 'information' was designed for the English speaking audience and might simply be a piece of political propaganda.

At the same time, the reference to chemical weapons revives memories of the alleged chemical weapon plant in Sudan that was attacked and destroyed by US cruise missiles following the attacks on the US embassies in Nairobi and Dar es Salaam in August 1998. According to the US government, the pharmaceutical factory destroyed was a production plant for chemical warfare agents and had clear links to Osama bin Laden. More recent information on possible al Qaeda experiments with chemical weapons has been supplied by secret service sources claiming that the group has access to possible production plants near Kabul and has carried out chemical weapon tests on live animals.³²

30 See "Osama claims he has nukes: If US uses N-arms it will get same response", interview by Hamid Mir, *Dawn* Web edition at <http://www.dawn.com>, 10/11/2001.

31 See http://news.bbc.co.uk/1/hi/english/world/south_asia/newsid_1648000/1648572.stm, 10/11/2001.

32 See "Al Qaeda Sites Point to Tests of Chemicals", *New York Times*, 11/11/2001.

2.3.4. Scenario 4: “Osama bin Laden meets Saddam Hussein” – the anthrax assassins have a state sponsor

In the fourth scenario, the culprits are thought to come from the bin Laden terror network and are thought to be supported by a state sponsor. The first choice amongst the circle of suspect states is Iraq. The thesis of state support is backed up by arguments coming from three different sources. The ‘quality’ of the anthrax spores – the exact details of which are still not known – indicates that the pathogen originates from a state programme, as for example carried out in the former Soviet Union or in Iraq.³³ Secondly, advocates of a conspiracy theory claim that the Iraqi dictator Saddam Hussein was already responsible for the first attack on the World Trade Center in 1993. The most prominent advocate of this theory is the former head of the Central Intelligence Agency (CIA), James Woolsey.³⁴ After all, the Iraqi leadership and its official media offer evidence enough to support this thesis.³⁵

There are, however, doubts about this scenario, too: firstly, it is not clear whether the anthrax spores actually originate in a state bioweapon programme. According to reports in the media, there are 30 to 40 laboratories in the US alone that would be capable of treating anthrax pathogens ‘chemically’.³⁶ In addition, even if the spores originate from a state BW programme, Iraq is not the only candidate. Some commentators consider Iraq a politically probable source for the anthrax attacks as, according to the conspiracy theory, the Clinton administration dispelled suspicions that Iraq could have carried out the first attack on the World Trade Center in 1993 in order to avoid a military confrontation with Iraq. As this position is found predominantly in the Conservative camp³⁷, it should at least be asked whether other political intentions and calculations lie behind the untiring propagation of the thesis of Iraqi support of the terrorists. After all, it comes as no surprise that Saddam Hussein would like to claim leadership in the fight against the US but this is of little use as ‘evidence’ for an Iraqi involvement in or even authorship of the anthrax attacks.

2.4. New paradigm or temporary confusion? The attempt to classify the anthrax attacks

In a political field, a new paradigm should be claimed only when previous assumptions about the central influencing factors and the causal connections between the relevant variables are no longer able to give an adequate picture of the political reality.

Two factors are of key importance in the assessment of the new political reality regarding terrorism and bioweapons. Firstly, not only are Osama bin Laden and his organisation prepared to allow

33 See for example *USA Today*, 24/10/2001: “Anthrax, Weapons Compared. Investigators look at Iraqi, Soviet samples to see whether they match letters’ chemical mix.”; *Washington Post*, 25/10/2001: “Additive Made Spores Deadlier.”

34 See Woolsey in *The New Republic*, online edition, 13/09/2001: “The Iraq Connection. Blood Baath”; see also *Daily Telegraph*, online edition 1/11/2001: “Saddam ‘still ready to use germ warfare’”.

35 See “the open letter” of Saddam Hussein in: *Baghdad Republic of Iraq Radio Main Service*, 30/10/2001: “Letter from President Saddam Husayn to Western Nations and Governments”, via FBIS.

36 Citation by Senator Bob Graham, chairman of the US Senate Committee on the Secret Service, as appeared in *Chicago Tribune*, 27/10/2001.

37 See “Study of Revenge: The First World Trade Center Attack and Saddam Hussein’s War against America” by Laurie Mylroie, published by the American Enterprise Institute 2001.

the death of thousands, they even make such multiple deaths a central element in the planning of their attacks. In this way, the old 'rule' of terrorism research, which maintains that terrorists are interested in creating large numbers of spectators but not of victims of their attacks, is challenged. Secondly, the use of pathogens in biological weapons, in the way seen recently, adds a new dimension to the terrorist's repertoire. However, it is crucial both that BW's were not used as means of mass destruction and that a link between the September 11th attacks and the anthrax letters cannot be established. Only if one of these conditions were met, the birth of a new paradigm could be proclaimed. Short of this, the claim of a new worldview is, however, at best premature and at worst leads to inappropriate policies to remedy the problem.

In this context, it remains unclear whether the measures planned in the *Patriot Act* passed by the US Congress and the Bush administration will hit home or will utterly fail to address the core of the problem. The assumption at the root of this act of law is that a lack of secret service and police intelligence led to the events of September 11th. If this assumption is wrong, then the limitation of individual rights and the authorisation of police measures intended by the new law, which in the past did not have the support of the majority of the Congress, will not lead to greater future security.³⁸

2.5. Distorted risk perception – is the Biological Weapons Convention a victim of neglect?

Finally, the debate about biological weapons and their potential danger, currently focused on the subject of bioterrorism, has one side effect that should be mentioned. The Biological Weapons Convention (BWC) could be one of the first and, at same time, most dramatic victims of the current preoccupation with the risks of biological terrorism. The BWC Review Conference, held from 19th November to 7th December 2001, was adjourned until November 2002 after substantial American sabotage attempts. This adjournment was the only way to avoid a failure of the review process. Since the BWC is the most useful multilateral instrument currently available for countering the threat of bioterrorism, failure would be disastrous.

2.5.1. Act 1: US rejection of the additional protocol

The American rejection of the additional protocol in July 2001 left six years of diplomatic negotiations to strengthen the BWC in pieces.³⁹ The multilateral attempt to improve the enforcement of the Convention by an additional protocol was rejected by the Bush administration after the chairman of the negotiations presented the draft of a compromise text: the American government justified their disapproval by claiming that the protocol was not going to achieve its goals and that its realisation would pose a threat to American biotechnology as well as to pharmaceutical industries and the national security of the US. In short, the US government was not convinced that the gain of infor-

38 See Laura Donohue/Jim Walsh: "Patriot Act – remedy for an unidentified problem", *San Francisco Chronicle*, 30/10/2001.

39 See Jenni Rissanen: United States Reject Protocol, ACRONYM Institute, BWC Protocol Bulletin, 25/7/2001.

mation relevant for non-proliferation purposes generated by the protocol would outweigh the potential damage it would cause.⁴⁰

To find a new consensus amongst the states involved in the treaty before the next review conference would have been a Herculean task, even without the events of September 11th. Now, as most important participating states focus on bioterrorism, agreement about the future course of action will be even more difficult. BWC review conferences have been an important instrument in the past, confirming the general view that a misuse of modern biotechnology in warfare is considered prohibited according Article I of the BWC. Thus, the effects of this development are all the more serious. A renewal of this consensual interpretation would be most desirable in view of the enormous progress biotechnology has made.⁴¹

2.5.2. Act 2: The Bush administration torpedoes the review conference

The Bush government presented 'new' suggestions on 1st November 2001 that, for the most part, are neither new nor likely to lead to a consensus.⁴² Four of seven suggestions aim at internationally coordinated measures, whereas the remaining three are thought to strengthen the national powers of states working towards a 'reinforcement' of the BWC.

The United Nations should establish an effective procedure for the investigation of suspicious outbreaks of illness and suspected use of BW's in the international sphere. Several UN resolutions, passed in 1987-9 were intended to place such a procedure under the responsibility of the UN General Secretary – they have so far not been applied. Were the American suggestion to strengthen the procedural powers of the General Secretary then this would be, at best, a 'peripheral reinforcement' of the BWC. The UN resolutions mentioned all relate to the Geneva Convention of 1925, which regulates the use of BW's.

In addition, the Bush administration would like to see the establishment of procedures that determine how violations of BWC regulations are dealt with. This suggestion in itself must come as a blow to those who have been involved in the negotiations of the ad-hoc group for the strengthening of the BWC over the last six years. Bush's demand means, in plain language, starting again right from the beginning, however, this time without a laboriously negotiated mandate that tried to integrate different interests, but with clear preconditions set by the last remaining superpower.

In addition, the core of the central demand for strengthening the BWC on a national level is contained in the Convention itself and thus is about 25 years old: The BWC member states should integrate the prohibitions of the treaty into their national legislation, including punishment for violation. The Americans wish to include extradition clauses in this legislation. Again, the American line

40 See Department of State, Washington File, Text: Mahley Statement on Biological Weapons Protocol, <http://usinfo.state.gov/admin/006/eur307.htm>.

41 See Malcolm Dando: Benefits and Threats of Developments in Biotechnology and Genetic Engineering, Appendix 13A, in: *SIPRI Yearbook 1999: Armaments, Disarmament and International Security*, Oxford, 1999, id.: Genomics, Bioregulators, Cell Receptors and Potential Biological Weapons, in *Defense Analysis*, Vol. 17, No. 3, 2001, pp.239-258.

42 See The White House, Office of the Press Secretary, Text: Bush Proposes Steps to Strengthen Biological Weapons Pact, Washington, D.C., 1/11/2001.

of sight is easily recognisable. The primary aim is not to strengthen multilateral mechanisms, such as an international convention that would condemn the production or the use of bioweapons as crime against humanity or an international organisation that would have to be newly founded. The primary aim is to strengthen the right of individual states to claim the extradition of suspected bioterrorists so that they can be brought before their own national courts.

The US administration's remaining suggestions are exceedingly vague and are not designed to contribute to the strengthening of cooperative and multilateral institutions. They aim at:

- obliging an improvement both in the control of illnesses and the mechanisms of sending teams of experts to fight illnesses;
- creating sound national mechanisms for the control of the safety and the genetic engineering of pathogenic organisms;
- creating a universally valid ethical code of conduct for the life sciences;
- ensuring responsibility in every aspect of dealing with pathogenic organisms.

These suggestions lack three central components of the compromise developed for the additional protocol that would have enabled many states to agree to them. An independent and authoritative organisation for the control of the BWC should be realised in form of a) declarations, b) visits to biological plants that would bring about an element of non-proliferation and would lead to a greater extent of transparency in biological activities, and c) regulation of the field of international cooperation controlling the peaceful use of the life sciences and guarantying certain aid measures that may be needed.

For many developing countries, the last point represented a particular strength of the protocol. Consolidated and detailed aid regulations dealing with the event of an unusual outbreak of illness or presumed use of biological weapons would have been a powerful tool in the fight against bioterrorism and would have had the side effect of strengthening the BWC itself. Bearing in mind the views expressed here, the sacrifice of the Convention to the current focus on terrorism with biological weapons, ignoring all other aspects of the problems caused by bioweapons, is unacceptable.

Many states are of the opinion that the American negotiation strategy is both, incomplete and undiplomatic, even confrontational. At the beginning of the review conference, the head of the US delegation, John Bolton, accused six states, by name, of running secret offensive bioweapon programmes. Four of these are member states of the BWC (Iran, Iraq, Libya and North Korea), a further one has signed the agreement (Syria), and only the sixth is not involved in the BWC (Sudan).⁴³

After the storm whipped up by this confrontational prelude had died down, it became apparent which subjects were going to be critical for the success or failure of the conference. These included (a) the question of reconciling national export controls and the offer of cooperation contained in Article X of the agreement, (b) the question of how investigations of suspicious outbreaks of illness,

43 "U.S. Accuses Rogue States of Developing Bio Weapons", *Washington Post*, 19/11/2001; "U.S. Publicly Accusing 5 Countries of Violating Germ-Weapons Treaty", *New York Times*, 19/11/2001.

suspected use of biological weapons and suspected production plants should be conducted, and (c) questions concerning violations of the treaty and their investigation. Finally, the debate over the mechanism by which further talks on the strengthening of the Convention would be conducted was high on the conference agenda.⁴⁴

In this context, the existence of the ad-hoc group that had tried to negotiate a verification protocol for the previous six and a half years was discussed. It was indeed this question that finally led to the failure of the review conference. After 95 % of the final conference declaration had been agreed, on the afternoon of the last conference day the US delegation presented a non-negotiable draft for the final declaration, proclaiming the end of the ad-hoc group.

This suggestion not only went against the opinions of the overwhelming majority of the treaty states; it even hit the US's closest friends without warning or consultation. This suggestion can be regarded as an emergency brake applied by the Bush administration after the public accusations at the beginning of the conference, that some member states were violating the agreement with offensive bioweapon programmes, failed to derail the conference. The combination of the contents, the suggested wording and the way it was proposed practically guaranteed failure. This assured that further negotiations over legally binding control measures, refused by the US, would not take place until the conference met again at the end of 2002. As the US and the majority of the BWC member states understand the purpose of the bioweapon control regime in such fundamentally different ways, as reflected in the American behaviour, the expectations for the continuation of the conference was set rather low from the outset.⁴⁵

Yet, expectations for any meaningful outcome of the continuation of the Review Conference decreased even more, when US government representatives in September 2002 proposed to have the resumed conference meet for a mere ten minutes and only decide to meet again in 2006 for the next regular review. Although it is still unclear what exactly changed the US position back to its minimalist approach pursued the year before, the resumed conference was able to decide on a "pre-cooked" decision for three annual meetings of experts and of the states parties to the BWC to be held before the next Review Conference.⁴⁶ The topics to be discussed during these meetings are predetermined in the decision taken and represent the least common denominator revolving around the original set of alternative measures to a BWC Protocol as proposed by the US in the fall of 2001. With this compromise solution a complete failure of the review could be averted. However, the adoption of a simple decision falls far short of the practice of previous Review Conferences to agree on a detailed final document containing substantive interpretations of the BWC.

44 See Jenni Rissanen: Differences and Difficulties as Delegates Consider Wide Range of Proposals, BWC Review Conference Bulletin, ACRONYM Institute, 30/11/2001, available at <http://www.acronym.org.uk/bwc/revcon4.htm>.

45 Details about the course of the last conference day and first reactions to the US *fait accompli* are found in Jenni Rissanen: Anger After the Ambush: Review Conference Suspended After US Asks for AHG's Termination, BWC Review Conference Bulletin, ACRONYM Institute, 9/12/2001, <http://www.acronym.org.uk/bwc/revcon8.htm>.

46 The draft decision was presented by the Chairman of the Review Conference, Ambassador Tibor Toth of Hungary, on the first day of the meeting and later circulated as conference document BWC/CONF.V/CRP.3, dated 6 November 2002.

3 Terror using nuclear weapons and nuclear material?

To date, the scenario of nuclear weapons in terrorists' hands has been considered extremely unlikely, as it was thought that terrorists were technically incapable of producing an operating nuclear weapon.⁴⁷ Moreover, it was widely held that their interest in nuclear weapons was low, as compared to other terrorist means. The events of September 11th have finally made it clear that mass murder can be a terrorist's objective. Nuclear weapons are particularly suited to maximising the number of casualties. A nuclear explosion would be a next step in the escalation of terror.

Bin Laden, for example, has repeatedly announced his interest in nuclear weapons and other weapons of mass destruction and has claimed to already possess some. He has probably also tried to get hold of highly enriched uranium (HEU), which is weapon-usable nuclear material. Whilst there is no evidence that he has been successful, this cannot be ruled out. In recent years, there have been many reports of attempts to smuggle nuclear material, the theft of entire nuclear weapons and the increasing decay of the Russian nuclear complex, which thwarts reliable control of components and material that could be used in the production of nuclear weapons. Some of these reports have turned out to be false; others, however, point to a long-term danger that, at the moment, is still largely underestimated.

In the following, an assessment is made of whether terrorists are capable of building or procuring a nuclear explosive device. In this discussion, two different terms should be distinguished:⁴⁸ A *nuclear weapon*, as can be found in the arsenals of the nuclear states, has a complicated design that is the result of years of development and many tests. Such a weapon is optimised in many respects. For example, the mass of the nuclear material is minimised, the explosion energy is controlled precisely, several safety mechanisms are in place to prevent unintentional detonation and the weapons are resistant to heat, pressure and radioactive radiation. Above all, such a nuclear weapon can be delivered to its target by ballistic missiles. In contrast, a terrorist group could, at best, produce a simple *nuclear explosive device* that would only be capable of generating a nuclear explosion. Like the nuclear bombs dropped on Hiroshima and Nagasaki in 1945, it would have a simple design, would require a large amount of nuclear material and would have a large mass that could only be transported by ship, boat or lorry but not by a ballistic missile. Besides which, the creators of such a bomb could never be entirely sure that it would really explode.

3.1. The theoretical know-how

During the Second World War, thousands of scientists and ancillary staff contributed to the creation of the first crude nuclear explosive devices, in the Manhattan project. The American government recruited the best scientists and enormous logistical and financial efforts were made. Would terror-

47 See for example Karl-Heinz Kamp, *Nuklearterrorismus – hysterische Sorge oder reale Gefahr?* Außenpolitik III/1995, p. 211.

48 Tom Shea, presentation at the Workshop on Innovative Directions for the Future Development of IAEA Safeguards Technology, Landau Network – Centro Volta, Como, Italy, 2-6/7/2001.

ists now be in a position to construct such a nuclear explosive device without comparable efforts? There is one important difference: The physicists of the Manhattan project did not even know if a nuclear explosion would be possible, and years were spent on basic research and essential inventions. They had to produce the nuclear material themselves. Furthermore, the operating procedures had to be developed and studied.

Today, not only are the principles of nuclear weapons identified, the fundamental theories are also published in detail and are, to some extent, even available on the Internet.⁴⁹ These publications are not officially authorised and might contain mistakes in the detail. However, they are based on information that has been declassified and that can be used to reveal and understand the physical facts.⁵⁰ Condemnation of the declassification is of no use – it is merely a consequence of the inevitable scientific progress that has been made since the beginning of the nuclear age. Since those beginnings, the subject nuclear physics has been established, many textbooks written, numerous nuclear plants designed and the and the functioning of nuclear weapons researched. Moreover, many countries had ambitions to develop nuclear weapons in the 50's and 60's. Therefore, scientists studied the relevant underlying theories. The physics of a crude nuclear explosive device is simple when compared to the physics of a nuclear reactor. After a few semesters of study, an average physics student will have sufficient knowledge to understand such a device. There was no way to avoid the essential theoretical foundations becoming publicly known. Moreover, regulations implementing exaggerated secrecy have counterproductive effects: they can impede nuclear disarmament and its verification,⁵¹ they can be misused to hide mismanagement, corruption and mistakes and they can be used to influence political decisions.⁵² However, they are to some extent useful in protecting information that facilitates the proliferation of nuclear weapons.⁵³

3.2. The development of ignition technology

But there is still information that is kept secret, especially in relation to engineering. Many laborious steps are between a basic understanding of the operating principles and an actual technical blue-

49 Examples are: Carey Sublette, Nuclear Weapons Frequently Asked Questions, Version 2.25: 9/8/2001, <http://www.fas.org/nuke/hew/Nwfaq/Nfaq0.html>; and Gerhardt Locke, Aufbau und Funktionsweise von Kernspaltungswaffen, Bericht INT 25, Euskirchen 1982 (not available on the Internet).

50 An example of such a document containing declassified information is: U.S. Department of Energy, Office of Declassification, Restricted Data Declassification Policy 1946 to the Present (RDD-6), 1/1/2000. This document was available on the Internet during the Clinton administration. The following publication is amongst the first concerning the function of nuclear weapons to be declassified: Robert Serber, *The Los Alamos Primer – The First Lectures on How To Build an Atomic Bomb*, Berkeley 1982 (written in 1943, declassified in 1965).

51 Russia, for example, refused to publish the composition of the plutonium that stems from Russian disarmed nuclear weapons. In this way, the international cooperation for the inclusion of this material in civil disposal programmes is impeded.

52 Edward Teller's lobbying of Ronald Reagan with regard to SDI is an example for the latter.

53 The Clinton administration tried to define the boundary between secrecy and transparency in a way that, on the one hand, the proliferation of the means of mass destruction is minimal and 'national security' is guaranteed and, on the other hand, the democratic interest in transparency is taken into account. See the criteria: Openness Advisory Panel, *Responsible Openness: An Imperative for the Department of Energy*, U.S. Department of Energy, Washington, D.C., 25/8/1997, <http://vm1.hqadmin.doe.gov:80/seab/openness.pdf>.

print. It is not enough just to understand the theory. Terrorist organisations would have to acquire special abilities and techniques in order to build even a simple nuclear explosive device. These include, for example, the generation of shock waves with the aid of high explosives, the handling of fuel, electronics, radioactive material, radiochemistry and the precision mechanics of metallic uranium or plutonium. Even these subjects are covered in detailed specialist publications that are available not only in libraries but also on the Internet. In principle, it is possible to study these publications and use them as a basis for acquiring the relevant capabilities. However, many crucial details are kept secret, especially those that are based on experimental measurements rather than theory. Development work would be necessary to work these out.

In principle, there are two different ignition techniques. Using the *implosion method*, a hollow sphere of plutonium or HEU is imploded to create a so-called *overcritical* mass. When a neutron enters this mass, a *chain reaction* is started that will lead to a nuclear explosion. In the case of plutonium, such a starting neutron will practically always be present, as plutonium generates initial neutrons through the high rate of *spontaneous fission*. HEU has a lower rate of spontaneous fission and thus a lower *neutron background*. Therefore, in the case of HEU, neutrons will have to be added artificially at the right point in time in order to start the chain reaction. A comparatively high compression can be achieved using the implosion method, which means that large overcritical masses can be achieved with relatively small amounts of material. The production of a warhead with this method requires complete mastering of the technique of generating precise spherical shock waves. This in turn requires experimental preliminary studies involving many conventional explosions that would probably take several years.

Using the *gun-type method*, two non-critical masses of HEU are shot at one another to generate an overcritical mass. This method was used by South Africa to build six warheads. It should be noted that only HEU is suitable for this method. This is due to the time that passes until maximal overcriticality is reached. Using the gun-type method, this period of time is on the scale of milliseconds and far longer than the few microseconds (thousandths of a millisecond) needed using the implosion method. If plutonium were used, the chain reaction would start too early, due to its high neutron background, leading to a small detonation on the scale of a conventional explosion. Compression cannot be achieved using the gun-type method. Thus, larger masses of several tens of kilograms are necessary and only a relatively small overcriticality can be achieved. Nevertheless, this method can be sufficient to generate a nuclear explosion on the scale of the Hiroshima bomb. States and terrorists would only choose this method if they were sure of having access to sufficient HEU.

It is not sufficient to simply 'drop' one part of HEU onto the other. Although HEU generates fewer spontaneous neutrons than plutonium, they occur too frequently to allow such a long period of time for the combination of the two parts. The danger of early ignition would be far too high. The combination has to be achieved as quickly as possible, that is in a few milliseconds. The terrorists would have to develop a technique to shoot the two parts at each other in a gun barrel, without them bending out of line and getting stuck. This presents an engineering challenge that is not trivial, considering the large masses involved, and which would presumably require months if not years of preliminary experimental tests.

In principle, it remains possible for a highly motivated and financially well-endowed terror organisation to acquire the technical abilities necessary to manufacture an ignition mechanism for a

nuclear explosive device. However, this would require enormous efforts. Various specialists would have to acquire the necessary knowledge and skills in university studies abroad.

Revelations over the preparations undertaken for the attacks against the World Trade Center show that terrorists are prepared to go this far to achieve their aims. The organisation would need shelter for several years, where they can work undisturbed and carry out the necessary experiments. Such a base could hardly be mobile, as a test site would be needed to carry out conventional explosions, together with some research labs and offices. The work could only be done under the supervision of highly qualified physicists. For the development of the ignition mechanism, the handling of plutonium or highly enriched uranium (HEU) is not required. Thus, hiding the base would be comparatively easy. Research into conventional explosives is usually carried out in a military environment, and, therefore, hardly accessible for outsiders, for obvious reasons. Nevertheless, the cover and protection by a state like, for example, Afghanistan is required, as the existence of a base and the experiments carried out in it would be noticed by nearby residents. Once a state comes under suspicion, it will always face the risk of secret services discovering the base. In the now abandoned South African nuclear weapons programme, the development of the ignition technology represented only a small part, requiring a correspondingly small amount of effort,⁵⁴ and a fraction of this effort would probably be sufficient for terrorists.

3.3. The procurement of nuclear material

All deliberations so far made relate to the development of ignition technology. However, it is far more difficult to get hold of the nuclear fuel. Nuclear material exists in many different forms. Of these, only metallic plutonium or HEU can be used directly in nuclear weapons, without having to be processed further. As a rough estimate, beginners would need at least 20 kg HEU or 10 kg plutonium in order to build one warhead using the implosion method, as was used for the Nagasaki bomb.⁵⁵ A simpler construction principle was applied to the gun-type method used for the Hiroshima bomb. Using this method, plutonium does not work and an estimated 50 kg of uranium are needed for one bomb. A terrorist group would only choose the gun-type method if it was sure of having access to enough HEU.

Globally, there are about 250 t of military plutonium and about 1,700 t of military HEU. Civil stocks have to be added to this. Obviously, this and other nuclear material is subject to strict security measures. Additionally, nuclear material located in non-nuclear weapon states is subject to controls by the International Atomic Energy Agency (IAEA), called "safeguards". These security measures are designed to detect a theft as early as possible, leaving enough time for the international community to agree on a line of action before a bomb is operational. In practice, in nearly all non-nuclear

54 David Albright, Corey Hinderstein, South Africa's Nuclear Weaponization Efforts: Success on a Small-Scale, ISIS-Working-Paper, 13/9/2001, <http://www.isis-online.org/publications/terrorism/safrica.pdf>.

55 This estimate is based on the assumptions that the implosion would not be perfect, the material would partially be lost in the production process and a reflector would probably be used. It is assumed that the HEU is more than 90% enriched. See A. Schaper, Zur Waffentauglichkeit verschiedener Uranbrennstoffe, working paper for the expert committee on the research reactor Garching, German Federal Ministry for Education and Research (BMBF), 5/3/1999.

weapon states like Germany, all supplies are accurately registered. Thus, it is very unlikely that a theft could go undiscovered.

The situation is different in states that possess nuclear weapons and are not subject to international controls.⁵⁶ Of these, the states of the former Soviet Union have been the subject of great concern for many years, with regard to the security of nuclear material. It seems that an exact overview of stocks has been lost or never existed in a sufficiently accurate form. Moreover, many plants and deposits are not sufficiently secure. It is not known whether terrorists or third party states have already managed to get hold of nuclear material. However, it is certain that several attempts have been made in the past, some involving bin Laden. Several cases were already uncovered in the mid 90's, where smugglers stole weapon-ready nuclear material, sometimes in kg amounts.⁵⁷ In 1998, Russian government members revealed that plans had been made to steal 18,5 kg of HEU from one of the nation's largest nuclear weapon plants. The plan was stopped before the material had left the plant.⁵⁸

It is, however, perfectly possible that thefts have been carried out on other occasions that have never been discovered. It is not known, whether potential thieves of nuclear material, smugglers and recipients have already made contact. Thus, it is possible that a terrorist cache of sufficient nuclear material to build a weapon already exists. We have no indication that this is really the case.

The problem of insecure nuclear material is not only confined to the former Soviet Union. Even in the US, complaints about the limited security surrounding weapon-ready material have repeatedly been filed, even though much stricter and more modern regulations concerning the physical protection of nuclear material are in place.⁵⁹ It should be noted that the US, as nuclear weapon state, is not subject to international controls. One instance where security concerns arose came from an event in October 2000, when a group of 'terrorists', made up of army and navy personnel, managed to get hold of sensitive nuclear material from the Los Alamos laboratories, during the course of a training exercise.⁶⁰ In the first decades after the invention of nuclear weapons, the recording of nuclear materials was still very incomplete. The US Department of Energy published a detailed account of the history of American plutonium production in 1996.⁶¹ It was demonstrated that 2.5 tons of plutonium are 'missing', which means that the stocks taken by measurement and the number calculated from historical documents differ by 2.5 tons. This material has not necessarily been lost or stolen – this

56 These are the five official nuclear weapon states, USA, Russia, Great Britain, France and China, and the unofficial nuclear weapon states, India, Pakistan and Israel.

57 A. Schaper, Nuclear smuggling in Europe — real dangers and enigmatic deceptions, in: V. Kouzminov, M. Martellini (ed.): *Illegal nuclear traffic: risks, safeguards, and countermeasures, Proceedings of the International Forum*, Science for Peace Series, Vol. 4, Venice, 1998. Most cases that were discovered and published in Germany and Central Europe in the 90's turned out to be harmless, as the material used was not weapon-ready.

58 Matthew Bunn, *The Next Wave: Urgently Needed New Steps to Control Warheads and Fissile Material*, Carnegie Endowment for International Peace and Harvard Project on Managing the Atom, Washington, DC, April 2000, <http://ksgnotes1.harvard.edu/BCSIA/Library.nsf/pubs/Nextwave>.

59 President's Foreign Intelligence Advisory Board, *Science At Its Best, Security At Its Worst: A Report on Security Problems at the Department of Energy (the Rudman Report)*, Washington, DC: President's Foreign Intelligence Advisory Board, June 1999, <http://www.fas.org/sgp/library/pfiab/>.

60 Stephen J. Hedges and Jeff Zeleny, *Mock terrorists breached security at weapons plants*, Chicago Tribune, 5/10/2001, <http://www.chicagotribune.com/news/nationworld/chi-0110050267oct05.story>.

61 Department of Energy, *Plutonium: The First 50 Years. United States plutonium production, acquisition, and utilization from 1944 to 1994*, Washington, DC, February 1996.

number could just indicate the extent to which the early recording of material was inexact. However, what becomes clear is that it is not possible to determine whether material has been taken away in the past. It can be assumed that such inaccuracies are even worse in Russia.

Metallic plutonium is difficult to process, due to its radiotoxic properties and its reactivity. A terrorist group would be taking on substantial risks – of accidents and of health, as they would be unable to gain practical experience of processing plutonium. However, it is assumed that they are willing to put up with these risks. The handling of metallic uranium is slightly easier, however, larger amounts are needed if a nuclear warhead is to be built with it. Should a terrorist already master the ignition technique, then an operational weapon can be assembled quickly, once enough plutonium or HEU comes their way.

The US American Department of Energy issued a warning in 1997:

“Several kilograms of plutonium, or several times that amount of HEU, is enough to make a bomb. With access to sufficient quantities of these materials, most nations and even some sub-national groups would be technically capable of producing a nuclear weapon...”⁶²

3.4. The production of plutonium or highly enriched uranium (HEU) in ally states

It can be ruled out that a terrorist group has the capability to produce plutonium or HEU. At most, only a state with appropriate resources could carry out such an endeavour, and it is doubtful whether such a programme could be kept hidden for long. Large-scale nuclear plants are necessary, the procurement and operation of which could not be kept a secret. All procedures for the enrichment of uranium or for plutonium reprocessing leave traces in the environment. In case of suspicion, these activities could be traced immediately as all plants, at least in non-nuclear weapon states, are subject to IAEA safeguards. The production of uranium or plutonium needs extraordinarily high efforts, as can be illustrated by the fact that Iraq employed thousands of members of staff for years in the 80's in order to manufacture HEU under cover. Nevertheless, only small amounts of HEU were produced. At that time, the IAEA inspections were less thorough and the extent of the production activities was only discovered after the gulf war. Meanwhile, IAEA safeguards have been tightened and it is regarded as improbable that a similar case could go undiscovered today. As a consequence, activities leading to the production of HEU or plutonium are likely to be revealed in time, even, for example, in Afghanistan. As a consequence of the Iraq scandal, with activities being detected at such a late stage, the industrial states now cooperate to observe international procurement activities. Moreover, other pieces of information, for example from intelligence or from satellite imagery, are provided for evaluation. The technique of collecting and collating scattered pieces of information and their interpretation has improved immensely. The IAEA maintains a database in which such information is collected and registered. Therefore, the IAEA is capable of drawing attention to suspicious facts at a

62 U.S. Department of Energy, Office of Arms Control and Nonproliferation, Final Nonproliferation and Arms Control Assessment of Weapons-Usable Fissile Material Storage and Excess Plutonium Disposition Alternatives, DOE/NN-0007, Washington, DC, January 1997, p. vii.

very early stage.⁶³ Routine inspections can be complemented with special inspections where appropriate. The civil nuclear activities of most countries are transparent.

There are, however, a small number of exceptions. Iraq is amongst these, as the IAEA has not been present in this country since 1998.⁶⁴ The enrichment plants that existed before the gulf war have been rendered useless and all nuclear material found there has been taken abroad. An international technical cooperation with Iraq in this field no longer exists and thorough observations are carried out by satellite. However, the technical know-how is still present, presumably including knowledge about ignition technology. Without controls, a small but significant risk remains that Iraq has meanwhile obtained enough HEU and has decided to cooperate with a radical fundamentalist terrorist group.

A further exception is North Korea, which has attempted to produce plutonium in the past. These activities were discovered by the IAEA, however, North Korea is not in compliance with its obligations, and therefore the IAEA is not able to reconstruct the past production. It cannot be ruled out that North Korea is in possession of sufficient plutonium for several warheads. However, it is extremely unlikely that Pyongyang would cooperate with terrorists or that terrorists could get access to this material or that terrorists could get access to this material.

Before South Africa signed up to the Non-Proliferation Treaty in 1991 and submitted to IAEA safeguards, it had produced large amounts of plutonium in its secret nuclear weapons programme. Meanwhile, these stocks have been completely accounted for.⁶⁵ It can be assumed, with a reasonable degree of certainty, that there are no more undeclared hiding places. Today, an undiscovered theft is just as unlikely as in the other non nuclear weapon states. However, some amounts might have been covertly sold in the past, and they might be in the possession of criminals today. It has been reported, for example, that bin Laden attempted to procure HEU of South African origin in 1993/1994.⁶⁶ It is unknown whether he had any success.

In addition, it has for years been suspected that Iran is interested in secretly obtaining nuclear weapons, particularly by the US. The American suspicion is based on the testimonies of arms dealers, which refer to Iranian representatives, who enquired about the possibility of purchasing fission material. It is also based on Tehran's attempts to buy enriched uranium in Kazakhstan and on the purchase of dual-use goods that might indicate an interest in the centrifuge technique. This has been confirmed by secret services from other countries. It has been reported that the German Federal Export Office prohibited any delivery to the Sharaf University in Tehran in 1996, after this university

63 K. Chitumbo, Information Analysis in the Strengthened Safeguards System, keynote presentation at the Symposium on International Safeguards: Verification and Nuclear Material Security, Vienna, 29/10 – 2/11/2001, proceedings in preparation.

64 Katja Frank, Annette Schaper, Das Nichtverbreitungsregime in der Krise? Massenvernichtungswaffen in Indien, Pakistan, Nordkorea und Irak, Friedensgutachten 1999, eds. Bruno Schoch, Ulrich Ratsch and Reinhard Mutz, p. 228, Münster 1999.

65 Adolf von Baeckmann, Garry Dillon, Demetrius Perricos, Nuclear Verification in South Africa, IAEA Bulletin, Vol. 37, No. 1, March 1995.

66 Kimberly McCloud and Matthew Osborne, WMD Terrorism and Usama Bin Laden, CNS Report, 14/3/2001, <http://cns.miiis.edu/pubs/reports/binladen.htm>; A Brownfeld, Bin Ladin's activities exposed in New York trial, Jane's Terrorism & Security Monitor, 14/3/2001, http://newsite.janes.com/security/international_security/news/jtism/jtism010314_1_n.shtml.

had attempted to purchase pieces of equipment for the manufacture of centrifuges. Another indicator is Iran's start of constructing a uranium enrichment plant that has recently been revealed.⁶⁷ However, the suspicion against Iran has never been proven. It is assumed that there are competing political fractions in Iran, some of them interested in strengthening the non-proliferation regime and preventing the development of nuclear weapons or the support of nuclear terrorism, others aiming at the contrary.

3.5. Nuclear weapons and material from Pakistan?

The case of Pakistan merits particular attention. It has a small arsenal of nuclear weapons and has produced larger amounts of HEU. Its nuclear capacity is sometimes polemically referred to as the 'Islamic bomb'. However, Pakistan's nuclear weapons programme was initially independent of religious motives or fundamentalism. Rather, it was initiated by the complex relationship with India. Pakistan has repeatedly stressed that it would not pass on any of its nuclear weapons and that it would not cooperate with other states in this field.

Little is known, however, about Pakistani national security measures. The Taliban and radical terrorists are met with sympathy by parts of the population. It is unknown whether religious fanatics could get access to nuclear material and could pass it on to terrorists. Two retired nuclear physicists, who participated in the construction of Pakistan's nuclear weapons, were arrested at the end of October 2001.⁶⁸ They are Taliban sympathisers, who had recent close contact to the former Afghan government. It is not clear whether they have passed on nuclear material. They were released after a few days, although the case will be investigated further.

The current and former Pakistani governments would not support terrorists. Whether they are capable of preventing theft, however, remains unknown. In Pakistan, the army has always had control over the nuclear activities, and the various civilian governments were only marginally involved.⁶⁹ The October 1999 coup eliminated the last remaining civilian influence. The army may sympathise with the Taliban in the same way as the civilian population and this support might increase, depending on how the war in Afghanistan develops. There are reports claiming that Pakistani officers helped protect the Taliban against American air strikes, which would be strictly against the orders of their government leader, general Pervaiz Musharraf.⁷⁰

At present, Pakistan possesses 585 – 800 kg HEU and several kilograms of plutonium. This amount would be enough for an estimated 30 – 50 warheads.⁷¹ The Pakistani government assures that it is in full control of this nuclear material and of its nuclear weapons. However, there are indi-

67 Washington Post, Sources Say Iran Lays Groundwork For Nuclear Bombs, December 19, 2002; Page A26.

68 BBC News, 25/10/2001, Pakistan holds nuclear scientists, http://news.bbc.co.uk/1/hi/english/world/south_asia/newsid_1619000/1619252.stm.

69 Gaurav Kampani, The Military Coup in Pakistan: Implications for Nuclear Stability in South Asia, CNS Reports, October 1999, <http://cns.miis.edu/pubs/reports/gaurav.htm>.

70 Jon Wolfsthal: "U.S. Needs A Contingency Plan For Pakistan's Nuclear Arsenal", Los Angeles Times, 16/10/2001.

71 David Albright, Securing Pakistan's Nuclear Weapons Complex, Paper for the 42nd Strategy for Peace Conference, 25-27/10/2001, Warrenton, Virginia, <http://www.isis-online.org/publications/terrorism/stanleypaper.html>.

cations that their physical protection is inadequate. For example, a year ago already, Pakistan asked the US for assistance to improve the physical protection of all nuclear material.⁷² The parts containing nuclear material and the ignition mechanisms of Pakistani nuclear weapons are apparently stored in different locations.⁷¹ However, they are not protected against accidental detonation nor equipped with “Permissive Action Links” – protective devices preventing unauthorised ignition. If terrorists were to get hold of a Pakistani nuclear weapon, then they would be able to detonate it. This, at least, is less likely to be the case for Russian nuclear weapons. The locations of Pakistani sites are kept secret, in contrast to those of the recognised nuclear weapon states that attract attention because of their high degree of physical protection. The reason for this secrecy is that the physical protection in place would be unable to withstand a significant attack. Immediately after the September 11th attacks, the nuclear weapons components were transferred to other secret locations in Pakistan. The Pakistani government feared that the storage sites could be chosen as a target by terrorists. These transfers also served the purpose of removing control over the nuclear weapons from religious hardliners inside the military.⁷³

A better degree of physical protection would decrease the risk of attack and theft by external forces. Therefore, cooperation with Pakistan in this area should be considered. However, even then the risk will remain that insiders might steal material or warheads and cooperate with outsiders. It is unknown, how are controlled and how the material accountancy works. At least, modern material accountancy techniques can create a greater internal transparency. Therefore, it would be sensible to cooperate in this aspect too. Moreover, the danger remains that, in the event of another civil war or a putsch, the whole Pakistani nuclear complex could fall into the hands of religious fundamentalists. Thus, international efforts should be focussed towards the promotion of stability in Pakistan, in order to prevent a change to a fanatical government.

Cooperation with Pakistan that aims to secure the nuclear complex and the nuclear weapons within will have political side effects that must be taken into account: Such cooperation might imply an indirect acceptance of Pakistan’s status as a nuclear state and, thus, might be in contravention of the Non-Proliferation Treaty, particularly if assistance is given with regard to Permissive Action Links. Safer nuclear weapons might lower the threshold for their use, so increasing the risk of a nuclear war in South Asia. India would probably demand a similar treatment if cooperation with Pakistan was undertaken. The question has been raised in public debate in the US, as to whether, in the event of a coup d’etat, the US should invade Pakistan, to secure the nuclear weapons and the nuclear complex.⁷⁴ However, the political consequences of such a measure in the region could hardly be controlled. Such action would be considered extremely provocative by other Islamic states. Therefore, this suggestion should rather be considered as playing with fire. Such action would probably result in a dramatically increased number of terror attacks. India would probably take advantage of such a situation in order to strengthen its position with respect to other conflicts with Pakistan. It is doubtful whether India’s activities would match Western interests. China does not

72 Pakistan's Nuclear Dilemma, Carnegie Endowment for International Peace, Non-Proliferation Project Roundtable, 2/10/2001. Transcript: <http://www.ceip.org/files/events/Paktranscript.asp>.

73 Pakistan Moves Nuclear Weapons; Washington Post Foreign Service, Sunday, 11/11/2001; p. A01, <http://www.washingtonpost.com/wp-dyn/articles/A9038-2001Nov10.html>.

74 Jon Wolfsthal: "U.S. Needs A Contingency Plan For Pakistan's Nuclear Arsenal", Los Angeles Times, 16/10/2001.

have a vested interest in the strengthening of Islamic fundamentalism in the region; however, a strong US supremacy would not be tolerated in the long term. The greatest danger lies in the possibility that, before being crushed, putschists might use the weapons.

3.6. Bin Laden's procurement activities

For several years, there have been growing indications that Bin Laden was attempting to get hold of weapons of mass destruction. He openly admitted that he did not exclude the use of such weapons in an interview in 1998. He claimed that it was "a religious duty to acquire these weapons and a sin not to try". Should he gain possession of such weapons then he would "thank God who had enabled him to do this".⁷⁵ His interest covered nuclear, chemical and biological weapons; but his first attempts apparently concentrated on the procurement of nuclear weapons.⁷⁶

An important source of information is a defector, named Jarmal Ahmad al-Fadl, a Sudanese who is said to have had close contact to Bin Laden.⁷⁷ In 2001, he was the main witness in the court proceedings against bin Laden, with respect to the 1998 bomb attacks on US embassies in Kenya and Tanzania. He fled to the US in 1996, when he feared that the terror organisation would discipline him, because of financial irregularities. He has been kept in US custody ever since. He provided exhaustive descriptions of attempts to get hold of uranium and also described in detail the organisational structure of the terror group. Osama bin Laden and the Sudanese government denied any contact with Jarmal Ahmad al-Fadl. Moreover, many doubt his credibility and his character. These doubts are based on a series of criminal activities in his past and on the ease with which he ignores his previous religious convictions in favour of financial gain. On the other hand, it can hardly be believed that he has invented such a complex web of lies, most of which incriminate himself, only to harm bin Laden. Bin Laden's motivation to keep his distance to al-Fadl is obvious, as is that of the Sudanese government. Other witnesses have confirmed details of his reports.

Jarmal Ahmad al-Fadl is thought to have been involved in bin Laden's attempts to procure several kilograms of HEU from South Africa in 1993. He claims to have seen a container of material whilst negotiating with suppliers in Sudan. The negotiations mainly concerned testing the quality of the uranium. He does not know if this testing was actually carried out or if the purchase was completed. It is possible that the organisation has gained possession of sufficient HEU through similar deals. At the end of the 80's, a number of press reports appeared about bin Laden's attempts to get hold of nuclear material, in order to build a bomb, however not all are reliable. It was claimed that he employed 'hundreds of Soviet scientists' to build a homemade reactor and it was said that works

75 Terror Suspect: An Interview with Osama bin Laden, ABC News, December 1998, http://abcnews.com/sections/world/DailyNews/transcript_binladen1_981228.html.

76 Kimberly McCloud and Matthew Osborne, WMD Terrorism and Usama Bin Laden, CNS Report, 14/3/2001, <http://cns.miis.edu/pubs/reports/binladen.htm>; A Brownfeld, Bin Ladin's activities exposed in New York trial, Jane's Terrorism & Security Monitor, 14/3/2001, http://newsite.janes.com/security/international_security/news/jtsm/jtsm010314_1_n.shtml.

77 *Ibid.*

were in progress to build a bomb smaller than a backpack.⁷⁸ These details are no doubt exaggerated as such efforts would not go undiscovered and are beyond the capabilities of an organisation like bin Laden's. However, it cannot be ruled out that terror organisations have taken possession of sufficient plutonium or HEU and have carried out experiments regarding the weapon technology. In October 2000, a member of the Russian Security Council confirmed that Russia had stopped an attempt by the Taliban to recruit a Russian nuclear expert.⁷⁹

Documents recently found in Afghanistan indicate that Al Qaeda's procurement activities have not yet progressed very far. The documents include general descriptions of radiological weapons and basic sketches about the operating principles of nuclear weapons. The information contained therein does not exceed the general knowledge that can also be found on the Internet.⁸⁰

3.7. Smuggling of complete nuclear weapons?

Bin Laden is said to have tried to get hold of complete nuclear weapons.⁸¹ Such rumours have repeatedly appeared in the press in recent years. These nuclear weapons are thought to be so-called 'rucksack bombs', that is, particularly small and compact explosive devices that can be transported easily.

General Alexander Lebed caused a stir when he claimed that Russia had lost 100 1-kiloton rucksack bombs in September 1997.⁸² These weapons are particularly small, mobile and are not equipped with the standard security measures against unauthorised use. They were designed for use by special units to carry out sabotage acts in times of war. Several of these weapons were located in states of the former Soviet Union and might not have been returned to Russia. Lebed was about to investigate this matter when president Yeltsin dismissed him in October 1996. A member of his fact-finding committee claimed that no evidence of missing weapons was found but stated that the investigation had remained incomplete, as the Ukraine, Georgia and the Baltic States had not been examined yet. A former adviser to the president, Alexander Yablokov, confirmed the existence of such special weapons, although the Russian government has always denied that such 'rucksack bombs' exist.⁸³ However, the various official statements partly contradict each other. Therefore, the

78 Emil Torabi, "Bin Laden's Nuclear Weapons," *Muslim Magazine* (Winter 1998); <http://www.muslimmag.org>, cited in footnote 72.

79 Matthew Bunn, George Bunn, *Reducing the Threat of Nuclear Theft and Sabotage*, IAEA Special Session on Combating Nuclear Terrorism, 30/10/2001, http://www.iaea.org/worldatom/Press/Focus/Nuclear_Terrorism/bunn02.pdf.

80 Bryan Bender, US: "Signs Seen Of Efforts To Get Terror Weapons", *The Boston Globe*, 17/1/2002.

81 Kimberly McCloud and Matthew Osborne, *WMD Terrorism and Usama Bin Laden*, CNS Report, 14/3/2001, <http://cns.miis.edu/pubs/reports/binladen.htm>; A Brownfeld, *Bin Ladin's activities exposed in New York trial*, *Jane's Terrorism & Security Monitor*, 14/3/2001, http://newsite.janes.com/security/international_security/news/jtism/jtism010314_1_n.shtml.

82 Ongoing speculation about missing Russian 'suitcase nukes', *Disarmament Diplomacy*, No. 19, October 1997, <http://www.acronym.org.uk/19nukes.htm>; Scott Parrish and John Lepingwell, *Are Suitcase Nukes on the Loose?*, *The Story Behind the Controversy*, Center for Nonproliferation Studies Report, November 1997, <http://cns.miis.edu/pubs/reports/lebedst.htm>.

83 Adam Dolnik, *America's Worst Nightmare? Osama Bin Laden and Weapons of Mass Destruction*, *Yaderny Kontrol Digest*, Vol. 7, No. 1, pp. 4-13, winter 2002.

official denial is not very convincing and it can be assumed that such weapons really exist. In the 60's, the US built hundreds of such weapons and it is unlikely that the then Soviet Union did not level the score and do the same.

Lebed's claim is not new, but striking as it stems from a person with access to information about nuclear weapons. It was already reported in the Russian press in 1995 that Chechnyan separatists had tried to get hold of nuclear weapons. It is not known if they were successful. Officially, Russia claims that all nuclear weapons are accurately recorded. This claim cannot be verified, as there are no international agreements in place that provide transparency about all stocks.

Rumours that terrorist organisations have already got hold of nuclear explosive devices cannot be disproved. For example, the Israeli secret service reported in 1998 that an agent in Kazakhstan received over 2 millions pound sterling and promised to supply a rucksack bomb within two years. According to Arab sources, bin Laden procured about 20 Russian nuclear weapons in Chechnya, in the same year, against a payment of \$30 million and 2 tons of opium in Chechnya. Allegedly, he plans to dismantle these warheads and use them to build new, small tactical nuclear weapons.⁸⁴ Although Afghan opium is thought to play a role in procurement activities, the reliability of these reports is doubtful, as the manufacturing of homemade rucksack bombs cannot be carried out by an organisation such as Al Qaeda. Miniature explosive devices needed for rucksack bombs are the result of technical optimisation that can only be achieved by years of experimenting, including numerous nuclear tests. It is impossible to assemble such weapons with the same simple methods that are used to build simple nuclear devices. Despite reports about the security of Russian nuclear plants and arsenals, it is doubtful whether there are any nuclear weapons left in Chechnya. It is even more unlikely that weapons could have been smuggled into this country. Russia claims to have withdrawn all nuclear weapons from most Soviet republics including Chechnya before the collapse of the Soviet Union. Ultimately however, certainty cannot be achieved, as it is not known how many nuclear weapons are in Russian possession and where they are deployed.

Countless reports in recent years have been proven false. Therefore, reports of this kind have to be treated with caution. However, if terrorists do have some complete nuclear weapons, the question should be asked whether these rucksack bombs really lack a security device preventing their ignition, as Lebed declared. If a security device is present, it is unlikely to be overcome by the terrorists. Under normal circumstances, ignition is only possible with the aid of an electronic signal or a code from Moscow. Should the security devices be present, the warhead would have to be dismantled in order to reconstruct it. Moreover, it should be considered whether the nuclear material that is contained in the warhead is still suitable for use in a weapon. As a rule, nuclear weapon plutonium has to be replaced every five to ten years. The material in the 'forgotten' Russian warheads has certainly not been replaced. Therefore, a rucksack bomb – without security device - will only release a relatively 'low' energy.

84 Cited in footnote 72.

3.8. Types of threat

If terrorists really have nuclear warheads, they will be able to use them in two different ways: they could attempt to kill as many civilians as possible, without advance warning; or they could try to use the weapons for blackmail. In either case, they would have to transport them to their target. The use of missiles can be ruled out. The technical hurdles standing in the way of the procurement or construction of missiles are much too high. Besides, any nuclear explosive device that could be built by terrorists would be much too heavy for transport in a missile. Even if terrorists have operating rucksack bombs and missiles, they would not have the technical ability to detonate the warhead in the right moment. Even states that the US likes to regard as threats against which an anti-missile shield has to be built are not actually capable of reaching American territory with missiles.⁸⁵ Therefore, bombs would have to be carried by ship, lorry or plane. Transport by air is likely to be discovered and success is improbable. Therefore, the terrorists would probably not choose this means of transport. However, there remains the option of transferring one or more explosive devices by sea or by land, in which case the probability of a discovery would be quite low.

If terrorists attempted blackmail, they would have to substantiate their claims of possessing nuclear explosive devices. This could be achieved by detonating one bomb and then threatening to detonate others. Alternatively, technical drawings, photos or samples of nuclear material could be sent that could be used by experts to determine whether the threat should be taken seriously.

A variant of nuclear terrorism that is technically much less challenging would be the use of a *radiological weapon* instead of a nuclear explosive device. Such a weapon is detonated by a conventional explosion and distributes highly radioactive material. Whole neighbourhoods could, thus, be made inhabitable for many years. Plutonium and HEU, which are used in nuclear weapons, are not only difficult to get hold of but are also not very radioactive. Therefore, they are not very suitable for such a radiological weapon. A more obvious material to use would be spent fuel elements, which are produced by all civil nuclear power stations. However, theft of spent fuel elements is extremely difficult; they are highly radioactive and would quickly release a lethal dose of radiation if not adequately shielded. Moreover, they are very heavy and bulky. The theft of such elements would require the use of an appropriate form of transport.⁸⁶ In Germany, they are transported by rail in specially designed "Castor Containers". It is difficult to imagine terrorists organising a raid to capture and remove such containers. In non-nuclear states, all spent fuel elements are registered by the IAEA and a theft would almost certainly be quickly discovered. It would be easier to get hold of high-level radioactive waste, emanating from reprocessing plants, or special radioactive materials and solutions, used in civil research institutes and hospitals. Reprocessing plants in non-nuclear or Euratom states⁸⁷ are, however, tightly controlled. Moreover, detectors are placed at all entrances and exits and

85 The sparsely populated Alaska might be the exception as North Korean missiles might be able to reach it. See George N. Lewis and Theodore A. Postol, "Future challenges to ballistic missile defense", *IEEE Spectrum*, September 1997, pp. 60-68.

86 This is why the concept of the 'spent fuel standard' is used in the discussion of the disposal of plutonium that stems from disarmed nuclear weapons. If the plutonium has been transformed into a state that is equivalent to that of a spent fuel element, then it is acknowledged to correspond to the spent fuel standard. At this stage, the disarmament process is to be regarded as completed.

87 Euroatom monitors the civil nuclear power stations of two nuclear weapon states, Great Britain and France.

at other locations that can register even small doses of radioactivity. Nevertheless, there is no way of ruling out the possibility of groups of staff conspiring to illegally remove small amounts of liquid radioactive waste. A more plausible scenario is the theft of material from those less secure plants that are not subject to international controls.⁸⁸

Liquid radioactive waste could be added to drinking water, so contaminating the entire area fed by a particular supply. A radiological weapon would initially cause few casualties, depending on where it was detonated. However, the contamination would have long-term consequences that would be dreadful. It is thought that, in 1980, Iraq produced and tested conventional bombs filled with radioactive material, presumably from spent fuel elements.⁸⁹ However, no such weapons have yet been used.

Another widely aired scenario involves a passenger plane, with full fuel tanks, being crashed into a nuclear power station. In fact, nuclear plants have frequently been the focus of terrorist and criminal interest. Attempts at invading, attacking or threatening nuclear power stations have been reported in Argentina, Russia, Lithuania, South Africa, South Korea and even in the US and France.⁹⁰ In Russia, acts of terror are feared from Chechnyan terrorists; in France, it is Algerians who are suspected of sabotaging a nuclear power station. Not all such attempts are classified as large-scale acts of terror, as some of them are 'only' sabotage attempts by discontented staff or bomb scares in nuclear power stations. There have, however, been cases of threatened suicide attacks by plane hijackers, as, for example, in November 1972, when three hijackers threatened to bring a plane down on a nuclear research plant in Oak Ridge.⁹¹

The containment design of German nuclear power stations does in fact take into account the possibility of a combat aircraft crashing but not of a plane with full fuel tanks. An IAEA spokesperson recently confirmed that this also applies to other countries.⁹² The containment would probably not withstand such an attack. The core of the reactor is unlikely to be hit but the cooling system might be destroyed. Additional failure of the emergency cooling system, which is designed to flood the reactor in such a situation, could lead to overheating of the core and, therefore, to a Chernobyl-type catastrophe. If terrorists succeeded in releasing the radioactive contents of a nuclear power station, whole regions would be rendered uninhabitable. Such an incident at the German nuclear power station at Biblis would affect most of the Hessen region, including, in the event of south-westerly winds, the Rhine-Main Valley (including cities like Frankfurt etc). However, the terrorists would have to be

88 States that are not subject to international controls of their plants are the US, Russia, China, India, Pakistan and Israel. The levels of physical protection in these states differ to a great extent.

89 Glenn Zorpette, Steve Miller, Unconventional Nuclear Weapons, IEEE Spectrum Online, November 2001, <http://www.spectrum.ieee.org/WEBONLY/publicfeature/nov01/nterr.html>.

90 Oleg Bukharin, Problems of Nuclear Terrorism, *The Monitor: Nonproliferation, Demilitarization and Arms Control*, p. 1, Spring 1997; Oleg Bukharin, Upgrading Security at Nuclear Power Plants in the Newly Independent States, *The Nonproliferation Review*, p. 28, winter 1997; Three Mile Island Alert, <http://www.tmia.com/sabter.html>.

91 Gavin Cameron, Nuclear Terrorism: Reactors & Radiological Attacks After September 11, IAEA Special Session on Combating Nuclear Terrorism, 30/10/2001, http://www.iaea.org/worldatom/Press/Focus/Nuclear_Terrorism/cameron.pdf.

92 William J. Kole, Global atomic agency confesses little can be done to safeguard nuclear plants, *Associated Press*, 19/9/2001, http://www.enn.com/news/wire-stories/200109/09192001/ap_45005.asp.

capable of hitting the reactor shield vertically, in a nosedive, rather than just scraping it from the side. This is a far greater challenge than directing a plane into a high building.

3.9. Minimising the risks

The possibility that terrorists either have or are close to having nuclear weapons cannot be ruled out. In addition to the current anti-terrorist armoury, strategies exist that would, at least in the long term, reduce the risk of nuclear terrorism.

These include, first and foremost, international cooperation to improve the security of nuclear material in Russia. In many nuclear plants, physical protection and nuclear material accountancy fall below defined 'Western standards'. The quantities and location of plutonium and HEU stocks remain unknown. There is estimated to be about 450 tons of military and civil plutonium and over 1700 tons of HEU.⁹³ Much of this material is in the hands of the five officially recognised nuclear weapon states, but 1306 kg of civil HEU is spread amongst a further 27 countries, some of which harbour quantities sufficient to produce a warhead.⁹⁴ The physical protection and security of nuclear plants varies considerably from one country to the next, as do the lists of scenarios against which plants have to be protected. In some countries, such lists do not even consider the possibility of terrorism or sabotage.⁹⁵ There is no international treaty, committing states to protect their weapon-ready material from theft or their nuclear plants from sabotage. The only relevant treaty is the 1980 Convention on the Physical Protection of Nuclear Material that lays down rules for material that is to be transported internationally. This does not apply to material or plants that are used, stored or transported nationally.

It will also be necessary to cooperate with the three *de facto* nuclear weapon states, India, Pakistan and Israel, which do not take part in the non-proliferation treaty, to increase the security of their nuclear facilities and materials. This will be a political tightrope walk as, on the one hand, it will be necessary to avoid indirectly giving these states the status of nuclear weapon states but, on the other, practical steps are needed to protect the most sensitive plants and materials in particular. It is, for the moment, unlikely that these states will allow international controls. Controls that might be accepted in future would only apply to civil, not military, nuclear energy. Nevertheless, good physical protection and precise bookkeeping are also vital in the military field, to secure nuclear weapons against unauthorised use. The easiest approach would be an informal cooperation between these states and the recognised nuclear weapon states, this being at a technical rather than a political level.

Following the September 11th attacks, the scenarios of threat against nuclear power stations have to be reviewed. To date, the possibility that terrorists might aim at mass murder or would be prepared to commit suicide has not been considered. Study of the September 11th attacks demonstrate

93 David Albright/Frans Berkhout/William Walker, *Plutonium and Highly Enriched Uranium 1996 – World Inventories, Capabilities and Policies*, SIPRI (Oxford University Press), 1997, brought up to date with reference to the Institute of Science and International Security (ISIS): <http://www.isis-online.org>.

94 International Atomic Energy Agency, *Nuclear Research Reactors in the World*, IAEA-RDS-3, september 2000.

95 George Bunn, *Raising International Standards for Protecting Nuclear Materials from Theft and Sabotage*, *Nonproliferation Review*, Summer 2000, p. 146.

that preparations can be carried out over a number of years and means can be found and used that have not previously been considered. Terrorists might regard nuclear materials and plants as ideal targets. Such possibilities have to be considered in developing new scenarios. States have to cooperate to harmonise their procedures and to achieve the highest possible level of physical protection. It would be appropriate to cooperate with the IAEA, which is involved in a variety of activities aimed at reducing these risks. These include the creation of a databank of threats of nuclear terrorism⁹⁶ and special training programmes for physical protection and for the analysis of threats.⁹⁷

As long as material remains in a weapon-ready state, there is a great risk that it could fall into the wrong hands.

An international plan for the disposal of excess weapons plutonium is in danger because of a lack of interest on the part of the participating states.⁹⁸ Additionally, international initiatives (in particular the German one), designed to combat the smuggling of nuclear material and to improve the safety of Russian nuclear plants, are not at all sufficient. Assigning a higher priority to such initiatives would be an important step in reducing the probability of nuclear terrorism.

A further problem is the lack of an overview of existing nuclear weapons. Little is known about the number and location of Russian nuclear weapons. This is especially true for so-called *tactical nuclear weapons*, which are still not subject to an arms control treaty. The dangers of such weapons are grossly underestimated.⁹⁹ Unlike strategic nuclear weapons, some of these are old and are poorly protected against theft and unauthorised use. Moreover, tactical nuclear weapons are subject to control at a lower level in the military hierarchy. At present, the US still has 970 tactical nuclear weapons. Some of these are based outside the US, including in Germany. It is estimated that about 5000 tactical nuclear weapons are still deployed in Russia. These have been given a higher political priority in recent years.¹⁰⁰ As arms controls are not in place, transparency of existing stocks does not exist. In 1993, the nuclear states declined a proposal by the German Foreign Minister to implement a UN register of all nuclear weapons.¹⁰¹ This proposal could be revived. An arms control treaty that includes the registration and disarmament of tactical nuclear weapons would reduce the risk of theft.

96 George Anzelon, Improving the Knowledge Base on Nuclear Terrorism Nuclear Terrorism Threats, IAEA Special Session on Combating Nuclear Terrorism, 30/10/2001, http://www.iaea.org/worldatom/Press/Focus/Nuclear_Terrorism/anzelon.pdf.

97 Richard Hoskins, IAEA Material Security Programme - Threat Assessments, IAEA Special Session on Combating Nuclear Terrorism, 30/10/2001, http://www.iaea.org/worldatom/Press/Focus/Nuclear_Terrorism/hoskins.pdf.

98 A. Schaper, Deutsche Abrüstungshilfe für russisches Waffenplutonium – Ein Plädoyer, Friedens-gutachten 2001, Ed. Reinhard Mutz, Bruno Schoch, and Ulrich Ratsch, p. 283; LIT-Verlag, Münster 2001.

99 William C. Potter/Nikolai Sokov/Harald Müller/Annette Schaper, Tactical Nuclear Weapons: Options for Control, UNIDIR Research Report, Geneva, 2000.

100 Some Russian politicians and decision makers have suggested increasing the number of tactical nuclear weapons based in Central Asia, in order to replace conventional systems that are in urgent need of maintenance, funds for which are not available. American plans for a missile defence system have also contributed to the renaissance of tactical nuclear weapons in Russia.

101 K. Kinkel, German 10-point initiative for nuclear non-proliferation, UN General Assembly, 48th Session, First Committee, Agenda item 71 (c), November 8, 1993; Harald Müller: The Nuclear Weapons Register – a Good Idea Whose Time Has Come, PRIF Reports, No. 51, 1998

4 Comparison of biological and nuclear terrorism

The above discussion demonstrates significant differences between biological and nuclear terrorism. For terrorists aiming at mass murder, a nuclear explosion would be the next logical step, with the consequences being likely to exceed those of the September 11th attacks. The consequences of a radiological weapon would be equally devastating. The construction of a simple nuclear explosive device or, in particular, of a radiological weapon would be easier than is commonly assumed. The greatest technical hurdle would be the procurement of nuclear material. Al Qaeda showed interest in nuclear terrorism but its preparations did not reach an advanced stage. Should a future terror organisation develop similar interests, it could, as long as it enjoys the protection of a state, engineer an operating nuclear warhead or, more easily, a radiological weapon in only a few years. However, the procurement of nuclear material is a precondition. Therefore, preventative measures should focus on the protection of nuclear materials.

In comparison, the technical uncertainties linked to the procurement of biological weapons are greater. It seems that terrorists find it technically difficult to generate comparable havoc and destruction with biological weapons. Therefore, these remain a less suitable next step, after the September 11th attacks, unless terrorists can manage to produce and effectively spread a pathogen that causes an infectious disease and, therefore, an epidemic. The example of the Aum sect undermines the old paradigm that terrorists disapprove of biological weapons, however, it also demonstrates that large-scale efforts in this direction do not necessarily bring success. As concluded from the interview cited above, bin Laden's terror organisation does not seem to have any interest in bioweapons.¹⁰² The September 11th terrorists are characteristically different from those who attempt to use biological weapons, such as the Aum sect or the sender of the anthrax letters.

Since September 11th, the arm control debates related to biological and nuclear weapons have become focused on terrorism. In some respects, international measures to fight terrorism have benefited from this. A good example is the Nunn-Lugar programme, which has existed for ten years and which aims to protect material from dismantled nuclear weapons. Its funds were cut drastically in the last US budget. Not only have these cuts now been cancelled, the funds available to the programme have even been increased.

The Nunn-Lugar programme only aims at informal cooperation and at measures that can be cancelled at any moment. The Bush administration has stood in the way of arms control measures relating to biological and nuclear weapons that could provide further important instruments. The most useful multilateral instrument available today is the BWC, which could be used to build a united front against the dangers of bioterrorism, amongst others. In the field of nuclear weapons, control and disarmament regimes need to be stabilised and extended. Transparency of all stocks and the irreversibility of existing measures are key objectives. This can only be achieved if states agree to commit themselves. A treaty that could play an important role in creating transparency is the Fissile Material Cutoff Treaty, (FMCT), which aims to end the production of fissile material for nuclear explosives. This has been awaiting negotiation by the UN Disarmament Conference in Geneva for

102 See footnote 27.

several years. The Bush administration shows no interest in these negotiations, nor in the Test-Ban Treaty, which they do not want to see ratified and which they even undermine by announcing preparations for new nuclear tests.¹⁰³

103 Department of Defense, Special Briefing on the Nuclear Posture Review, 9/1/2002, http://www.defenselink.mil/news/Jan2002/t01092002_t0109npr.html.