Assessing nuclear, biological, chemical and radiological threat to the European Union, 2005–13

Paul Cornish and Ian Anthony

sipri
Stockholm International Peace Research Institute

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Contents

Acronyms and abbreviations

BTWC	Biological and Toxic Weapons Convention (1972)
BW	Biological weapon(s)
CFSP	Common Foreign and Security Policy
CW	Chemical weapon(s)
CWC	Chemical Weapons Convention (1993)
EU	European Union
HEU	Highly enriched uranium
IAEA	International Atomic Energy Agency
ITDB	Illicit Trafficking Database
NBC	Nuclear, biological and chemical
NBCR	Nuclear, biological, chemical and radiological
OPCW	Organisation for the Prohibition of Chemical Weapons
UNSCOM	UN Special Commission on Iraq
WMD	Weapon(s) of mass destruction

Introduction

Until relatively recently, the subject of this paper—the assessment of nuclear, biological, chemical and radiological (NBCR) threats to the European Union—would not have been thought suitable for special attention and analysis. At one level of criticism, discussion of the EU's exposure to these 'threats' would have been merely to acknowledge a general problem of international security, with the 'NBCR threat' a passive, commonplace experience shared by all other European and international organizations, from the Council of Europe to the International Telecommunications Union. At another level, such a discussion would have been thought fanciful and presumptuous, implying authority and competence on the part of the EU which did not exist. While the EU and other organizations could, albeit without much point, *acknowledge* 'NBCR threats', the analysis and management of those threats was properly the concern of competent politico-military bodies such as the North Atlantic Treaty Organization.

Perceptions of the 'NBCR threat' have, however, evolved considerably over the past decade.

The end of the cold war in the early 1990s meant the abandonment of the dominant intellectual and political framework within which NBCR threats had been both conceived and contained. Thereafter, concerns over NBCR were more than a matter of how or whether such weapons and technology might be used (or threatened), either in the strategic balance or on the battlefield between organized armed forces. Vast surpluses of cold war NBCR, often without adequate monitoring and security, could conceivably now find their way into the hands of 'rogue' states, terrorist organizations or even individual lunatics, none of whom would feel restrained by the niceties of cold war deterrence theory.

As well as the broadening base of potential users of NBCR, issues such as chemical waste control, disease vaccination and nuclear fuel cycle management—all of which might previously have been thought peripheral to the central military/security concerns—now came increasingly to be seen as part of a widening, more diffuse 'NBCR threat'. The terrorist attacks on the United States in September 2001, the attacks in Madrid in March 2004 and those in London in July 2005, and the considerable European involvement in military campaigns in Afghanistan and Iraq, all indicated a shift away from vague, general concerns about international security to something more focused, and something requiring a more active response. And just as the features and demands of the post-cold war NBCR security problem were becoming steadily more clear, so the member states and institutions of the EU were moving determinedly (albeit not without occasional disagreement) to establish the EU as an active presence in the field of security and defence.

Weaknesses in international NBCR arms control regimes seemed to present similar opportunities. The illegal weapon programmes in Iraq, Libya and North Korea strengthened long-standing suspicion that countries which present themselves as being in good standing with arms control agreements could use their status as a cover under which to acquire the knowledge, equipment and material that would then be used to make weapons. Moreover, during the 1990s practical experience underlined that there was no simple (or single) solution to addressing the most difficult proliferation challenges successfully. Approaches based mainly on offering countries of proliferation concern inducements to change and approaches based mainly on applying pressure of different kinds were each found wanting, meaning that a successful strategy would have

to consist of a 'mixed package' of measures applied in a coordinated manner over an extended period.

Thus, by 2005 there was a mounting sense not only that the EU (broadly defined to include its Member States and its common institutions) might be vulnerable to NBCR use by a broadening array of antagonists, but also that it had declared itself competent to assess and analyse NBCR threats in its own terms, and make policy accordingly.

The aim of this paper is to account for the 'NBCR threat' to the EU. The paper begins in section 2 by showing the evolution of EU interest in, and sensitivity to, the dangers of NBCR proliferation and use. In section 3 there is a brief discussion of the notion of 'threat'. According to the traditional rules of threat assessment, 'capabilities' alone are insufficient, and focusing on them in isolation can only lead to worst-case analysis, rather than a balanced assessment. Yet there are, nevertheless, two reasons for organizing the paper in this way, and for concentrating on 'capabilities'. First, a detailed threat assessment, addressing intentions as well as capabilities, would require access to intelligence and assessment material which is not in the public domain and is therefore beyond the reach of the authors. Second, the increasingly diffuse nature of the NBCR problem in any case suggests that a different approach might be more appropriate, one which concentrates on what is knowable (capabilities) at the expense of what is not (intentions), and which seeks to gear EU policy for NBCR in a different way to the traditional military approach which was dominant during the cold war.

In section 4 the paper then examines the nature and availability of NBCR weapons, and the possible consequences of their use. The paper does not attempt a comprehensive analysis of all of the states, organizations and individuals who possess and might be inclined to use such weapons against the EU. The premise is that the availability and effect of NBCR are reasonably knowable, as is—in a very general sense—the vulnerability of the EU to such use. Information is presented in section 4 to support this assertion. What is much less knowable, at least to a similar level of detail, is who or what might wish to attack the EU in these ways, and for what motives. In other words, where 'NBCR threats' are concerned, 'capabilities' are more knowable than 'intentions'.

2. The European Union and NBCR

Since the inception of the European project in the 1950s, its central ideas and institutions have never been far removed from those areas of security policy with which this paper is concerned. Following the birth of the European Coal and Steel Community in 1952, the March 1957 Treaties of Rome provided for the establishment not only of the core of the European project, the European Economic Community (EEC), but also of the European Atomic Energy Community (Euratom). While committed to the 'speedy establishment and growth of nuclear industries' in its member states, the Euratom Treaty nevertheless embodied concerns which continue to resonate almost 50 years later, such as the need to protect the public from radiation, the requirement to ensure that fissile material is not diverted to unauthorized users and uses, and the importance of inspections of facilities and materials.

For much of the intervening 50 years, of course, the cold war meant that many of these concerns were first 'securitized' as matters of defence or military policy, and then managed elsewhere, in the various manifestations of East–West arms control and in NATO's preparations for war—potentially involving nuclear, biological and chemical

(NBC) weapons—with the Soviet Union and its allies. While the European institutions retained their interest and involvement in matters of nuclear security, their perspective and contribution were generally understood to be those of a 'civil' or 'soft' power concerned principally with the civil nuclear energy fuel cycle.

With the ending of the cold war in the late 1980s/early 1990s, the strategic context which had dominated for so long began rapidly to lose its credibility and authority. At the same time, a shift began in the European institutions' perceptions and expectations in matters not just of nuclear but also of biological and chemical security. The established interest with and competence in supposedly peripheral and low-level aspects of the civil nuclear fuel cycle now took on greater significance, with the realization that inadequate controls and unauthorized access to nuclear materials represented an urgent proliferation and security risk.

With its regulatory authority in most areas of European industry and research and development, it also became clear that the European Community was in a particularly good position to address the growing concern with the diffusion of dual-use technology (i.e., technology suitable for both civil and military applications, a concept discussed further below). Between 1991 and 1994 a dual-use export control system was developed that was at first based on two documents: EU Council Regulation 3381/94 of 19 December 1994 setting up a Community Regime for the control of exports of dual-use goods**;** and EU Council Decision 94/942/CFSP of 19 December 1994 on the Joint Action adopted by the Council on the basis of Article J.3 of the Treaty on European Union concerning the control of exports of dual-use goods. This initial framework, which took effect in 1995, was thoroughly revised and updated in 2000 and has been further modified since.[1]

The early 1990s also saw concerted efforts in some quarters to realize a long-standing aspiration for the EU to become a credible and competent actor in various aspects of international security, including defence.[2] The 1991 Maastricht Treaty on European Union established a Common Foreign and Security Policy (CFSP) as a 'pillar' of the EU and included in the mandate for the CFSP 'all questions related to the security of the Union, including the eventual framing of a common defence policy, which might in time lead to a common defence'. The Maastricht Treaty was in many respects the beginning of a lengthy and often deeply contentious process which, a decade and more later, had given rise to the beginnings of a discrete EU 'strategic culture'. But more importantly, at least for the purposes of this paper, by creating the CFSP the Maastricht Treaty acknowledged the danger of NBCR proliferation and committed the EU to an ever closer involvement in non-proliferation policy, making non-proliferation a 'central area of the CFSP' and resulting in the systematic inclusion of non-proliferation issues as a routine item at summit meetings.

As the 1990s progressed it became steadily clearer that the EU was responding to the mood of the moment—reflected in declarations made by the United Nations and other international bodies—to the effect that the proliferation of weapons of mass destruction (WMD) was, by its very nature and with no need of elaboration, a threat to global and therefore European security. Furthermore, EU pronouncements on the subject of proliferation revealed the growing conviction that the EU by now had the credentials and the competence to deliberate and even to act in the field of non-proliferation.

[1] The basis for the control system is now unified in Council Regulation (EC) no. 1334/2000 setting up a Community regime for the control of exports of dual-use items and technology in its most recently amended form.

[2] Bailes, Alyson J. K., *The European Security Strategy: An Evolutionary History*, SIPRI Policy Paper no. 10, Stockholm, Feb. 2005, URL <http://www.sipri.org>.

In the wake of the terrorist attacks in the United States on 11 September 2001 there was an additional change in the character of EU statements. In its statements the EU continued to draw attention to proliferation that had previously been a cause for concern, in particular in the Middle East, South Asia and East Asia. Moreover, in articulating a response, the need for proliferation of WMD to be fought through international governance based on generally binding and transparent rules was a strong theme. However, the risk that such weapons and their delivery vehicles could fall into the hands of non-state-actors now became a prominent theme.

After 11 September 2001 both the tone and the substance of EU interest in non-proliferation changed dramatically. Speeches and declarations became far more urgent, while substantially the threat of terrorist use of WMD, which had always been widely acknowledged within the EU and elsewhere, albeit largely in terms of a 'nightmare scenario', now came to the fore. The changing mood within the EU is most clearly revealed in a series of key documents.

Shortly after 11 September 2001, the EU's General Affairs Council made an explicit connection between non-proliferation, disarmament and arms control and the 'global fight against terrorism'. In order to reduce the 'risk of non-state actors gaining access to weapons of mass destruction, radioactive materials and means of delivery', the Council launched a 'targeted initiative' to address the implications of the terrorist threat on the non-proliferation, disarmament and arms control policy of the EU.[3] The initiative would, *inter alia*:

- strengthen non-proliferation, disarmament and arms control regimes and initiatives;
- strengthen EU export control systems;
- help other states to manage and/or reduce stocks of NBC weapons, and associated materials; and
- seek 'enhanced political dialogue' with third countries in order to promote 'non-proliferation, disarmament and arms control policies as a means of combating terrorism.'

The initiative was subsequently amplified in the form of a comprehensive and ambitious implementation plan, announced in April 2002. The new plan committed the 'EU as such and its Member States' to as many as 42 separate 'concrete measures', ranging from promotion of the International Atomic Energy Agency (IAEA) safeguards system, support for 'the inclusion of "prevention of terrorism" in the objectives of export control regimes and arrangements', assistance in the disposal of nuclear, biological and chemical weapons and materials, and intensification of 'the political dialogue on disarmament, arms control and non-proliferation, in particular with countries in Asia and the Middle East'.[4]

In April 2003 the Council instructed Javier Solana, the Secretary General/High Representative (SG/HR), working with the Commission and the Political and Security Committee (PSC), to revisit the problem of NBCR proliferation and to submit proposals for consideration by the European Council. The first result of this exercise was a document entitled Basic Principles for an EU Strategy against Proliferation of Weapons

[3] 'Implications of the terrorist threat on the non-proliferation, disarmament and arms control policy of the EU', General Affairs and External Relations Council, Council Conclusions, 15 Apr. 2002, URL <http://europa.eu.int/comm/external_relations/cfsp/intro/gac.htm#sd150402a>.

[4] 'Implications of the terrorist threat on the non-proliferation, disarmament and arms control policy of the EU' (note 3).

of Mass Destruction, published in June 2003.[5] While many of the 13 principles address the means by which proliferation could be slowed or reversed, the document also provides important indications as to the evolving EU NBCR threat assessment. In this regard, the first two principles merit quotation in full:

> 1. The proliferation of all weapons of mass destruction (i.e., biological, chemical and nuclear weapons) and means of delivery such as ballistic missiles constitutes a *threat to international peace and security*. These weapons are different from other weapons not only because of their *capacity to cause death on a large scale* but also because they *could destabilise the international system*. [Emphasis added]
> 2. The acquisition of WMD or related materials by *terrorists* would represent an *additional threat* to the international system with potentially uncontrollable consequences. Armed with weapons or materials of mass destruction terrorists could inflict damage that in the past only states with large armies could achieve. [Emphasis added]

Elsewhere, the document makes a particular case for addressing the risks of proliferation in the Mediterranean area, given that 'security in Europe is closely linked to security and stability in the Mediterranean' (Principle 11). And in the clearest indication so far of the EU's mounting self-confidence as an actor in the field of non-proliferation, the third principle not only refers to an 'EU strategy against the proliferation of WMD', but also insists that such a strategy should be based upon a 'common assessment of global proliferation threats'—the responsibility for which will lie with the EU Situation Centre. The Basic Principles were accompanied by an Action Plan, published the same day. The Action Plan was intended to provide a practical framework for activity, with proposals for both the immediate and the longer term, and was intended to complement the 'concrete measures' set out in April 2002.

Within days, the focus and priorities of the EU's evolving NBCR threat assessment became clearer still at the meeting of the European Council in Thessaloniki, Greece, on 19–20 June 2003. At Thessaloniki, leaders of EU governments endorsed a Declaration on Non-Proliferation of Weapons of Mass Destruction which had been adopted some days earlier by the General Affairs and External Relations Council.[6] The Thessaloniki Declaration used very direct language in its assessment of the threat to the EU:

> 1. The proliferation of [WMD] and means of delivery such as ballistic missiles is a *growing threat to international peace and security*. A number of states have sought or are seeking to develop such weapons. The risk that *terrorists* will acquire chemical, biological, radiological or nuclear materials adds a *new dimension to this threat*. [Emphasis added]
> 2. The European Union cannot ignore these dangers. WMD and missile proliferation puts at risk *the security of our states, our peoples and our interests around the world*. … [Emphasis added]

Following the appointment in October 2003 of Ms Annalisa Giannella as Personal Representative of the SG/HR in matters of NBCR non-proliferation, the EU's public position concerning the threat from NBCR was given its clearest and most urgent exposition in the form of the EU Strategy against Proliferation of Weapons of Mass Destruction (the WMD Strategy), agreed by the European Council on 12 December

[5] The Basic Principles and the Action Plan are available at <http://www.sipri.org/contents/expcon/eu_wmd.html>.

[6] The Declaration on Non-Proliferation of Weapons of Mass Destruction agreed in Thessaloniki is available on the web site of the Council Secretariat at <http://ue.eu.int/cms3_fo/showPage.asp?id=718&lang=en&mode=g>.

2003.[7] The document began by making the general case against the proliferation of NBCR and their means of delivery, describing them as 'a growing threat to international peace and security'. As in past documents, the Strategy noted that 'a number of states' were responsible for NBCR proliferation and added that the possibility that terrorists might acquire 'chemical, biological, radiological or fissile materials and their means of delivery' added a 'new critical dimension' to the NBCR threat. Using the 'security… peoples… and interests…' language of the Thessaloniki Declaration (see above), the introduction to the EU strategy made clear that the general, international threat from NBCR proliferation and possible terrorist acquisition was neither remote from the EU, nor optional in policy terms. The nature of the NBCR threat to the EU is set out clearly in two paragraphs of the first chapter of the strategy paper:

> 10. All such weapons could directly or indirectly threaten the [EU] and its wider interests. A WMD attack on the EU's territory would involve the risk of disruption on a massive scale, in addition to grave immediate consequences in terms of destruction and casualties. In particular, the possibility of WMD being used by terrorist present [*sic*]a direct and growing threat to our societies in this respect.
>
> 11. In areas of tension where there are WMD programmes, European interests are potentially under threat, either through conventional conflicts between States or through terrorist attacks. In those regions, expatriate communities, stationed and deployed troops (bases or external operations), and economic interests (natural resources, investments, export markets) can be affected, whether or not specifically targeted.

But the strategy paper also seeks to develop a broader and more sophisticated understanding of the NBCR threat. Thus, the paper notes that NBCR proliferation takes place 'outside the current control regime' (paragraph 4). The implication here is that 'threat' is to be understood not only in the traditional sense of an antagonist's intentions and capabilities, and our own vulnerability to the acquisition and misuse of NBCR by undesirable states and groups, but also more structurally, as an indication of the limitations of the established control and management regimes. In other words, assessment of the NBCR threat internationally and to the EU should encompass not only what *can* be done by deviant states and groups, but also what *cannot* properly be done by the international community and the institutions and members of the EU.

In a related fashion, the paper points to the problem of access to 'materials, equipment and know-how' that are 'dual use', that is have both legitimate civilian and illegitimate NBCR applications. This has long been understood to be a particular problem in respect of chemical weapon-related technology, but it is relevant across the NBCR spectrum. The spread of technology and know-how also presents a problem in the form of delivery systems, ranging from ballistic and cruise missiles to unmanned aerial vehicles (UAV), which the paper acknowledges to be a growing cause of concern.

The traditional understanding of non-proliferation has been linked to preventing the spread of weapons in militarily significant quantities to the armed forces of states. However, the documents of the European Union suggest that a more modern approach is being adopted in light of the need to combat current security problems.

The EU non-proliferation agenda includes measures aimed to address problems of the traditional kind, notably by actions intended to strengthen regimes and export controls. However, the WMD Strategy and the statements and declarations which precede it suggest that the NBCR proliferation threat to the EU is regarded as complex and multi-

[7] The Strategy against Proliferation of Weapons of Mass Destruction is available on the web site of the Council Secretariat at <http://ue.eu.int/cms3_fo/showPage.asp?id=718&lang=en&mode=g>.

faceted, with different aspects of the threat requiring different levels and styles of policy response. Based on an assessment of existing statements and documents, it can be argued that from the EU perspective, elements of the NBCR threat are as follows.

Global/general threat. At the most general level, the proliferation, illegitimate possession and use of NBCR can be understood to represent a latent or actual threat to international peace and security, with implications for the EU as a large and active element of the international political and economic system.

Threat to norms and regimes of non-proliferation. There are now a significant number of cases where states have carried out activities that are prohibited in arms control treaties and agreements to which they are parties. Moreover, in a number of cases these prohibited activities have gone undetected over an extended period. For example, Soviet non-compliance with the Biological and Toxin Weapons Convention (BTWC) was not confirmed for many years in spite of the massive cold war intelligence effort. In other cases—such as North Korean non-compliance with the (nuclear) Non-Proliferation Treaty (NPT)—the exposure of the violation and its subsequent discussion in the UN Security Council did not lead to any satisfactory resolution of the compliance problem. NBCR proliferation provides compelling evidence of the inadequacy of non-proliferation regimes and the need to reinforce them. In this regard, a 'worst-case analysis' might run as follows: if regimes and norms cannot be reinforced, and if their value as a source of security becomes progressively more questionable, then at some point the norms against proliferation might be reversed, with states arguing that the norm for security in a world with CBRN is proliferation, rather than non-proliferation.

Neighbourhood/regional threat. NBCR proliferation, and associated concerns, could give rise to a threat to peace and stability in certain regions bordering or close to the EU, such as the Mediterranean littoral, inviting EU interest and involvement, certainly diplomatic and economic and perhaps also military.

Direct/physical threat. EU member states could face a specific threat of NBCR use (or blackmail) from either state or non-state actors, as a result of past or present policies, current political loyalties and trading ties. The institutions of the EU could be said to be threatened for broadly similar reasons.

Remote/physical threat. EU representatives and personnel (civilian and military) deployed on mission could face the direct threat of low-level NBCR use against their facilities, installations and positions, or could be threatened indirectly by damage and pollution through unintended proximity to NBCR use.

Indirect threat to EU interests. The institutions and member states of the EU have a range of political and economic interests around the world which could be disturbed or undermined by instability associated with NBCR proliferation.

Reputational threat. Having for several years had the goal of becoming a more coherent and effective actor in matters of foreign, security and defence policy, having described themselves as threatened by NBCR, and having committed themselves publicly, in documents and declarations, to countering that threat, the institutions and member states of the EU run the risk of having their reputation and credibility as actors in the field of international security undermined.

Threat of accident. Unsafe storage and management of NBC facilities and material could represent a general hazard to which EU citizens might be exposed. Such accidents could occur during attempted terrorist attacks or as a result of efforts to steal or smuggle material.

3. Threats, hazards and risks

The traditional approach to threat assessment based on evaluating the capabilities and intentions of known adversaries has serious limitations under the current circumstances. The near impossibility of knowing the antagonist reduces the opportunity to try and understand and analyse intentions. The fact that 'weapons' as that term has come to be understood are no longer the only (and may not be the most important) capability in the hands of adversaries further complicates applying the traditional approach.

The question of vulnerability has always been a component of 'threat perception' in that it has been taken into account (sometimes implicitly) as an aspect of enemy capability. To illustrate, an antagonist's missile capability is only a concern to the extent that there would be undefended cities that could be hit by them. However, in present conditions this problem is of a different scale in that modern societies might have what can be termed 'structural vulnerability' because recent events suggest that anyone with the intent and the basic commodities could mount an NBCR attack somewhere in the EU. The decision about how to approach reducing the risk of such attacks is important because the wrong strategy could lead to the squandering of huge amounts of resources or to failure to prevent a high-impact attack or both. At the same time, the fact that the elements needed to mount an attack are dual-use in nature means that a strategy based on complete denial of access to them is neither feasible nor desirable.

The dual-use character of proliferation-sensitive materials and technologies

In discussions of non-proliferation controlled access to dual-use technologies is the main focus since transfers of the complete, operational nuclear, biological or chemical weapons themselves are are highly unlikely to occur. Dual-use technology is not a threat in and of itself, and denial of access to dual-use technology is only sought where the technology concerned is going to be misapplied or where the risk that it will be misapplied is unacceptably high. In discussing how to measure technology transfer, Erkko Autio and Tomi Laamanen have defined technology as 'the ability to recognize technical problems, the ability to develop new concepts and tangible solutions to technical problems, the concepts and tangibles developed to solve technical problems, and the ability to exploit the concepts and tangibles in an effective way'.[8] This definition captures the notion that technology consists of more than equipment or tangible items.

Jordi Molas-Gallart has noted that the definition supplied by Autio and Laamanen can provide 'a framework to study the variety of skills, materials, artefacts, and knowledge that can be applied to develop solutions that satisfy both military and civilian requirements'.[9] This definition of technology captures physical items (i.e. equipment) under the notion of 'tangible solutions to technical problems'. However, Molas-Gallart notes that 'hardware alone is not enough to solve problems and satisfy the requirements of sections of our societies. Technical problems must be properly recognized, solutions developed, and once such a solution has reached the product stage, the users will often require specialist knowledge and skills to exploit it efficiently.' Applying the definition in regard to security-relevant technology therefore expands the envelope of the dual-use

[8] Autio, Erkko and Laamanen, Tomi, 'Measurement and evaluation of technology transfer: review of technology transfer mechanisms and indicators.' *International Journal of Technology Management* 10 (7/8 1995), pp. 643–64.

[9] Molas-Gallart, Jordi, *Dual use technologies and the different transfer mechanisms*, Complex Product Systems Innovation Centre (COPS), COPS Publication 55 (26 Aug.–2 Sep. 1998), p. 2, <http://www.cops.ac.uk/pdf/cpn55.pdf>.

concept to include the people (scientists and technicians) who have the knowledge and skills needed to develop and efficiently deploy weapons.

If the idea of dual use is regarded as an intrinsic property of technology—that is, something that stems from the potential uses of the item based on its technical characteristics—then, contrary to what was said above, technology itself would become a threat, and according to this logic all technology must be controlled. However, applying this approach to underlying technologies in regard to WMD proliferation means continuous tension because many of the technologies themselves cannot be banned and their control is inherently difficult. It has often been pointed out that a contentious dual-use control issue generally arises when the attempt to control a particular technology for security-related reasons confronts the non-military (often commercial and/or scientific) interest in acquiring such technology. The need for a control system to balance the security and commercial imperatives has been a consistent issue in export controls, for example. This issue can also emerge as a confrontation between different vested interests where non-prohibited activities being carried out in civilian facilities need to be verified and where there is a need to prevent inadvertent assistance to prohibited activities—something that happened in the discussion of a verification system for the BTWC.

Following Molas-Gallart, it can be stated that technology is the ability to recognize technical problems, the ability to develop new concepts and tangible solutions to technical problems, the concepts and tangibles developed to solve technical problems as well as the ability to exploit the concepts and tangibles in an effective way. However, Jean Pascal Zanders has noted that an additional factor is also important, namely the context in which items are to be used.[10] This is the factor underpinning the 'end-use' controls that are now applied to the export of dual-use items. According to this approach the use to which an item will be put is the main characteristic determining its military or civilian classification and not its technical characteristics.

In the past this element of context was provided by the risk of clashes between organized armed forces using weapons. These weapons are obviously classified as single-use rather than dual-use. Within this frame of reference it has usually been thought that a particular material should have certain characteristics to be useful as a weapon. It is not enough for a material to be lethal or destructive in order to be selected for weaponization. To be attractive to a military user the material needs to be stable enough to resist a reduction of its effect during handling and storage as it is unlikely to be used immediately after production. The results of using the weapon should be predictable under different climatic and geographical conditions and against different kinds of target.

Once the material to be used in the weapon has been identified, it must be possible to produce, process and shape it into forms that can be filled into munitions or other delivery systems, or to be held ready for such filling. The process of filling and storing weapons and then transporting them and using them must be possible to undertake without too great a risk to its possessor. In the context of the 'new terrorism' none of the above factors might apply when materials are being selected for use in an attack. The classification of an item as a 'weapon' is only loosely connected to its technical properties and becomes heavily dependent on the intentions of the actor that acquires it (whose identity could be unknown in advance of an attack).

[10] Zanders, Jean Pascal, 'Biological weapons, dual-use technologies, and the non-proliferation paradigm', presentation to the COST A24, Working Group 1: Proliferation and Weapons of Mass Destruction Meeting, SIPRI, 11 Nov. 2005.

In this context Roger Roffey has pointed out that because of their characteristics biological threats, whatever their nature, should be seen as risks to be managed rather than problems to be solved.[11] There is no comprehensive inventory of locations where biological agents are being isolated, produced, held and used. However, Roffey notes that dangerous pathogens are distributed globally and it can be stated with certainty that they are held in thousands of laboratories, clinical facilities or commercial companies. The biological agents and toxins can be in a number of places in a facility if they are used or being studied in addition to where pure cultures are stored in freezers and so on. Apart from these stocks, which could in theory be catalogued, although this would be a very large task to perform, biological agents can, in many cases, be isolated from nature.

Roffey also points out that since micro-organisms are self-replicating, maintaining and updating a catalogue of agents would be a formidable challenge since only extremely small quantities are required to permit mass production given the right growth conditions. Furthermore, the approaches for handling biological material are frequently somewhat different for human, animal and plant pathogens and for toxins. Therefore if the threat of malicious use is extended beyond attacks against people to include attacks against plants and animals the magnitude of the task becomes even greater.

Chemical agents that have been identified with a risk of terrorist use include choking agents such as phosgene, chlorine, oxides of nitrogen and sulphur dioxide. These are extremely common industrial chemicals that are in very widespread use throughout the world. They are produced in many places and in large quantities. Heavy restriction of their use would be a serious impediment to the civilian chemical industry and could add significantly to the cost of many everyday products.

In their background paper on the security of high-activity radiological sources Maurizio Martellini and Kathryn McLaughlin of the Landau Network–Centro Volta explain that ‘there are hundreds of thousands of radiological sources currently in use in scientific and commercial activities worldwide, ranging from nuclear medicine and pharmaceuticals to geological activities. These sources pose varying degrees of proliferation risk according to their level of radioactivity and their relative sizes’.[12] Moreover, Martellini and McLaughlin note that, although the vast majority of civilian-use radioactive sources are controlled by their users in line with government regulations and reach the end of their working lives without incident, at which point they are subject to safe and secure disposal, not all users manage sources in line with the highest international standards. In some cases redundant radioactive sources are simply abandoned without further control. Furthermore, in Europe large numbers of ‘orphaned’ high-activity radiological sources are regularly either reported missing by their users or recovered by national authorities in spite of never having been reported missing.

Radiological terrorism requires little technical knowledge, and this might make radiological terrorism appear an attractive option for sub-state actors. Nuclear terrorism—that is, obtaining or constructing a device that produces a nuclear explosion—requires great technical expertise and access to specific types of material (highly enriched uranium (HEU) or certain types of plutonium) that are not easy to obtain. Carrying out an act of radiological terrorism would require less expertise and could involve a much wider range of more easily accessible materials.

[11] See background paper 4.
[12] See background paper 3.

Radioactive sources differ greatly in their size and level of radiation. Some may be big, heavy and unwieldy and some may be easy to detect because they emit radioactivity. However, there are other types of radioactive sources that are small (e.g., Martellini and McLaughlan note that tubes of caesium can be only three-quarters of an inch long by one-eighth of an inch wide), they may be in powder form (making them relatively easy to disseminate over a wide area if packed into a 'dirty bomb') and they may be difficult to detect due to minimal alpha and beta emissions (such as plutonium).

Intention assessment

There is not complete agreement that it is an issue of when, as opposed to whether, sub-state actors will obtain NBCR capabilities. There have been documented cases in which sub-state actors have tried to develop biological, chemical and radiological capabilities but have not succeeded. There are also a smaller number of cases of such capabilities being developed and used. There has not been any case of a nuclear explosive device being successfully developed or used by a non-state actor.

In terms of the distribution of cases, most have involved the use of chemical and biological devices while the use of radiological weapons is comparatively more rare. It is not possible in this paper, however, to settle the dispute between those who argue the threat posed by these weapons and those who argue that there are no clear indications as to the intent of these groups to acquire such capabilities.

The data published by the Monterey Institute of International Studies suggest that between 1975 and 2004 there were around 50 incidents involving radiological material, compared to over 300 involving chemical agents and almost 100 involving biological agents.[13] On closer examination, the majority of all of these recorded incidents seem to be cases in which individuals have carried out attacks for a variety of motives. Sometimes these have been criminal acts carried out for personal gain of one or another kind; in other cases they seem to reflect the behaviour of disturbed individuals. Only in a very few cases could the events be attributed to non-state actors seeking to commit acts of mass-impact terrorism.

In discussions of mass-impact terrorism it is often stated that the prevailing view held among analysts of 'classical' terrorism—that the objective of attacks is to gain an audience and not to bring about large-scale killing or destruction—does not hold good for the 'new' terrorism. According to this analysis the classical model may only hold for secularly motivated terrorist organizations and not to religious fundamentalists or extremist groups with malign intent. It has been argued in some of these accounts that, although the new terrorist groups do not make up a single body and are separate organizations, they do have certain common features that link them. These features include a deliberate quest to acquire or develop high-impact weapons; a willingness to accept martyrdom; and a perception that the only 'audience' worth having is a deity.

There is disagreement in the current analytical literature about whether mass destruction and mass casualties are necessary elements of mass-impact terrorism. Some analysts point to recent attacks as evidence that groups will continue to escalate their attacks in order to maintain the element of shock and that this will inevitably translate into a more determined pursuit of WMD. The attacks on children at a school in Russia are put forward as an example of terrorist groups escalating attacks in order to maintain the shock value of their campaign. Other analyses point to different ways in which terrorists might seek to make a mass impact. The economic and psychological impact of

[13] These data is discussed further in background paper 3.

using non-conventional weapons might be sufficient to achieve the objective without either high lethality or widespread destruction.

The use of certain types of biological agents (like ricin) or high-activity radiological sources in a 'dirty bomb' could fit the pattern of attacks relying on a 'shock factor' to cause psychological, political and economic damage to the affected state since in these cases neither lethality nor destruction would be severe. Moreover, the range of different types of attack that could be mounted to achieve these results is not confined to WMD. Attention has been drawn to the risk of attacks on the electronic systems and networks that modern, advanced societies depend on for their efficient functioning. Attacks on such systems and networks might be attempted or made through the pursuit of electronic warfare capabilities (such as electro-magnetic pulse weapons) or through so-called 'cyber-attacks' on information networks. Another form of attack that has attracted attention is the possible use of small, man-portable weapons to mount a number of simultaneous attacks on civilian airliners in flight (an attack on an individual airliner has already happened on at least one occasion).

4. The nature and availability of NBCR materials and technologies

This section will briefly review information about the nature and availability of NBCR materials and technologies. Following from the discussion above about the dual-use problem associated with proliferation, it is clear that this cannot be a comprehensive analysis in regard to materials that might be relevant to the discussion.

The difficulties of identifying the location of chemicals and biological agents that could be proliferation-sensitive are formidable. As noted above, there are legitimate uses for many of the chemicals and agents that could be relevant. Chemicals are in widespread use at many locations. The number of pathogens and toxins in use at any time is not known and there is no inventory of locations where collections are kept.

The global chemical industry of relevance to the Chemical Weapons Convention (CWC) is subject to inspection by the Organisation for the Prohibition of Chemical Weapons (OPCW) and the declaration and inspection mechanisms have led to systematic engagement with the chemical industry that could be the basis for a dialogue on chemical terrorism. The use of and trade in chemicals that could be the precursors of chemical weapons (CW) are carefully monitored under the treaty. However, this verification system was designed to detect the acquisition of militarily significant stockpiles of CW intended for battlefield use. The verification system is not a comprehensive monitoring of the chemical industry. Moreover, a number of countries remain outside the CWC and are therefore not part of the verification system. There is no verification system for biological weapons (BW).

In the nuclear field a limited range of materials can be used to make a device that could cause a nuclear explosion. Fissile materials are isotopes that can sustain a chain reaction in either a reactor or a bomb, but for military or terrorist purposes only some fissile materials can be used to produce a nuclear explosion (HEU, i.e. with more than 20 per cent uranium-235 or more than 12 per cent uranium-233, or weapons-grade plutonium, i.e. with less than 80 per cent plutonium-238), plutonium-239 and plutonium-241).[14] This technical characteristic limits the task of monitoring stocks of

[14] von Hippel, Frank, 'Global stocks of fissile materials', NUPI, Conference on Managing Nuclear Material Stockpiles in the 21st Century, Oslo, 3 Mar. 2005.

fissile material. Nevertheless, the task remains formidable and no comprehensive inventory of HEU and plutonium in the world has yet been undertaken.[15]

Nuclear-related

The information available in the public domain suggests that North Korea is the only country that does not possess a deployed nuclear arsenal that is actively seeking nuclear weapons. Two countries, India and Pakistan, have recently deployed small nuclear arsenals and both are increasing their weapon stockpiles to the levels they believe they require for a minimum deterrent.

A larger number of states are believed to be holding open the technical option of a future nuclear weapons programme by developing a nuclear research capacity and an industrial base sufficient to acquire HEU or plutonium—the fissile materials that are the basic elements of all existing nuclear weapons.

While large commercial enrichment facilities are to be found in China, France, Germany, the Netherlands, the United Kingdom (UK), the USA, and Russia, other countries with a smaller but active uranium enrichment capacity include Argentina, Brazil, Iran, India, Israel, Japan and Pakistan. Moreover, other countries have carried out experiments and developed technologies and processes to the point where they can be said to have a working understanding of uranium enrichment. Australia, South Africa and South Korea and almost certainly Taiwan also fall into this category.

A number of countries also operate facilities at which the chemical separation of plutonium and HEU from other fission products contained in spent nuclear fuel takes place. All the states that have or are suspected to have nuclear weapons (including India, Israel, Pakistan and North Korea) have reprocessing facilities, as does Japan. Other countries that pursued nuclear weapons but subsequently abandoned their programmes (including Argentina, Brazil, Egypt, Iran and South Korea) have also researched and in some cases actively developed reprocessing technologies and processes.

The level of concern over the risk that non-state actors would use fissile materials to make an improvised nuclear explosive device that could be used in a nuclear terrorist attack has risen in recent years following the documentation of efforts by Islamic extremist groups, including al Qaeda, to acquire relevant knowledge and materials.

As noted above, there is no comprehensive global inventory of fissile material and it is not known how much fissile material has been made in the past, who made it and where it is currently located. However, it is beyond dispute that very large quantities of the materials that would be needed to construct such a device, HEU or plutonium, exist. By far the largest stocks of HEU—roughly 90 per cent of world stockpiles—are contained in the military inventories of states with nuclear weapons. In the case of plutonium stockpiles the balance is probably reversed, with more than 90 per cent of the global inventory contained in civilian stockpiles. Concerns about the security of stocks of all fissile material (HEU, whether in the custody of the military or with civilian users, as well as both weapons-grade and reactor-grade plutonium) have been expressed, and in a number of cases the level of concern about nuclear security has raised fears about the risks from nuclear terrorism.

[15] The nearest things that exist to a comprehensive inventory have been produced by non-governmental sources. See in particular Albright, David, Berkhout, Frans and Walker, William, SIPRI, *Plutonium and Highly Enriched Uranium 1996: World Inventories, Capabilities and Policies* (Oxford University Press: Oxford 1997) and subsequent updates on the web site of the Institute for Science and International Security (<http://www.isis-online.org/global_stocks/end2003/tableofcontents.html>).

While the use of a radiological dispersal device (or 'dirty bomb') by the armed forces of a state has been more or less discounted as a threat, there is also considerable concern about the risk that such devices could be used in terrorist incidents. A dirty bomb would not cause destruction through a nuclear explosion but rather spread radioactive material, for example by the combination of radioactive material with conventional explosives. This kind of device, which kills or injures either through the conventional explosive blast or by the effects of radiation and contamination, would not cause mass destruction but could have a very damaging economic and psychological impact. There are credible public reports that such devices were constructed by al Qaeda for experimental purposes in Afghanistan. There are also unconfirmed reports that efforts to mount attacks with these weapons in the United States and in Europe have been thwarted by security services.

Chemical weapon-related

Most of the information on chemical weapons arsenals has been contained in reports submitted to the OPCW by states that joined the CWC. In all, 13 states have reported that they have had active CW programmes in the past. Altogether, these states have identified roughly 65 facilities where chemical weapons were produced. The 13 states are Albania, Bosnia and Herzegovina, China, France, India, Iran, Japan, Libya, Russia, South Korea, the UK, the USA, and Serbia and Montenegro. In addition three states (China, Italy and Panama) have declared that there are usable stocks of CW on their territory that were abandoned by another state without permission. To this list can be added Iraq, not a member of the CWC, whose CW programme was uncovered and destroyed by the UN Special Commission on Iraq (UNSCOM) during the 1990s.

In addition, four states—Egypt, Israel, North Korea and Syria—that have not joined the CWC are very strongly suspected to have had or still to have undeclared chemical weapon arsenals. Israel has signed but not ratified the CWC. While it is often reported that Israel no longer maintains a CW stockpile ready for use, it is widely believed that the capability to re-start production at relatively short notice has been retained.

Countries alleged in open sources to have or to have had CW programmes are Algeria, Cuba, Ethiopia, Pakistan, Sudan and Viet Nam. All these countries have signed and ratified the CWC. Most of the allegations about them have originated in unclassified material published by the United States Government.

The growing concern about mass-impact terrorism has led to a number of analyses of potential threats from attacks with hazardous materials not normally considered to be weapons. The risk that toxic chemicals that are not considered chemical weapons could be used in acts of mass-impact terrorism has been considered. Exercises involving industrial chemicals such as ammonia, chlorine or sulphur dioxide suggest that under certain conditions attacks with hazardous materials could cause very high casualties and/or extreme disruption. However, the widespread availability and frequent peaceful use of these chemicals suggest that an effective response to the threat of chemical terrorism cannot be based on traditional arms control approaches of elimination, limitation or denial.

Biological weapon-related

States are not prohibited from developing effective defences against attack by biological weapons. The technologies on which effective defences are based (including those used

for testing defensive equipment) are recognized to be similar to those that would also facilitate an illegal offensive BW programme. Therefore the proliferation risk associated with bio-defence programmes could not be based on a technical assessment alone. Judging proliferation risk would also revolve around the degree to which a state intends to develop and use BW, and the extent to which states develop the doctrine, operational art and capability (consisting of trained forces in being and appropriate delivery systems) that would be needed for effective military use of BW. At present no country is known to have developed such a combination of doctrine, tactics, trained forces in being and delivery systems.

A small number of countries, including Canada, France, Iraq, the former Soviet Union, the UK and the United States, are known to have manufactured biological weapons in the past. While all these programmes are believed to have been eliminated, the lack of a verification system for the BTWC makes it impossible to make a definitive statement to that effect. In the case of Iraq, the BW programme was uncovered and eliminated by UNSCOM. In the case of Russia, as the successor state to the former Soviet Union, there are still serious questions about when and how the illegal and clandestine BW programme, which continued until at least 1993, long after the Soviet Union signed and ratified BTWC, was eliminated.

Two countries, Israel and North Korea, are often claimed in open sources to have BW. However, for both of them the open-source descriptions of the respective programmes are inconsistent and in some ways contradictory. In each case there is a broad consensus that specialized institutes have carried out research into biological warfare.

In the light of the new threats identified by states and by the EU, increased attention has focused on the risk that a non-state actor would deliberately spread disease in order to carry out a mass-impact terrorist attack. If the objective of the attack was mass disruption, the attempt might include diseases that affect humans, plants or animals.

The risk of such attacks is real. It is known from information in the public domain that al Qaeda carried out experiments in Afghanistan with botulinum toxin and ricin as well as chemicals (potassium cyanide, hydrocyanic acid and chlorine). Moreover, there have been a number of actual attacks by groups (such as the Aum Shinrikyo in Japan) and individuals in the United States and elsewhere. However, thus far there is no evidence that groups have succeeded in developing biological instruments that would cause mass destruction or mass disruption.

Delivery systems

Weapons are designed to cause injury or death to people or damage to material. They may include bombs and warheads, grenades, munitions, mines, depth charges or demolition charges. However, if weapons are to fulfil their purpose (whether that is the actual use or the threatened use) it must be possible to deliver them to the target that the user intends to destroy.

Weapon delivery systems may be of different types. They may be guided and ballistic missiles, field artillery, mortars, rockets, guns, torpedoes, clusters and dispensers. Historically all of these systems have been developed by one or more countries to deliver nuclear, biological or chemical weapons. These delivery systems may in turn be carried by platforms of different kinds to a place where their designated targets are within range. Platforms may include manned or unmanned aircraft, land vehicles, ships or submarines.

In many contexts the possession of weapons, delivery systems and weapon platforms creates a potential security problem but not one that is connected to weapons of mass destruction. In the context of WMD the problem is created when the weapon delivery system is under the control of a user with access to NBC. There may also be a WMD-related problem if a country that does not have but is suspected to be developing NBC weapons is also developing systems that might be used to deliver a future arsenal of weapons.

All the delivery systems above have widespread military applications other than the delivery of weapons of mass destruction. However, concern over one particular class of delivery system—medium- and long-range ballistic missiles—has been highlighted by the international community. These systems were the focus for bilateral arms control between the United States and the Soviet Union because of their particular connection with delivering nuclear weapons and because they were not seen as particularly cost-effective means of delivering other types of weapons. The extended 'reach' that medium- and long-range missile delivery systems offer their possessors, combined with the fact that there is no effective defence against many of them after they have been launched, has also heightened concern about their proliferation.

The countries that have or are known to be in the process of acquiring ballistic missiles with ranges in excess of 1000 kilometres are China, France, India, Iran, Israel, North Korea, Pakistan, the Russian Federation, Saudi Arabia, the UK and the USA. From this it can be seen that, while missiles of different kinds are becoming a central element in the inventories of many armed forces, the list of countries that are known to be acquiring medium- and long-range ballistic missiles is rather short. In all cases except one (Saudi Arabia) the states acquiring ballistic missiles of this type either are nuclear-weapon states or have been identified as nuclear-weapon proliferation countr**ies** of concern.

It is extremely unlikely that a long-range ballistic missile could ever be used by a non-state actor. Acquiring and using the other delivery means for NBC weapons that have been developed by states for their armed forces would also present major challenges to non-state groups. It is likely that a more unconventional form of delivery would be used to commit a terrorist act involving chemical, biological, radiological or nuclear materials. The traditional state-centric objectives of non-proliferation and disarmament remain important. However, the threat assessment suggests that there is a need to supplement existing programmes with greater efforts to consolidate, secure and (in some cases) eliminate proliferation-sensitive materials. These efforts should become a more central element in threat reduction.

5. The acquisition of proliferation-sensitive material through trafficking

The discussion above highlights that there is a wide range of different materials of proliferation relevance that need to be taken into account and that many of them are available locally (i.e. within the European Union) as well as from international suppliers. However, the earlier discussion of intentions underlined that the existence of what are essentially dual-use materials does not in itself represent a proliferation problem. One particular set of data that does exist can be the basis of an assessment of material that is of clear proliferation concern—the data for illicit trafficking in nuclear materials. This information is of interest because it points to a demand for the materials by actors that are not able to acquire it by legitimate means—although not all of the customers for

illicit trafficking activities are engaged in proliferation**:** their motives may be purely criminal.

Illicit trafficking in nuclear materials

The IAEA has noted that 'illicit trafficking in nuclear materials is a potential threat to the security of states and international security. Nuclear trafficking could be a shortcut to nuclear proliferation and to nuclear terrorism. And loss or unauthorized disposal of nuclear material or nuclear waste may result in grave economic and environmental consequences'.[16] The trafficking network that has recently attracted most attention in the context of proliferation concerns has been the A. Q. Khan network, although the activities of that network appear to have been focused on trafficking knowledge and equipment rather than nuclear materials. In 2004 it was confirmed that Pakistan's most prominent nuclear scientist, Abdul Qadeer Khan, was behind an illicit nuclear trafficking network that was established and operated during the two decades that he spent as head of the Khan Research Laboratory.[17]

The existence of the network was revealed in October 2003, when Iran admitted to the IAEA that it had secretly imported centrifuge components from Pakistan. Libya's decision in December 2003 to abandon its WMD and missile programmes resulted in the disclosure of more detailed information about the network's activities and about individual suppliers.[18] The network's large numbers of sellers, middlemen and manufacturers and the complexity of their arrangements made it difficult to detect. However, similar operations have been discovered in the past. Iraq and South Africa both used labyrinthine procurement processes during the 1970s and 1980s to acquire the know-how, materials and equipment they needed to undertake weapons development.[19]

Reference to the 'Khan network' may seem misleading as it focuses too much on the role of one individual when in reality the network was international and relatively non-hierarchical. The key technology holders and several of its leaders, including Khan, were based in Pakistan, but other participants were operating in Europe, Dubai in the United Arab Emirates, Turkey, South Africa and Malaysia. The network also depended on a variety of unwitting manufacturing companies and suppliers on several continents.[20]

Other networks involved in WMD proliferation may include those concerned with drug trafficking, but this nexus is an issue that remains to be further studied.[21]

As noted above, the dual-use trafficking problem applies to the knowledge of people as well as to physical items. It has been noted that there can be no guarantee that

[16] IAEA, 'The IAEA Illicit Trafficking Database', 31 Dec. 2004, <http://www.iaea.org/NewsCenter/Features/RadSources/PDF/itdb_31122004.pdf>.

[17] Kile, Shannon, 'Nuclear arms control', in *SIPRI Yearbook 2005: Armaments, Disarmament and International Security* (Oxford University Press: Oxford 2005), pp. 552–55.

[18] Weiss, Leonard, 'Turning a blind eye again? The Khan network's history and lessons for US policy', *Arms Control Today*, Mar. 2005, URL <http://www.armscontrol.org/act/2005_03/Weiss.asp>.

[19] The disaggregated illicit procurement processes that the Iraqi regime practiced were a central focus of the UK's Scott Inquiry in 1996.

[20] Albright, David and Hinderstein, Corey, 'Uncovering the nuclear black market: Working toward closing gaps in the international nonproliferation regime', Institute for Nuclear Materials Management (INMM) 45th Annual Meeting Orlando, F., 2 July 2004, <http://www.isis-online.org/publications/southasia/nuclear_black_market.html>.

[21] Recent publications have questioned whether some of the personnel in the CW and BW programmes of apartheid's South Africa's Project Coast may have combined some of their proliferation activities with drug-related activities but this is far from confirmed.

scientists with relevant knowledge 'would refrain from selling scientific knowledge to proliferants ... there will always be someone willing to sell out to the highest bidder'.[22]

There are a number of sources of data on illicit nuclear trafficking. The IAEA Illicit Trafficking Database (ITDB) contains information about incidents of illicit trafficking and other related unauthorized activities involving nuclear and other radioactive materials. The ITDB was established in 1995 to facilitate exchange of authoritative information on incidents of illicit trafficking and other related unauthorized activities involving nuclear and other radioactive materials among states. The information in the database has been confirmed by the states involved, but this means that the fact that an incident is under investigation been confirmed, not that trafficking has taken place. The database includes incidents which involve the unauthorized acquisition, provision, possession, use, transfer or disposal of nuclear materials and other radioactive materials, whether intentional or unintentional and with or without crossing international borders, including unsuccessful and thwarted events. The scope of the ITDB also includes other related unauthorized activities involving nuclear and other radioactive materials. These include incidents involving inadvertent loss and discovery of such uncontrolled materials, such as 'orphan' sources.

The ITDB collects information from open sources, and through the collection and evaluation of such information the IAEA is alerted to nuclear trafficking events not yet reported through official channels. It provides additional material for analysis and a point of reference for alleged incidents. However, when the Secretariat obtains information from an open source, it seeks confirmation, or otherwise, from the IAEA Member State concerned before deciding how to use the data. Communication with participating Member States is maintained through the network of national Points of Contact (POCs). Meetings of the POCs are organized regularly to review the database operations.

Examining the most recent data available (from 1993 through December 2004) the ITDB contained 662 confirmed incidents. Of these 662 confirmed incidents, 196 involved nuclear materials, 400 involved other radioactive materials, mainly radioactive sources, 24 involved both nuclear and other radioactive materials, and five involved other materials.

While the data reported to the ITDB in 1993–2004 show a long-term downward trend in the occurrence of incidents involving nuclear materials, in 2004 the ITDB recorded an increase in the number of such incidents for the first time since 2000. However, none of these involved HEU or plutonium. Since 1993 there have been 18 confirmed incidents involving trafficking in HEU and plutonium—the last of them in 2003—and a few cases involved seizures of kilogramme quantities of weapons-usable nuclear material. Most incidents involved very small quantities, although in some incidents these were alleged to be samples of a larger quantity that was available for sale.

The majority of confirmed incidents involving nuclear materials recorded during the period 1993–2004 involved criminal activity, such as theft, illegal possession, illegal transfer or transaction. The geographical distribution of the data suggests that illicit trafficking is a global phenomenon. About 50 of the incidents in the database for the period 1993–2004 involved radioactive sources that would present considerable radiological danger if used in a malicious act. The overwhelming majority of these incidents were reported during the last six years.

[22] Alessi, Victor, 'The brain drain problem', in *Protecting against the Spread of Nuclear, Biological, and Chemical Weapons*, CSIS, Jan. 2003, URL <http://www.sgpproject.org/publications>.

The IAEA database is not the only source of information on nuclear trafficking. The Nuclear Threat Initiative (NTI) has released information compiled from the database maintained by the Monterey Institute for International Studies that details reported nuclear, radioisotope and dual-use materials trafficking incidents involving the countries that emerged on the territory of the former Soviet Union.[23] Background paper 3 on radiological security also contains some details of individual cases of trafficking.

This information tends to confirm the conclusion from the IAEA data**,** that incidents involving weapons-grade material are very few and were mainly taking place between 1992 and 1994. In that period there was a very serious trafficking problem, with at least seven unambiguous cases of diversion and recovery of weapons-usable nuclear material.

6. Conclusion

This paper has discussed the need to focus on the hazard or risk associated with certain materials in conditions where it is known that non-state actors are thinking about how to carry out acts of mass-impact terrorism. This approach needs to become an important supplement to the more traditional notion of analysing the threat posed by militarily significant quantities of weapons held by the armed forces of states. Nevertheless, this paper has put forward evidence that this traditional approach cannot yet be abandoned. Approaches to non-proliferation threat assessment must combine a range of different factors to make a modern and sophisticated analysis.

The need for a new approach to threat assessment also stems from the growing evidence of illicit trafficking in proliferation-sensitive items (knowledge, materials and equipment). Illicit trafficking networks are operated by criminals who are mainly motivated by commercial considerations. Therefore, the networks could be exploited by either state or non-state procurement efforts.

It has further been argued that this effort to make a new kind of assessment must distinguish between speculation concerning terrorists' *intentions*, disquiet over society's own *vulnerability* to such attacks, and hard analysis of terrorists' *capabilities* in the NBCR field.

Excluding the factor of intentions from the assessment leads to the discussion of worst-case scenarios whose distinctive feature is quite often that they are so awful or complex as to be unmanageable, and thus in a perverse way discourage activity when it is most needed. However, little if anything is known about the real intentions of groups such as al Qaeda, and what is known suggests that there is not much that could be done to modify their intentions. The 'new terrorism'/NBCR nexus embodies very complex policy challenges, but perhaps also represents something of an opportunity. Policy based on wild speculation about terrorists' intentions, even if responsive to public fears, is likely to be reactive and incoherent and ultimately mistaken.

As part of the wide debate that has started over the intentions of sub-state actors, the assessment of the likely damage from attacks is one factor that has a direct bearing on the approach to threat assessment. It might be possible to do more to address society's vulnerability—but not much, since Western societies are in effect structurally vulnerable. However, without the capability, the intention alone cannot constitute a threat, and vulnerability cannot be exploited in the way societies and governments most fear.

[23] Nuclear Threat Initiative (NTI), 'Reported nuclear, radioisotope, and dual-use materials trafficking incidents involving the newly independent states' (undated), URL <http://www.nti.org/db/nistraff/tables/2003%20by%20material.htm>.

This changes the perception process massively from the cold war mind-set, and invites a different sort of response. Perhaps the new thinking that is needed could lie somewhere in the old idea of 'deterrence by denial'. The central element in such an approach should be to do what can be done to deny unauthorized access to materials, and at the same time make clear that consequence management and disaster and business recovery processes will make any attack pointless. Increase resilience, in other words, and reduce brittleness.

The argument of this paper is therefore that the EU should not focus on the notion of 'NBCR threat' if this means making an attempt to sum up all of the capabilities and intentions that identified or possible adversaries are known to have. Instead the EU should use a different approach, based upon the notion of 'NBCR risk'. This approach invites, first, an objective assessment of hazard—the *potential for harm* to the EU represented by NBCR, based on the characteristics and availability of the weapons and the vulnerability of the EU to them. Rather than make NBCR policy contingent upon the identification of potential assailants—whose grievance might be unsuspected and who might be able to exploit the availability of NBCR with relative ease and with little evidence of having done so—the concern of policy makers should then be to reduce the *likelihood* of such harm, by seeking, for example, to limit the availability of NBCR weapons and technology, or by improving response to and recovery from NBCR use.

This is not only a more accurate and realistic approach to the NBCR problem as it has evolved in recent years; it is also more compatible with the EU and its attempts to position itself as a responsible and effective actor in this field. After all, although some of the NBCR hazards, risks and threats to the EU still retain a broadly military character, many of them have nothing at all in common with earlier military/defence thinking on this subject. It could be suggested, therefore, that the best type of international organization to deal with the evolving, very broad-spectrum NBCR security problem is not a politico-military alliance but a civil organization such as the EU which has competence and confidence (albeit inchoate) across the political spectrum, from diplomatic to economic to scientific to—if and when necessary—the military.