Verification Yearbook

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Acronyms

3-D	three-dimensional
A&E	Audit and Examination
ABACC	Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials
ABM	Anti-Ballistic Missile
AFRC	Armed Forces Revolutionary Council (SierraLeone)
AHG	Ad Hoc Group
AP	Additional Protocol
AWE	Atomic Weapons Establishment (UK)
BOMVIC	Baghdad Ongoing Monitoring, Verification and Inspection Centre
BW	biological weapons
BWC	Biological Weapons Convention
BWPP	BioWeapons Prevention Project
CBM	confidence-building measure
CD	Conference on Disarmament
CDM	Clean Development Mechanism
CFC	chlorofluorocarbon
CFE	Conventional Armed Forces in Europe (Treaty)
CIS	Commonwealth of Independent States
CMR	Centre for Monitoring Research (US)
COP	Conference of the Parties
COW	Committee of the Whole
C/S	Containment and Surveillance
CSA	Comprehensive Safeguards Agreement
CSP	Conference of States Parties
CTBT	Comprehensive Nuclear Test Ban Treaty
CTBTO	Comprehensive Nuclear Test Ban Treaty Organization
CTR	Cooperative Threat Reduction (Programmes)

CW	chemical weapons
CWC	Chemical Weapons Convention
CWDF	Chemical Weapon Destruction Facilities
DNLEU	depleted, natural and low enriched uranium
DOC	Discrete Organic Chemicals
DOD	Department of Defense (US)
DOE	Department of Energy (US)
DRC	Democratic Republic of the Congo
DTRA	Defense Threat Reduction Agency (US)
ERT	Expert Review Team
EU	European Union
EC	Executive Council (OPCW)
ECOMOG	ECOWAS Monitoring Group
ECOWAS	Economic Community of West African States
EOR	enhanced oil recovery
FAR	Federal Acquisitions and Regulations Act (US)
FMSF	Fissile Material Storage Facility
FSB	Federal Security Service (Federal'naya Sluzhba Bezopasnosti, Russia)
G8	Group of Eight industrialised countries
GAO	General Accounting Office (US)
GCI	Global Communications Infrastructure
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	greenhouse gas
GT	gigatonne
GTC	gigatonnes of carbon
HCFC	hydrobromofluorocarbon
HEU	high enriched uranium
IAEA	International Atomic Energy Agency
IAU	Investigation of Alleged Use
ICA	International Co-operation and Assistance
ICBL	International Campaign to Ban Landmines

ICRC	International Committee of the Red Cross
IDC	International Data Centre
IET	International Emissions Trading
IMS	International Monitoring System
INVO	Iraq Nuclear Verification Office
IPA	International Peace Academy
IPCC	Intergovernmental Panel on Climate Change
IPP	Initiative to Prevent Proliferation
IR	infrared
ISG	Iraq Survey Group
ISTC	International Science and Technology Center
IUPAC	International Union of Pure and Applied Chemistry
JI	Joint Implementation
KEDO	Korean Peninsula Energy Development Organization
LEU	low enriched uranium
LOF	Location Outside Facilities
LWR	Light Water Reactor
MEA	multilateral environmental agreement
Minatom	Ministry of Atomic Energy (Russia)
MOD	Ministry of Defence (Russia)
MOP	Meeting of the Parties
MOX	mixed oxide
MPC&A	Materials Protection, Control, and Accounting (Program)
MSSP	Member State Support Programme (IAEA)
MT	megatonne
MTCR	Missile Technology Control Regime
NAM	Non-Aligned Movement
NATO	North Atlantic Treaty Organisation
NBC	nuclear, biological and chemical
NCI	Nuclear Cities Initiative
NGO	non-governmental organisation
NPT	Nuclear Non-Proliferation Treaty
NTM	national technical means

NWTS	Nuclear Weapon Transportation System
ODP	Ozone Depleting Potential
ODS	Ozone Depleting Substance
OLR	On-load Refuelled Reactors
OMV	Ongoing Monitoring and Verification
OPCF	Other Chemical Production Facilities
OPCW	Organisation for the Prohibition of Chemical Weapons
OSCE	Organization for Security and Co-operation in Europe
OSI	On-Site Inspection
PAMS	Policies and Measures
PNET	Peaceful Nuclear Explosions Treaty
PPIA	Processing and Packaging Implementation Agreement
PPMV	Parts Per Million by Volume
PrepCom	Preparatory Commission
PTBT	Partial Test Ban Treaty
PTS	Provisional Technical Secretariat
R&D	Research and Development
R-OMV	Reinforced Ongoing Monitoring and Verification
RDD	Radiological Dispersion Device
RUF	Revolutionary United Front (Sierra Leone)
SAB	Scientific Advisory Board
SAGSI	Standing Advisory Group on Safeguards Implementation (IAEA)
SBI	Subsidiary Body on Implementation
SBSTA	Subsidiary Body for Scientific and Technological Advice
SER	State Evaluation Report
SIR	Safeguards Implementation Report
SOAE	Strategic Offensive Arms Elimination
SORT	Strategic Offensive Reductions Treaty
SSAC	System of Accounting for and Control of Nuclear Material
START	Strategic Arms Reduction Treaty
STCU	Science and Technology Center in Ukraine
TNW	Tactical Nuclear Weapon
TS	Technical Secretariat

UAV	unmanned aerial vehicle
UN	United Nations
UNDDA	United Nations Department for Disarmament Affairs
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNICOI	United Nations International Commission of Inquiry
UNIDO	United Nations Industrial Development Organization
UNITA	União Nacional para a Independência Total de Angola (National Union for the Total Independence of Angola)
UNMOVIC	United Nations Monitoring, Verification and Inspection Commission
USEC	United States Enrichment Corporation
UV-B	ultraviolet-B
VEREX	Verification Experts
WGRC	Working Group for the preparation of the Review Conference
WMD	weapons of mass destruction
WPC&A	Weapons Protection, Control, and Accounting

Preface

Wolfgang Hoffmann

An effective verification regime, which includes a reliable monitoring system that provides data on which a judgement can be made, is a prerequisite for any arms control or nonproliferation agreement. Verification provisions in arms control accords promote compliance by rendering the risks and costs of evasion unacceptably high, thereby deterring potential violators. Verification also plays a role in international confidence building by reassuring participating states that their interests are being protected. Furthermore, a verification mechanism makes it easier for a party unjustly accused of breaching the terms of a treaty to demonstrate its innocence. By providing evidence that member states are fulfilling their obligations, and by confirming that the prohibited activities have not taken place, verification helps to generate trust in arms control and disarmament initiatives.

Since the 1950s, the nuclear powers have used nuclear testing to develop new types of weapons as well as to assess the reliability of their existing arsenals. A comprehensive test ban was regarded as crucial to preventing spiralling nuclear proliferation. Limited success was achieved with the 1963 Partial Test Ban Treaty (PTBT), which banned nuclear tests in the atmosphere, underwater and in space. However, the PTBT failed to prohibit underground testing due to concern about whether this could be adequately verified. Neither France nor China, both nuclear weapon states, signed the accord. In 1968, the Nuclear Non-Proliferation Treaty (NPT) was opened for signature. In 1974, the Soviet Union and the US signed the Threshold Test Ban Treaty, limiting the yield of underground weapon tests to 150 kilotons. The maximum yield of peaceful nuclear explosions was restricted to 150 kilotons when the same two countries signed the Peaceful Nuclear Explosions Treaty (PNET) in 1976.

The adoption of the Comprehensive Nuclear Test Ban Treaty (CTBT) by a special session of the fiftieth United Nations General Assembly on 10 September 1996 was the product of almost four decades of international effort to end nuclear testing. It also signified confidence that the treaty could be verified in all environments.

The CTBT bans any nuclear weapon test explosion or any other nuclear explosion in any environment. Each state party undertakes to 'prohibit and prevent any such nuclear explosion at any place under its jurisdiction or control'. By constraining both the development of nuclear weapons by states that have not previously possessed them and the qualitative improvement of nuclear weapons by states that already have them, the treaty plays an important role in preventing horizontal and vertical proliferation. It also fosters nuclear disarmament, which is still one of the international community's key objectives.

The number of signatures and ratifications continues to increase. Mauritania became the one-hundredth state to ratify the CTBT on 5 May 2003, representing a notable milestone on the road to universality. As of 11 November 2003, 108 states had ratified the treaty. More are expected to follow suit prior to and during the Conference on Facilitating the Entry into Force of the CTBT in Vienna, Austria, from 3–5 September 2003. The accord has been signed by 170 states, indicating the support of the vast majority of governments for a verifiable end to nuclear test explosions.

Since monitoring is crucial to an effective and credible test ban, the CTBT provides for a global verification regime. This includes: an International Monitoring System (IMS) to provide data on possible nuclear explosions and ambiguous events; a consultation and clarification process; on-site inspections (OSIS); and confidence-building initiatives. The Preparatory Commission for the Comprehensive Nuclear Test Ban Treaty Organization (CTBTO) has been established in Vienna to prepare for implementation of these verification measures.

The IMS consists of a global network of 337 monitoring facilities (170 seismic stations, 11 hydroacoustic stations, 60 infrasound stations, 80 radionuclide stations and 16 radionuclide laboratories). Many of the stations are located in remote areas in order to provide global coverage, presenting logistical and engineering challenges unprecedented in the history of arms control. Areas that are particularly demanding include Antarctica and the remoter oceanic islands. Of the 13 IMS stations that will exist in Antarctica by the time the CTBT enters into force, several are already operational and transmitting data to the International Data Centre (IDC) in Vienna. IMS facilities have also been established in many other isolated places, such as the Crozet Islands, sub-Antarctic rocks in the South Indian Ocean, which are unin-

habited except for scientific personnel, and the Juan Fernandez Island, better known as Robinson Crusoe Island, over 600 kilometres off the coast of Chile.

The IMS employs four verification methods (seismology, hydroacoustics, infrasound and radionuclide monitoring) and uses the most modern technologies available. The seismological component senses and locates seismic events. New seismic signal processing techniques can detect very small explosions and can differentiate them from earthquakes. Hydroacoustic monitoring identifies acoustic waves produced by natural and man-made phenomena in the world's oceans. The infrasound network uses micro-barometers to distinguish very low frequency sound waves in the atmosphere produced by natural and man-made events. Finally, the radionuclide network uses air samplers to detect radioactive particles and gases released from atmospheric explosions or vented from underground or underwater explosions.

Establishing an IMS station is a lengthy process. After the conclusion of an agreement with the host state, site surveys must be conducted to ensure that the proposed location is suitable for treaty monitoring. Site preparation normally includes the construction of shelters for instruments, the establishment of a power supply, the erection of antennae or the laying of cables for communicating data from sensors to the central site, and the assembling of security fencing. The next stage involves acquiring and installing the equipment. Transporting the hardware to remote places often entails prolonged, expensive ship journeys.

Since the CTBT was opened for signature in 1996, significant progress has been made in establishing the IMS. Site surveys for 88 percent of the stations have been completed. One hundred and fifty stations have been built or substantially meet specifications. Of these, 55 have been certified as satisfying all technical requirements for them to become part of the IMS. An additional 80 stations are currently under construction or subject to contract negotiations. Some 80 facilities are already contributing data to the IDC, where it is processed and, together with IDC 'products', released to states signatories for further analysis.

Once the treaty enters into force, a state party which suspects that a nuclear explosion has been carried out in violation of the treaty may request an OSI. Prior to doing so, though, the treaty encourages states parties to try to resolve, either among themselves or with the CTBTO's assistance, any matters that may indicate possible non-compliance with the basic obligations of the CTBT. A state party must provide

clarification of an ambiguous event within 48 hours of receiving a request to do so. If the requesting state party considers the clarification to be unsatisfactory, measures to redress the situation, including sanctions, may be contemplated in accordance with Article V of the treaty.

The verification regime also provides for confidence-building measures, which serve a dual purpose:

- they may contribute to the prompt resolution of compliance concerns relating to conventional (chemical) explosions; and
- they may assist in the calibration of IMS stations by improving knowledge of how vibrations propagate through the earth's structure, thus enhancing the accuracy of assessments of the location of seismic events.

The effectiveness of the CTBT verification regime could be measured by whether, and to what extent, a state could successfully conduct a nuclear test and evade detection. The IMS, with its associated communications infrastructure and the IDC, is capable of identifying nuclear explosions of very low yield in any environment. Nuclear tests below the system's detection level would add little, if anything, to the nuclear capabilities of advanced nuclear states. It is unlikely that less advanced nuclear states or potential newcomers would be able to carry out low-level tests undetected. Furthermore, the fact that development of new nuclear weapons requires multiple tests means that the chances of detection by the IMS are greatly increased.

Potential evasion scenarios include cavity decoupling and masking via conventional mining explosions, although there are no credible examples of the latter. Without substantial experience of underground nuclear testing, however, a state attempting to use large underground cavities to decouple explosions from the surrounding geological media would be unlikely to succeed. Moreover, the process would be costly and would require substantial technical and human resources. The seismic signal generated would have to be significantly reduced so as to avoid detection by the IMS and other seismic networks. In addition, all radioactive particles and noble gases produced by the explosion would have to be contained within the cavity.

With regard to masking, chemical explosions in mines tend to be ripple-fired and, therefore, less efficient at generating seismic signals than single explosions of the same total yield. A very high yield, single-fired chemical explosion could

mask a nuclear explosion with a similar yield, but the event would undoubtedly arouse suspicion, since these kinds of chemical explosions are very unusual. In order to mask a nuclear yield of one kiloton in a mine, for instance, a combination of cavity decoupling and masking techniques would be required, increasing the likelihood of detection.

In addition to its monitoring network, OSIs will reduce even further the prospect of testing going undetected. The purpose of an OSI is to clarify whether a nuclear weapon test explosion or any other nuclear explosion has been conducted in violation of the treaty, and to gather facts, to the extent possible, that might assist in identifying any possible violator. An OSI thus serves as a last resort verification measure for the CTBT.

In 1999, the Preparatory Commission's Provisional Technical Secretariat (PTS) conducted an extensive field experiment in Kazakhstan to develop further inspection procedures and the technical and logistical aspects of an inspection. Twenty-one IMS stations around the world detected the simulated nuclear test of 0.1 kilotons. Following more than a year of intensive planning and building on lessons learned during a successful field experiment in Slovakia in October 2001, the PTS carried out another large-scale field experiment in Kazakhstan between September and October 2002. More than 25 surrogate inspectors spent three weeks in a remote part of the country engaging in activities similar to those that a real inspection team would perform. The experiment provided valuable data and insights for the development of the OSI Operational Manual.

Installation of the IMS is progressing at a steady pace. New research, improved communications technology and more sophisticated methods of data analysis are strengthening its monitoring capabilities. As provided for in the CTBT, national technical means of verification offer an additional source of data that can be used to identify nuclear explosions or to support an OSI request. Together, these capabilities serve as a powerful deterrent to any potential treaty violator. The possibility of an OSI, and the high political costs of detection, will make attempts to evade the treaty extremely difficult and increasingly unlikely.

As an independent non-governmental organisation (NGO) concerned with effective and efficient verification, the Verification Research, Training and Information Centre (VERTIC) plays a significant role in promoting the early implementation

of the CTBT and its verification system. VERTIC has organised several seminars related to CTBT verification in coordination with the Preparatory Commission, raising awareness of the treaty and highlighting the importance of international cooperation in ridding the world of weapons of mass destruction. Along with other VERTIC publications, the *Verification Yearbook* is an important tool in disseminating information on, and analysis of, not just the CTBT's verification regime, but also nuclear verification issues generally. In 2000, VERTIC initiated and published the Final Report of the Independent Commission on the Verifiability of the CTBT. This document lauded the agreement's verification system, concluding, *inter alia,* that its global capabilities 'constitute a complex and constantly evolving verification gauntlet, which any potential violator will have to confront'. By verifiably banning nuclear weapon test explosions and all other nuclear explosions in any environment, the CTBT helps to prevent further nuclear proliferation, facilitates movement towards the elimination of nuclear weapons and promotes global peace and security.

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I

Introduction: multilateral verification in flux

Trevor Findlay

The past year saw the most intensive and intrusive international verification undertaking ever—that of the UN Monitoring, Verification and Inspection Commission (UNMOVIC) and the International Atomic Energy Agency (IAEA) in Iraq. Those of us who support multilateral verification can only despair at the fact that this endeavour—hastily deployed and equally hastily ended and superseded by war—was not given the opportunity to prove itself fully. Nonetheless, it brought verification to the fore in international, and some cases national, discourse in a way that is without precedent.

The whole decision about whether the UN Security Council should authorise war against Iraq or, alternatively, whether the United States, the United Kingdom and their allies should go it alone, was made contingent on the answer to a verification question: was Iraq already sufficiently in verifiable non-compliance or should UN inspectors be given additional time to make the case? Questions about the veracity, interpretation, and use or misuse of national intelligence information by both the British and the US governments in making the case for war reinforced for many observers the need for a multilateral verification process to be allowed to discern the truth. Largely unsuccessful post-war efforts by the US army, followed by the joint Australian/UK/US Iraq Survey Group (ISG), to find any evidence of reconstituted or new Iraqi weapons of mass destruction programmes kept the verification question in the news throughout 2003. The tragic death of British weapons inspector and scientist Dr David Kelly, a friend of VERTIC and contributor to last year's volume of the *Verification Yearbook*, and the subsequent Hutton Inquiry, have kept the Iraq issue, and with it the verification question, in the public arena in the UK long after it might otherwise have subsided. Inquiries by

the legislatures in Australia, the UK and the US into the credibility of the coalition governments' case for going to war have further fuelled debate about the value of multilateral verification as a means of resolving compliance crises.

As if this were not enough, 2003 also saw the emergence of serious questions about Iran's compliance with its legally binding commitment, under the 1968 Nuclear Non-Proliferation Treaty (NPT), to renounce the option of acquiring nuclear weapons. Here a verification and compliance regime has, to date, functioned exactly as it should: allegations were made, the IAEA undertook inspections to verify the charges and discovered suspicious and ambiguous evidence, and Iran was given a deadline to greatly increase its co-operation, permit even more intrusive inspections, cease the production of enriched uranium and sign an Additional Protocol to its existing nuclear safeguards agreement. International pressure, notably from the European Union, and the IAEA's steadfastness have produced Iran's compliance, so far, with these demands.

The case of North Korea, considered by Kenneth Boutin in this edition of the *Yearbook,* became more worrying from a verification perspective in the past year: currently there are no IAEA inspections in the country, North Korea has claimed that it has already acquired nuclear weapons undetected—meaning that previous verification efforts, including by the IAEA, have been seriously inadequate—and current multiparty talks to find a political solution have produced no verification plan that would be remotely acceptable to both North Korea and its regional interlocutors. All these high-stakes situations—in Iraq, Iran and North Korea—confirm, once again, the old verities of multilateral verification and compliance.

Political context

One of the most important variables in the life cycle of a verification regime, dramatically confirmed by the fate of UNMOVIC, is the degree of political support it commands. Verification does not operate in a vacuum, no matter how clever negotiators might be in attempting to establish legal and organisational barriers to the intrusion of politics. As Duncan Brack shows in his chapter in this *Yearbook,* it was the sudden scare about the hole in the ozone layer in the 1980s that led swiftly to the 1987 Montreal Protocol and its successful monitoring and compliance regime. By contrast, there had not been sufficient political momentum behind

the Biological Weapons Convention (BWC) when it was negotiated in 1972 to afford it a comprehensive verification system—an outcome that multilateralists have lived to regret, as Jez Littlewood recounts in his chapter in this volume.

The politics of the moment can be used to set up quite far-reaching verification regimes if the time is ripe. It also means, however, that verification systems can atrophy if not well tended. Often there will be great enthusiasm for a new regime's establishment, with large numbers of states coming on board, but over time the interests of governments turn elsewhere as other priorities arise. This appeared to be the fate of the Organisation for the Prohibition of Chemical Weapons (OPCW) before the heartening developments of the past year, as described by Bob Mathews in his chapter. If they are not reoriented, some regimes may end up being targeted at the wrong problem or only part of the problem. For example, the threat of terrorism was not well taken into account by states when the goals of the verification systems for the original treaties dealing with weapons of mass destruction were negotiated. They are all now scrambling to make good the resulting lacunae. An example dealt with by Klaas van der Meer in his chapter is the use of radioactive sources in or as radiological dispersion devices (RDDs), a possible threat only recently identified.

Part of the solution to tackling the possibility of non-state actors undermining treaty implementation is to ensure that states parties adopt national legislation and other domestic implementation measures to make sure that their treaty commitments are complied with across their national jurisdictions and that appropriate penal and other sanctions are in place. The renewed emphasis in many treaty regimes on the domestic implementation of international legal commitments is long overdue. This should not, however, be at the expense, or in place, of strengthening multilateral verification and compliance mechanisms. Unfortunately, the current US focus on national measures to combat biological weapons proliferation is intended deliberately to subvert the strengthening of multilateral verification arrangements for the BWC.

States parties' neglecting their verification regimes is one danger. The obverse danger is unwarranted political interference in them. Many accused the US of interference on political grounds in the case of the removal of the head of the OPCW in 2002, while in the case of UNMOVIC's predecessor, the UN Special Commission

on Iraq (UNSCOM), a number of permanent members of the UN Security Council attempted to exert undue influence. The lesson here is to have proper guidelines in place, to encourage greater transparency in the operation of verification systems, and to try to avoid overdependence on one state or one group of states for material and financial support. UNMOVIC seems to have learned these lessons well.

Negotiation of verification

Like all other aspects of an arms control or disarmament regime, the monitoring and verification aspects should be well negotiated so that they function effectively when the treaty comes to be implemented. However, there is almost always a tension between achieving consensus on a treaty to allow it to go forward and achieving agreement on the optimal verification and compliance system that should be adopted. Often a powerful conception of verification will be traded off for some other, unrelated aspect of the envisaged treaty, such as its entry into force provisions. While states almost invariably tend not to like intrusive verification which involves them in great effort and expense and the possibility of embarrassing revelations, there is a price to be paid later in terms of verifiability, the credibility of the verification mechanisms that are established and the possibility of international controversy. An example was the crisis in IAEA nuclear safeguards in the 1990s after Iraq, and then North Korea, were found to have flouted them.

One other difficult trade-off that occurs in negotiating verification arrangements is that between the level of detail that is included in the text and the pressure to conclude the negotiations. The temptation is often to avoid particulars in favour of getting an early agreement, leaving the detail to the bodies charged with implementing the treaty. It is, indeed, sensible to avoid setting too much detail in stone, since implementation always throws up unexpected problems which may be difficult to resolve if options are precluded by treaty language that can only be amended through protracted procedures requiring consensus and/or the negotiation of additional legal instruments. On the other hand, situations like that which faced the Comprehensive Nuclear Test Ban Treaty Organization (CTBTO) need to be avoided: it was charged with establishing seismic monitoring stations whose geographical co-ordinates were in the sea or in the middle of urban areas because the negotiation of the detail had been rushed in order to ensure that the treaty was

adopted. All this speaks to the immense value of pre-negotiation research and preparation, part of which can be done by non-governmental research organisations like VERTIC.

One aspiration that negotiators should have is to build flexibility into their verification system so that it can adapt itself to future needs and challenges. This should be done creatively. States will oppose too much flexibility because they want to be sure about what they are signing up to: they need reassurance that future modifications will be made on an agreed basis. As the chapters by both Molly Anderson and Jason Anderson reveal, the Kyoto Protocol is an extreme example of an agreement that has been a work in progress ever since it was agreed in 1997. Even now there remain hugely complex details of implementation, such as the operation of the so-called flexible mechanisms and their monitoring and verification.

The organisation of verification

Much has been learned by now about the organisational structures required for effective verification and compliance, especially when a comprehensive system is envisaged. There is now a standard model of a conference of states parties, an executive body and a technical secretariat, including where necessary a standing inspectorate. International verification organisations still, however, rarely adopt best management practices as used in business or in the more effective national governments. They still tend to use allegedly tried and true UN practices, often simply because they are readily available. They still often assume that running a verification organisation is a unique organisational challenge that has no parallels elsewhere. The OPCW has been grappling with this legacy in the past year. There would appear to be no a priori reason why the highest managerial standards—including those relating to finance and human resources—should not be expected of our verification systems. International security is too important to be waylaid by distracting organisational problems that have ready solutions. As Alex Vines illustrates in his chapter on African sanctions monitoring, one individual or national delegation (in this case in the UN Security Council) can be enough to make a difference. As Jill Cooley shows in her chapter on integrated safeguards, new approaches to making verification more effective and efficient, and in the long-run saving money, are possible in the most venerable of multilateral verification bodies.

Funding of verification

The question of the funding of verification is a perennially fraught one. While no one expects verification systems to be given a blank cheque, verification cannot be expected to be done on the cheap lest it discredit the whole verification enterprise. Almost all of the multilateral verification organisations and arrangements are experiencing funding challenges at present. Luckily, rescue money is being provided for the OPCW and, thanks to the US, the IAEA has in 2003 finally been released from over a decade of punishing zero growth. Particularly when compared to spending on defence, spending on verification is a security bargain. It should be considered in the same light as allegedly more hard-headed co-operative threat reduction and counter-proliferation programmes, the monitoring of which is considered by Michael Jasinski in his chapter on laudable American efforts in this regard. Verification regimes need to be looking at other funding possibilities, including foundations and commercial spin-offs. For example, some of the data collected by the CTBTO's International Monitoring System has commercial value, for instance, for the airline industry.

Techniques and technologies

The extent to which the latest and most appropriate techniques and technologies can be used in multilateral verification systems is, perhaps surprisingly, often controversial. To begin with, there is always a trade-off between effectiveness and cost. States parties will naturally want to keep the costs of verification as low as possible, while still giving the verification system the requisite degree of credibility. But other issues are involved. Some states are fearful of technology that is too capable and will want to restrict it. This was a difficulty in the negotiations on the 1992 Open Skies Treaty, to the point where the sensor technology being allowed for use by the treaty parties is now, one year after it entered into force, quaintly old-fashioned. In other cases the type of verification technology being applied needs to be restricted in order to prevent proliferation-relevant information being disseminated to the verifiers—hence the use of so-called blinded instrumentation that will detect only specific, limited types of information. Sometimes bureaucratic inertia in multilateral organisations prevents greater use being made of technologies, as in the case of the mysterious inability of the OPCW to replace expensive permanent

human monitors at chemical weapon destruction facilities with equally effective remote on-site monitoring equipment.

Another difficulty is that verification technology can be so specialised that it must be researched and developed by verification bodies themselves: no commercial company will invest in research for such a limited market and potentially low profit. This can be a heavy burden on verification organisations, although creative partnerships with universities and less commercially-driven organisations should be possible. As Christine Comley and Owen Price point out in their chapter on the UK's role in radionuclide monitoring for the CTBT, there can also be a mutually beneficial exchange of technology and methodologies between international verification organisations and national research and monitoring agencies.

The good news where technology is concerned is that off-the-shelf equipment can be readily used for a variety of verification roles, and its price often drops rapidly once it begins to penetrate the commercial market. Both the hardware and the software of computers have demonstrated this trend dramatically.

National technical and technological incapacity for self-monitoring and for implementing treaty commitments is also a major issue in many regimes. Many developing countries, especially in Africa, and those that used to be part of the Soviet empire, struggle to report on their own compliance with international treaties and to adopt national implementation measures. They have even more difficulty in contributing technical personnel, including on-site inspectors, to international verification efforts. Molly Anderson illustrates this in relation to the 'demonstrable progress' issue under the 1997 Kyoto Protocol on climate change, while Angela Woodard considers three treaty regimes—for chemical and biological weapons and anti-personnel landmines—where large numbers of states are in non-compliance with their obligations to adopt national implementation legislation, often due to a lack of capacity. The obvious answer is for regimes to ensure that appropriate assistance and capacity-building are available to those states that need them.

As a verification technique, on-site inspections have come a long way in recent decades. The confidence-building measures (CBMs) pioneered by the Organization for Security and Co-operation in Europe (OSCE), the 1990 Treaty on Conventional Armed Forces in Europe (CFE Treaty) on-site inspections and those for the US–

Soviet bilateral nuclear treaties were the forerunners of today's modern inspections, as exemplified in Iraq and Iran in 2003. There are now bodies of professional on-site inspectors, detailed protocols, procedures and technologies for on-site inspections, and a useful corpus of experience in making them effective. This includes 'managed access' techniques, the use of remote monitoring to supplement on-site inspections, environmental sampling, and procedures for handling commercially and militarily sensitive information. The difficulties that the CTBTO is facing in reaching agreement on its on-site inspection manual indicate, however, the sensitivities surrounding on-site inspections and the need for an educational process about them.

Use of information

One of the most pleasing verification developments in recent years has been the realisation that multilateral verification organisations can and should use the vast array of open source material to their advantage. Commercial satellite imagery and the internet are just the most obvious of the new information tools available. The IAEA is leading the way in this respect and is to be highly commended. Clearly, however, open source information needs careful and discriminate handling lest the multilateral organisations be overwhelmed by a tidal wave of information, as some national intelligence agencies would appear to be.

Similarly, the use of information provided by states from their national technical means (NTM) is a significant development. The experience of UNMOVIC is, however, salutary. The intelligence information provided to UNMOVIC and the IAEA about Iraq was late and much of it was of dubious character—notably the infamous allegation that Iraq had tried to obtain yellowcake (milled uranium oxide) from Niger. When almost all of the intelligence leads were verified by the international bodies as being without foundation, there was no public acknowledgement by the states that had provided the information that they had been wrong. Indeed, the impression was left that the UN's inspectors were not quite up to the verification job. While there are clearly enormous difficulties in states obtaining credible information from closed, autocratic regimes through NTM, and there is an undoubted need to protect sources, especially human sources of intelligence, those states that are able to provide NTM-derived information should be more honest and transparent

in doing so. The UNMOVIC experience should be a warning for the standing verification bodies.

Determination of compliance

One of the least developed aspects of verification regimes is often the compliance aspects. While a great deal of attention is paid to what information is to be sought and how it is to be collected, collated and analysed, there is often a reluctance to be clear about how a determination of non-compliance is to be made and what subsequent steps are possible if such a finding is made. Even IAEA safeguards have not been free from this: the confusion surrounding the possibility of 'special inspections' (essentially challenge inspections) has long been a factor in at least popular scepticism about the effectiveness of verification of the NPT. If Iran fails to comply with its recent undertakings, including its Additional Protocol, the question of how it can be induced to comply will soon confront the UN Security Council, since the IAEA itself will have exhausted the range of 'carrots and sticks' that it has at its disposal. The Montreal Protocol in late 2003 was faced with the prospect of the US unilaterally violating its obligations by increasing its use of methyl bromide under pressure from its farming lobby. The parties are already in heated discussion about how to respond to this unexpected compliance threat to their treaty—whether to grant the world's most powerful state a precedent-setting exemption, to rewrite the treaty or to declare the US in non-compliance and apply sanctions. All the options look daunting.

Building the international verification community

One of the critical lessons that can be drawn from the experience of multilateral verification and compliance regimes over recent years has been the necessity to sustain political support and relevance. In this respect the multilateral organisations need to do better at promoting an appreciation of the contribution they make to international peace and security, global environmental well-being or whatever their objective may be. Even governments themselves need to be reminded. Some governments, for example, when pressed to sign Additional Protocols to their nuclear safeguards agreements, have actually requested a quid pro quo in the form of technical and/or economic benefits—in essence a bribe from developed

countries—when clearly the primary benefit derives from enhancement of their national security. These benefits need to be made clearer.

While political support can, naturally, wax and wane after a verification system has been put in place, there are steps that verification bodies can take to cushion themselves against this. They could start by cultivating stakeholders elsewhere, including in civil society and among non-governmental organisations (NGOs), the general public, the media and the philanthropic foundation world, and even in business. The treatment of NGOs by some treaty parties and secretariats, oblivious to the benefits that co-operation with civil society can bring, is short-sighted. Unless verification organisations can improve their record in this they will forever be dependent on the kindness of governments and the limited attention span they often display, and their work will always be seen as arcane and marginal.

For its part VERTIC has attempted to steadily enhance its relationship with and support for multilateral verification organisations by participating in states parties' annual and review meetings, organising 'side events' at such gatherings, undertaking research into the challenges faced by verification regimes and, increasingly, by offering assistance and advice to states parties, including in such areas as national implementation legislation, compliance reporting and fact-finding missions. This eleventh *Verification Yearbook* is published in the same spirit. Once more it is a collaborative effort involving VERTIC staff and external collaborators. VERTIC is indebted to them all, especially commissioning co-editor Kenneth Boutin, sub-editor Eve Johansson, and Richard Jones, who handled design and production. VERTIC also acknowledges the financial support of the Joseph Rowntree Charitable Trust, the Ford Foundation, and particularly the John D. and Catherine T. MacArthur Foundation, which in early 2003 made a new three-year grant to VERTIC, in part to permit continued publication of the *Verification Yearbook.*

This *Yearbook* is dedicated to the memory of David Kelly.

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arms control and disarmament

2

Integrated nuclear safeguards: genesis and evolution

Jill N. Cooley

The International Atomic Energy Agency (IAEA) implements 'safeguards' or nuclear verification measures to verify states' compliance with their nuclear non-proliferation commitments. The range of measures the Agency can use in any given state stems from the type of safeguards agreement that the Agency has concluded with it. For states which have both a comprehensive safeguards agreement (CSA) and an additional protocol (AP) in force, the IAEA has the full range of safeguards measures at its disposal, including important strengthening measures endorsed by its Board of Governors. However, just as not all the tools in a tool-kit are used concurrently, safeguards measures are selected to respond to specific verification objectives. 'Integrated safeguards' are the means by which the IAEA seeks to achieve the most effective and cost-efficient[1] combination of safeguards measures to enable it to discharge its safeguards obligations and meet its verification objectives for states with CSAs and APs in force.

The objective of strengthened safeguards for such states is to provide credible assurance of the non-diversion of nuclear material from declared nuclear activities and of the absence of undeclared nuclear material and activities. What all this signifies in a practical sense can be understood only by reference to the provenance of the Agency's 'right and obligation', how that has been and is now being exercised through safeguards implementation, and what is meant by 'the optimum combination of safeguards measures'. This chapter seeks to explain these aspects and to place them in the context of the radically changed way in which the IAEA now draws its safeguards conclusions—the foundation of the assurances that it can provide about the exclusively peaceful nature of a state's nuclear activities.

Background

The Statute of the IAEA empowers the Agency to implement nuclear verification measures, or safeguards, to verify states' compliance with their nuclear nonproliferation commitments.[2] The scope of safeguards implementation stems from the nature of the safeguards agreement that a state concludes with the Agency. Most states have a CSA based on the model text in IAEA document INFCIRC/153 (Corrected) of 1972.[3] For such states—mainly but not exclusively in the context of the 1968 Nuclear Non-Proliferation Treaty (NPT)—the Agency has the right and obligation to ensure that safeguards are applied on all of their nuclear material (which by definition can be used only in non-proscribed nuclear activities) under their jurisdiction or control anywhere. The drafters of INFCIRC/153 (Corrected) considered, and the IAEA Board of Governors has since reaffirmed, that the scope of CSAs is not limited to the nuclear material actually declared by a state to the Agency under its safeguards agreement; it includes that which should be declared. The Agency has the right and obligation to ensure that nuclear material declarations submitted by states are not only correct but also complete. Despite this, the safeguards system as it had developed pre-1991 had limited capability to deal with 'completeness'.

That has since changed. The discovery of Iraq's clandestine nuclear weapons programme and other important factors[4] highlighted the shortcomings of safeguards implementation that focused, as it did then, on declared nuclear material and on safeguards conclusions drawn at the level of nuclear facilities. This set the stage and provided the catalyst for far-reaching efforts by the IAEA, with the support of its member states, to strengthen the safeguards system, in particular its ability to detect undeclared nuclear material and activities, and for much more broadly based safeguards conclusions to be drawn for a state as a whole.

Efforts to strengthen safeguards must also be seen against the backdrop of zero real growth, which characterised the Agency's budget for 15 years until the IAEA General Conference endorsed a budget increase in September 2003. This in part[5] explains the mandate the Director General gave to the Standing Advisory Group on Safeguards Implementation (SAGSI) in 1992 to re-examine safeguards implementation in order, concurrently, to reduce costs, meet new requirements and maintain effectiveness. SAGSI's work led to a fully-fledged safeguards development programme undertaken by the IAEA Secretariat from 1993.[6] Its main elements stemmed from

(a) a perceived need for the IAEA to acquire a much broader range of information than it was previously able to obtain about a state's nuclear material, activities and plans; (b) the need for more access for IAEA inspectors to nuclear sites and to other locations where nuclear material is or could be present; and (c) the use of advanced techniques and technology. The combination of these elements gives a state's nuclear programme greater transparency and equips the Agency to give enhanced assurance about the exclusively peaceful nature of such a programme.

A watershed in this respect was the approval of the Model Protocol Additional to Safeguards Agreements (Model Additional Protocol) by the IAEA Board of Governors in May 1997.[7] Although some of the measures of the safeguards development programme could be implemented on the basis of the legal authority conferred on the IAEA by CSAs, others could not (see table 1). APs based on the Model Additional Protocol give the Agency the complementary legal authority and the necessary technical measures to strengthen its ability to detect undeclared nuclear material and activities and thus to provide credible assurance of their absence.

The additional information,[8] increased access for IAEA inspectors[9] and the other technical measures which an AP provides for are vital to an assessment of the completeness of a state's declarations about its nuclear material subject to safeguards. That assessment is essential to safeguards conclusions, drawn at the level of a state as a whole,[10] that all of the state's nuclear material has been placed under safeguards and remains in peaceful nuclear activities or has otherwise been accounted for. Such a conclusion is a combination of two separate but interrelated elements: a conclusion that there is no indication that a state's declared nuclear material has been diverted from peaceful to proscribed use (the focus of the safeguards measures in a CSA); and a conclusion that there is no indication of undeclared nuclear material and activities in the state as a whole (the focus of the measures in an AP). This combination is possible only for a state that has both a CSA and an AP in force: it is only for such states that the IAEA has the full range of available safeguards measures at its disposal to reach the requisite safeguards conclusions.

Towards integrated safeguards

It was never the intention to 'layer' the IAEA's safeguards-strengthening measures onto one another.[11] The goal was and remains to integrate, in an optimal way,

Table 1 **Safeguards-strengthening measures**

A. Measures under comprehensive safeguards agreements

- State provision of design information on new facilities or on changes in existing facilities handling safeguarded nuclear material as soon as the state authorities decide to construct, authorise construction of or modify a facility; and the IAEA's continuing right to verify the design information over the facility's life cycle, including decommissioning.
- Agency enhanced evaluation of information from a state's declarations, Agency verification activities and a wide range of open and other sources (e.g., the scientific literature, news articles, satellite imagery, and third parties).
- State voluntary reporting on inventories, imports and exports of nuclear material and exports of specified equipment and non-nuclear material (components of this scheme are incorporated in the Model Additional Protocol).
- Agency use, to a greater extent than previously, of unannounced inspections within the routine inspection regime.
- Agency collection of environmental samples in facilities and at locations where, under safeguards agreements, IAEA inspectors have access during inspections and design information visits; and sample analysis at the IAEA Clean Laboratory and/or at qualified laboratories in member states.
- Provision of enhanced training for IAEA inspectors and safeguards staff and for member state personnel responsible for safeguards implementation.
- Agency use of unattended and remote monitoring of movements of declared nuclear material in facilities and the transmission of authenticated and encrypted safeguards-relevant data to the Agency.
- Closer co-operation between the Agency and the state (and regional) systems for accounting for and control of nuclear material (SSACs) in member states.

B. Measures under additional protocols

- State provision of information about, and IAEA inspector access to, all parts of a state's nuclear fuel cycle, from uranium mines to nuclear waste and any other location where nuclear material intended for non-nuclear uses is present.
- Agency collection of environmental samples at locations beyond those provided under safeguards agreements.
- State provision of information on, and agency short-notice access to, all buildings on a nuclear site.
- State acceptance of IAEA designations of inspectors and issuance of multiple entry visas (valid for at least one year) for inspectors.
- State provision of information about, and Agency verification mechanisms for, a state's research and development activities related to its nuclear fuel cycle.
- Agency right to make use of internationally established communications systems, including satellite systems and other forms of telecommunication.
- State provision of information on the manufacture and export of sensitive nuclear-related technologies, and IAEA verification mechanisms for manufacturing and import locations in the state.
- Wide area environmental sampling, after Board approval of procedural arrangements for such sampling and after consultations with the state concerned.

a set of measures to enhance the Agency's ability to verify correctness— essentially through nuclear material accountancy measures, complemented by containment and surveillance (C/S)—with measures to verify completeness—essentially through the much broader information and access measures in an AP.[12] Integration aims to take account of the synergy deriving from combinations of the two sets of measures and thus to achieve greater effectiveness and efficiency. For example, if the Agency is able to conclude for a state as a whole that there is no indication of undeclared nuclear material and activities,[13] especially activities related to enrichment and reprocessing, this should allow some safeguards measures to be applied at a reduced level.

Important in this context is the notion of timely detection, or the maximum time stipulated in traditional IAEA safeguards implementation criteria that may elapse between the diversion of a significant quantity[14] of nuclear material to a proscribed purpose and the detection of that diversion by safeguards activities. In cases where the Agency is not equipped with all the measures it needs to draw a conclusion in regard to the absence of undeclared nuclear material and activities for a state as a whole, it has to assume that the facilities and activities needed to convert diverted nuclear material from peaceful use to nuclear weapons-usable form may exist undetected in the state. In such circumstances, 'detection time' must correspond approximately to 'conversion time', or the time required to convert different forms of nuclear material into critical components of a nuclear explosive device. Conversely, if the Agency is able to conclude that there is no indication of undeclared nuclear material and activities for a state as a whole, it can adjust certain parameters of safeguards implementation, such as timeliness goals, for less sensitive types of nuclear material (depleted, natural and low-enriched uranium, DNLEU) and reduce the level of verification effort that would otherwise be required for such material. For example, the diversion of irradiated nuclear fuel and the existence of a clandestine reprocessing plant are each part of the same potential 'acquisition path' by which a state which was determined to do so could seek to acquire weapons-usable nuclear material. If the IAEA can draw a conclusion regarding the absence of any undeclared reprocessing plant in a state with both a CSA and an AP in force, it follows, prima facie, that it needs to spend less effort to verify that there has been no diversion of irradiated nuclear fuel in that state. This contributes to 'the optimum combination of measures' for effectiveness and efficiency.

The elements and features of integrated safeguards

Integrated safeguards consists of a number of 'piece-parts'—concepts, approaches, guidelines and criteria that govern their design, implementation and evaluation. Collectively, these elements form the 'conceptual framework' for integrated safeguards. This was developed between 1998 and 2001 by the IAEA Secretariat, assisted by a small group of external experts appointed by the IAEA Director General for their safeguards knowledge and expertise; by IAEA member states, especially through the mechanism of Member State Support Programmes (MSSPs) for safeguards; and with technical advice from SAGSI. The basic elements, which are described below, enable the IAEA to implement safeguards in the relevant states not only in an optimal way but also in the consistent and non-discriminatory manner expected of it. They take into account the fact that nuclear fuel cycles and nuclear facilities in individual states can and do differ. They provide the Agency with flexibility to allow state-specific features to be factored in. They also permit refinement in the light of practical implementation experience, further evaluation and developments in technology.

Element 1: The overall objective and basic principles of integrated safeguards

(a) The overall objective

The development of this element was guided by a combination of the Board of Governors' confirmation of the IAEA's right and obligation in respect of a CSA state; the verification measures necessary to fulfil that right and obligation; and the effectiveness and efficiency objectives of safeguards-strengthening measures. The overall objective of integrated safeguards is to achieve 'the optimum combination of all safeguards measures available to the Agency under comprehensive agreements and additional protocols which achieves the maximum effectiveness and efficiency within available resources in fulfilling the Agency's right and obligation in paragraph 2 of INFCIRC/153 (Corrected)'.[15]

Given that the IAEA is empowered to ensure that nuclear material declarations submitted by CSA states are both correct and complete, and that such assessments can be made only for states with both a CSA and an AP in force, it follows that integrated safeguards cannot be implemented in a state until initial conclusions have been drawn about the non-diversion of declared nuclear material (the focus of a CSA) and of the absence of undeclared nuclear material and activities (the focus of an AP). Once this has been achieved, the Agency must seek to reaffirm these

safeguards conclusions annually in the light of any additional information obtained about the state or of any follow-up action deemed necessary as a result of the evaluation process.[16] It does so both as an objective in itself and as a condition for the continued implementation of integrated safeguards.

(b) The basic principles

The basic principles underlying integrated safeguards will continue to guide their further development. First, integrated safeguards must be non-discriminatory. This means that, although the verification measures used in individual states might differ because of state-specific features, the same technical objectives must be pursued in all states with comparable safeguards undertakings. Additionally, through the application of the supporting guidelines and criteria developed for integrated safeguards (see the relevant paragraphs below), similar procedures are to be used in all states.

Second, integrated safeguards must also be based on state-wide considerations. More specifically, this involves two fundamental aspects. The first is that comprehensive information evaluation for a state as a whole is essential to integrated safeguards and plays a key role in planning and conducting the safeguards activities that are implemented for any specific state. For example, the state evaluation process can help to identify the state-specific features that need to be considered in selecting and using specific safeguards measures. The second aspect is that the integrated safeguards approach for a state (described below) must cover all possible acquisition paths by which a state might seek to acquire weapons-usable nuclear material. The state-level integrated safeguards approach must therefore cover paths by which nuclear material could be diverted from different stages of the nuclear fuel cycle as well as clandestine routes to the acquisition of such material. For any path involving both diversion of nuclear material from declared activities and the existence of undeclared nuclear activities, coverage needs to include verification measures on nuclear material as well as measures to detect undeclared activities.

A third principle is that nuclear material accountancy remains a safeguards measure of fundamental importance and will continue, under integrated safeguards, to be the basis for deriving a conclusion about the non-diversion of declared nuclear material in a state. Nuclear material accountancy begins with the nuclear material accounting activities undertaken by the operator of a nuclear facility and reported

to the IAEA by the relevant state in accordance with its safeguards agreement. Under integrated safeguards, the IAEA will continue to evaluate the nuclear material accounting information reported by states for conformity with established formats and standards and for correctness and consistency. However, the verification of less proliferation-sensitive types of nuclear material can be expected to be less intensive than previously and consideration can be expected to be given to greater use of statistical techniques and advanced technology.

Element 2: The design of an integrated safeguards approach for a state

An integrated safeguards approach is designed individually for each state with a CSA and an AP in force, and can be implemented when the requisite safeguards conclusions have been drawn. Approaches are developed in the framework of the same multidisciplinary state evaluation groups which prepare the safeguards state evaluations. They have two main elements: the safeguards measures to be applied at each facility and location outside facilities (LOF)[17] in the state; and a complementary access plan which sets out the general level and focus of the complementary access activities to be carried out in the state as a whole.[18] Some components of a state-level integrated safeguards approach might require discussion with the state concerned, for example, arrangements for conducting unannounced inspections at specific facilities. On the other hand, components such as the specifics of complementary access activities to assure the absence of undeclared nuclear material or activities at declared nuclear sites would probably not be discussed; to do so could well jeopardise the purpose of the access. Guidelines have been developed and are used to design state-level approaches to ensure maximum effectiveness and efficiency. The design includes considering state-specific features and characteristics; adapting model integrated safeguards approaches for application at specific facilities; and developing a plan for implementing complementary access at nuclear sites and other locations. Approaches for individual states are reviewed on a continuing basis and modifications made as required.

The initial and most important consideration in designing a state-level integrated safeguards approach is the nature and scope of a state's nuclear fuel cycle and related activities, including: (a) the structure of the nuclear fuel cycle, from uranium mines to nuclear waste; (b) the number and types of nuclear facilities, LOFs and associated activities carried out at nuclear sites; (c) the safeguards-relevant charac-

teristics of facilities and LOFs; (d) the inventory and flow of nuclear material within and between facilities; (e) fuel cycle-related research and development; (f) the manufacture and export of sensitive nuclear-related equipment and materials; and (g) the correlation of all this information. Other considerations include the feasibility of using effectively such advanced safeguards technology as the remote transmission of safeguards data from unattended C/S devices or measurement devices foreseen in the provisions of APs; the extent to which unannounced inspections to deter diversion or detect any undeclared activities in the state are both feasible and desirable; and the scope identified for enhanced co-operation between the IAEA and the state or regional system of accounting for and control of nuclear material (SSAC).[19]

An important step in designing a state-level integrated safeguards approach is to adapt the model integrated safeguards approaches for facility types (described below) to the specific features and characteristics of the state and to the design and operational mode of each of its nuclear facilities. Each model approach includes alternative ways, of comparable effectiveness, to meet the safeguards requirements.[20] The selection of any particular approach involves a comparative cost analysis of the alternatives. Adaptation also takes account of the Agency's experience in implementing safeguards at the specific facility and its co-operation with the SSAC and facility operator.

Complementary access plays a key role in the process of drawing an initial safeguards conclusion regarding the absence of undeclared nuclear material and activities in a state and in maintaining that conclusion. Thus, within the constraint imposed on the IAEA by an AP that it must be neither mechanistic nor systematic in verifying information submitted under its provisions, a state-level integrated safeguards approach describes the proposed level and focus of the complementary access activities considered necessary.

Element 3: Model integrated safeguards approaches for specific types of nuclear facility

One important starting point in developing integrated safeguards and the conceptual framework for them was the technical objective of safeguards at facilities defined in paragraph 28 of INFCIRC/153 (Corrected)[21] and the measures necessary to achieve that objective. Another was the premise that some types of nuclear facility

warranted more immediate attention than others because they were operating in states which were early candidates for integrated safeguards implementation and offered the most potential for reducing verification effort on declared nuclear material.

To date, model or generic integrated safeguards approaches have been developed for five major types of nuclear facility: (a) light water reactors (LWRs), with and without the use of mixed oxide (MOX) fuel; (b) research reactors; (c) on-load refuelled reactors (OLRs); (d) spent fuel storage facilities; and (e) DNLEU conversion and fuel fabrication facilities. Other approaches are under development. As indicated above, these approaches result in less inspection effort being expended on declared nuclear material than is the case with current safeguards approaches. Savings in inspection effort have now been calculated, *inter alia,* for states with large nuclear fuel cycles where the IAEA anticipates implementing integrated safeguards by 2005–2006. Thus savings in inspection effort for the basic model approaches at LWRs, OLRs and fuel fabrication plants have been calculated for the European Union countries, Canada and Japan. They range from approximately 27 percent for the power reactors to 38 percent for DNLEU fuel fabrication plants.

Model integrated safeguards approaches reflect the types of nuclear material associated with specific types of nuclear facility. Nevertheless, there are common denominators, such as:

- retaining the basic principle that nuclear material accountancy remains a safeguards measure of fundamental importance. The IAEA's current practice of evaluating the material balance annually for all types of nuclear material is therefore also retained (using random selection of facilities as appropriate);
- extending the timeliness goals for types of nuclear material where appropriate, given the IAEA's enhanced ability to detect undeclared nuclear material and activities. The timeliness goal for irradiated fuel has been extended from three months to one year. For fresh MOX fuel assemblies, it has been extended from one month to three months;
- random interim inspections, including unannounced inspections where feasible, to detect and deter undeclared activities at facilities and to provide a capability for early detection of diversion;
- less intensive verification requirements where the types of nuclear material at a facility are less proliferation-sensitive;

- modifying verification procedures for specific types of nuclear material in a way that enables the IAEA to re-establish the inventories of those materials within the applicable traditional timeliness period where there is any indication of possible diversion or of undeclared nuclear material or activities; and
- increased co-operation with an SSAC under specific conditions.

Much progress has been made in designing integrated safeguards approaches and preparing for implementation in states with APs in force. Australia was the first state in which integrated safeguards were implemented, in 2001. In Norway, implementation trials of unannounced inspections as envisaged in the integrated safeguards approach have been carried out and the implementation of integrated safeguards began there in 2002. In Indonesia, surveillance systems have been upgraded and procedures for short-notice inspections carried out in preparation for integrated safeguards implementation, which began in 2003. Trials and tests are under way in other states and state-specific integrated safeguards approaches are being developed for several states with little or only moderate nuclear activity. The model integrated safeguards approaches developed for LWRs, OLRs and research reactors are being adapted for states with large nuclear fuel cycles.

Element 4: Supporting guidelines

An important part of integrated safeguards is providing adequate guidance to those responsible for implementation to ensure effectiveness, consistency and non-discrimination at each step of the process. Guidelines have been developed for drawing the safeguards conclusions which govern integrated safeguards implementation; the conditions which must pertain before any such conclusions can be drawn; information review and evaluation; conducting complementary access at each of the categories of location identified in Article 5 of an AP; the handling of anomalies, questions and inconsistencies; and the conduct of unannounced and short-notice inspections.[22] Work is proceeding on guidelines for enhanced co-operation between the Agency and an SSAC.

Element 5: Integrated safeguards criteria, evaluation and reporting

(a) Criteria

Although the design of an integrated safeguards approach for a state is based on a flexible approach using common principles and objectives, suitably adapted model

facility-type approaches and supporting guidelines, more specific criteria are required, at both the facility and the state levels. Because nuclear material accountancy remains a fundamental measure of integrated safeguards, there is a need for facility-focused criteria, for instance, dealing with the examination of records and reports, the verification of a physical inventory of nuclear material and the evaluation of material balances. At the state level, criteria are required for integrated safeguards implementation and evaluation to ensure consistency. They include criteria related to nuclear material verification activities that are not specific to individual facilities, for example, the matching of data on transfers of nuclear material. There are also broader requirements such as those related to updating and reviewing state evaluation reports (SERs).

(b) Evaluation

Evaluation and reporting under integrated safeguards involves continuous evaluation of all relevant information and activities, and an annual assessment of safeguards performance. Evaluation takes into account the results of all safeguards activities conducted under an integrated safeguards approach, the results of follow-up actions to resolve any anomalies, questions and inconsistencies, and continuing review and evaluation of all other information available to the IAEA. The results of evaluations are documented annually in SERs[23] and provide the basis for safeguards conclusions.

(c) Reporting

Reporting to individual states on activities under CSAs and APs continues under integrated safeguards. Under a CSA, the IAEA provides the state with statements on inspection results and on the conclusions it has drawn. Under an AP, it also provides statements on the activities performed during complementary access, the results of activities relating to questions or inconsistencies, and conclusions drawn from AP activities. The collective results of safeguards evaluation processes are reported annually in the IAEA's *Safeguards Implementation Report* (SIR).

Cost and resource implications

At this juncture, it is not possible to estimate precisely how much integrated safeguards will contribute to cost savings. What is clear, however, is that, for the near to medium term, more resources are needed to carry out the activities which must

precede and are involved in the implementation of integrated safeguards. The work associated with the initial conclusions necessary for implementing integrated safeguards in a state involves considerable work at IAEA headquarters and in the field. It includes the processing and analysis of state declarations, state evaluation and complementary access. In 2002 alone, activities related to AP implementation involved over 29 person-years of effort, including 5.5 person-years expended on state evaluation activities. Considerable time, effort and care are required to produce and update SERs. Between 1997, when five SERs were produced and reviewed, and the end of 2002, a total of 165 SERs were produced and reviewed covering 83 states, 61 of which had significant nuclear activities. In similar vein, complementary access has to be carefully planned and prepared before implementation in the field, and reviewed and evaluated when the relevant safeguards staff have returned to Vienna. Complementary access was conducted 86 times in 17 states in 2002. This was mainly to ensure the absence of undeclared nuclear material and activities at nuclear sites and at the other locations where a state had declared nuclear material to be present.[24] As more states bring APs into force, the workload can be expected to increase further—all this in addition to the concurrent requirement to implement traditional nuclear material accountancy safeguards and to prepare to introduce sound, cost-efficient safeguards measures in major new facilities. For reasons such as these, it is clear that in the next few years, the significant increase in work related to the strengthened safeguards system is likely to be only partially offset by any savings from a reduction of in-field inspection activity.

Next steps

The component parts of integrated safeguards will continue to be developed or refined in the light of experience, further evaluation and technological developments. The goal now is to widen the scope of implementation as more APs enter into force and the necessary safeguards conclusions can be drawn. The rate at which APs are entering into force in states is falling short of expectations and is constraining the IAEA's ability to implement safeguards with maximum effectiveness and efficiency. As of the end of October 2003—more than six years after the Board of Governors approved the Model Additional Protocol—only 78 states had signed APs and only 37—less than half—had brought them into force. Extensive efforts

have been and are being made to encourage wider adherence to safeguards agreements and APs. The full potential of the strengthened safeguards system can be realised only through universal adherence to all the strengthening measures, including those of the Model Additional Protocol.

Conclusion

The implementation of safeguards makes a major contribution to international peace and security. Safeguards help a state to demonstrate compliance with its nonproliferation undertakings and through them other states receive assurance of that compliance. Because of its key contribution to international security, the safeguards system must remain effective. The IAEA has developed integrated safeguards to optimise effectiveness and cost-efficiency. Because integrated safeguards can be implemented only in a state which has both a CSA and an AP in force and for which the IAEA Secretariat has been able to draw the necessary safeguards conclusions, states need to work towards concluding those CSAs that have yet to be brought into force and towards universal subscription to APs based on the model text.

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Endnotes

[1] 'Effectiveness' is a measure of the extent to which the IAEA meets its safeguards objectives. 'Efficiency' is a measure of how well the human and financial resources needed for this are used.

[2] See Pierre Goldschmidt, 'Strengthened safeguards: meeting present and future challenges', *IAEA Bulletin,* vol. 43, no. 4, 2001, pp. 6–11; and Pierre Goldschmidt, *The IAEA Safeguards System Moves into the 21st Century,* Supplement to the *IAEA Bulletin,* vol. 41, no. 4, 1999.

[3] International Atomic Energy Agency, 'The structure and content of agreements between the Agency and states required in connection with the Treaty on the Non-Proliferation of Nuclear Weapons', INFCIRC/153 (Corrected), IAEA, Vienna, 1972.

[4] Other issues directly influencing safeguards-strengthening measures were the difficulties the IAEA experienced (and continues to experience) in verifying the correctness and completeness of the initial report of nuclear material made by the Democratic People's Republic of Korea (North Korea) and its very different, positive experience in verifying the initial report of South Africa.

[5] Safeguards agreements in any case foresee the continuous development of safeguards verification, which must at all times take into account the interest of a state in (a) obtaining credible assurances, (b) not being impeded in its efforts to exploit the peaceful uses of nuclear energy, and (c) not being burdened with excessive costs. There is also a need to preserve the confidentiality of commercial and industrial secrets and of other knowledge obtained by the IAEA as a result of safeguards implementation.

[6] The programme began in 1993 and is described, *inter alia,* in a report to the 44th regular session of the IAEA General Conference, 'Strengthening the effectiveness and improving the efficiency of the safeguards system and application of the Model Additional Protocol', GC(44)/12, 16 August 2000. Refinements to the resulting measures continue to be made.

[7] Issued as 'Model Protocol additional to the agreement(s) between state(s) and the International Atomic Energy Agency for the application of safeguards', INFCIRC/540 (Corrected), IAEA, Vienna, 1998.

[8] This information is obtained from a state itself, from IAEA verification activities or from open and other sources of information available to the Agency. A state's declarations under articles 2 and 3 of an AP supplement the largely numerical nuclear material accounting data and design information submitted under safeguards agreements with site descriptions and with information about activities not involving nuclear material; waste processing; non-nuclear use of material; source material transfers and holdings; nuclear material activities; future plans; and equipment transfers.

[9] Access provided by a state to IAEA inspectors in accordance with the provisions of an AP is called 'complementary access'. Although Article 4 of an AP prescribes that the IAEA shall not mechanistically or systematically seek to verify the information provided by a state under Article 2 of its AP, the IAEA has the right to conduct complementary access for three purposes: (a) to assure the absence of undeclared nuclear material and activities at sites, mines, concentration plants and other locations where nuclear material has been declared to be present; (b) to resolve a question related to the correctness and completeness of the information provided by a state pursuant to Article 2 of its AP, or to resolve an inconsistency related to that information; and (c) to confirm, for safeguards purposes, the decommissioned status of a facility or a location outside facilities (LOF) where nuclear material was customarily used.

[10] The framework within which safeguards conclusions are now drawn is the safeguards state evaluation process. This seeks to integrate and assess the totality of information available to the IAEA about a state's nuclear activities and plans, whether provided by states themselves under safeguards agreements, under APs and voluntarily; deriving from the implementation of in-field verification activities; or obtained from open and other sources of safeguards-relevant information. The 'state-level' approach finds tangible expression in the state evaluation groups established to carry out evaluations and in the state evaluation reports (SERs) that result from them. These reports are regularly reviewed and updated: state evaluation is a dynamic process in which new information must continually be taken into account, assessed and factored into the

state evaluations. There are well established mechanisms for all of this within the IAEA, including senior management review of SERs. This is to ensure consistency of approach in evaluating all safeguards-relevant information available to the IAEA about a specific state; appropriate recommendations for any follow-up action required as a result of evaluation; and soundly based safeguards conclusions for each individual state which are reflected, inter alia, in the Agency's annual *Safeguards Implementation Report* (SIR).

[11] See Jill N. Cooley, 'Integrated safeguards: current status of development and plans for implementation', Proceedings of the 42nd Annual Meeting of the Institute for Nuclear Materials Management (INMM), July 2001; and Jill N. Cooley, 'The conceptual framework for integrated safeguards', Proceedings of the 43rd Annual Meeting of the INMM, June 2002.

[12] Nuclear material accountancy yields results and conclusions that are quantitative in nature. In contrast, the broader measures implemented under an AP yield results and conclusions which are more qualitatively based. See also note 8.

[13] Such a conclusion can only be inferred from the absence of any evidence to the contrary. Absence of evidence can never prove with total certainty that there has been no diversion or that there are no undeclared nuclear material and activities; it means only that, from a thorough evaluation of all relevant information available to the IAEA, no indication of diversion or of undeclared nuclear material and activities has been observed.

[14] A 'significant quantity' of nuclear material is the approximate amount for which the possibility of manufacturing a nuclear explosive device cannot be excluded. What this amount is depends on the nature of the nuclear material, for example, 8 kilogram (kg) of plutonium and 25 kg of uranium-235 contained in high enriched uranium (HEU).

[15] 'Report to the 44th regular session, IAEA General Conference on 'Strengthening the effectiveness and improving the efficiency of the safeguards system and application of the Model Additional Protocol', GC(44)/12, 16 August 2000.

[16] See note 10.

[17] A location outside facilities is any installation or location where nuclear material is customarily used in amounts of 1 effective kilogram or less. See International Atomic Energy Agency, *IAEA Safeguards Glossary,* IAEA, Vienna, 2001, p. 34.

[18] For the definition of complementary access, see note 9.

[19] Under a CSA, a state is required to establish and maintain a system of accounting for and control of nuclear material subject to safeguards under the agreement. The measures stipulated as necessary in this regard include those needed to determine the quantities of nuclear material on inventory and changes to these; a system of records and reports, including reports to the IAEA; and provisions to ensure that accounting procedures and arrangements are being operated correctly. These and other requirements constitute an important basis for the application of IAEA safeguards. An SSAC might also have a national objective—to account for and control nuclear material in the state for its own purposes.

[20] For example, one approach might involve using unannounced inspections to detect diversion of nuclear material or any undeclared nuclear activities at declared nuclear facilities. Another approach might involve announced inspections at dates selected randomly, supported by containment and surveillance measures.

[21] The technical objective is the timely detection of diversion of significant quantities of nuclear material from peaceful nuclear activities to the manufacture of nuclear weapons or other nuclear explosive devices or for purposes unknown and the deterrence of such diversion by the risk of early detection. On the meaning of 'significant quantities' see note 14.

[22] The use of unannounced inspections is provided for in INFCIRC/153 (Corrected), but because of difficulties in practical arrangements they have in the past been used only to a limited extent.

[23] See also note 10.

[24] As provided for in Article 4.a.(i) of the Model Additional Protocol.

3

UNMOVIC in Iraq: opportunity lost

Trevor Findlay and Ben Mines

In November 2002 the United Nations Monitoring, Verification and Inspection Commission (UNMOVIC), in partnership with the International Atomic Energy Agency (IAEA), resumed international inspections in Iraq after an absence of nearly four years. UNMOVIC had been established by the UN Security Council in December 1999 in the hope that a new organisation would attract greater co-operation from Iraq than its predecessor, the UN Special Commission on Iraq (UNSCOM).[1] However, it was not until the US Administration of President George W. Bush threatened credible military action that Iraq agreed to admit UNMOVIC inspectors (as well as readmitting those of the IAEA[2]) to its territory. Unfortunately, US patience ran out before UNMOVIC was able to fulfil its mandate. It and the IAEA were withdrawn in March 2003, after just four months of inspections, prior to US-led military action. Despite the brevity of its operations in the field, however, UNMOVIC's experience has yielded valuable lessons for future inspection and verification regimes. This chapter examines the history and achievements of UNMOVIC, from its inception to its withdrawal from Iraq, and its likely future.

UNMOVIC: establishment, organisation and capabilities

As part of the ceasefire that ended the 1991 Persian Gulf War, the UN Security Council demanded that Iraq divest itself of its nuclear, chemical and biological weapons capabilities and of its delivery systems with a range greater than 150 kilometres (km).[3] UNMOVIC, a specially created international inspection agency, and the IAEA were mandated to verify that Iraq was complying with these requirements. Among the achievements of UNMOVIC and the IAEA's Iraq Action Team—responsible for nuclear inspections in Iraq—were the discovery of an offensive

biological weapons (BW) programme, a VX nerve agent capability, long-range missiles capable of delivering weapons of mass destruction (WMD) and a clandestine nuclear programme. The inspectors successfully destroyed significant quantities of ballistic missiles, chemical munitions and agents, and closed down a BW facility and an entire nuclear weapons research and production capability.[4]

But Iraq never did produce a credible complete and final accounting of its capabilities and what had become of them, particularly in respect of its BW programme.[5] UNSCOM and the IAEA inspectors were also faced with persistent Iraqi non-co-operation, harassment and dissembling. They had therefore not been able to completely verify Iraqi disarmament, nor to put completely in place the planned long-term Ongoing Monitoring and Verification (OMV) system designed to prevent Iraq from re-acquiring WMD capabilities. The inspectors were forced to withdraw in December 1998 to avoid air strikes carried out by the US and the UK in a failed attempt to compel Iraq to co-operate fully.

Formation and mandate

UNMOVIC was created by Security Council Resolution 1284 on 17 December 1999 as a replacement for UNSCOM. The new body inherited its predecessor's responsibilities, as well as being mandated to strengthen UNSCOM's OMV,[6] now to be known as the Reinforced Ongoing Monitoring and Verification (R-OMV) system. The IAEA retained its separate role with regard to nuclear matters. Swedish diplomat Dr Hans Blix, former Director General of the IAEA, was appointed UNMOVIC's Executive Chairman.[7] Controversy attended his appointment after American critics pointed out that it was during his tenure at the IAEA that Iraq was able to establish an illicit nuclear weapons programme under the nose of the agency's nuclear safeguards regime.[8]

A 16-member College of Commissioners was also appointed.[9] Chaired by the Executive Chairman, it was to meet at least every three months to provide him with advice and guidance. He would be required to consult it on major policy decisions. The role and membership of the college elicited allegations that UNMOVIC would have less political independence than UNSCOM, but such fears never materialised.[10]

Organisation and capabilities

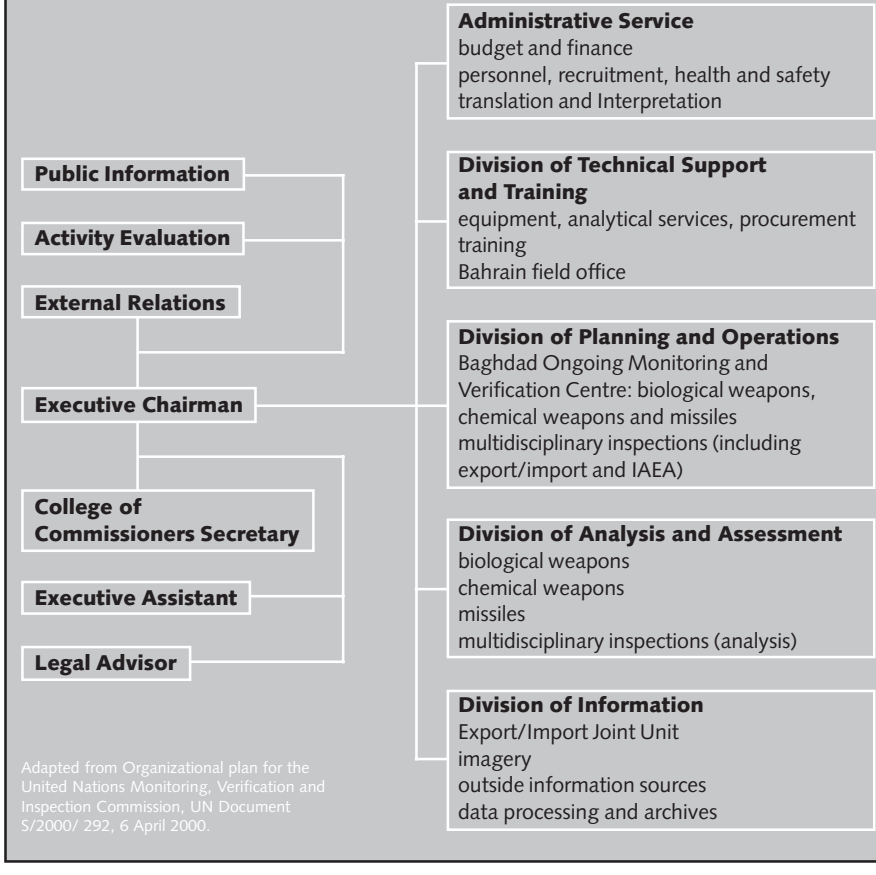
UNMOVIC drew heavily on the experience of its predecessor, as well as acquiring its assets and archives and some of its personnel. However, it became a much

more capable organisation than UNSCOM had been, partly because UNSCOM had laid much of the groundwork, but also because UNMOVIC used the three years between its establishment and the deployment of its inspectors to Iraq to great advantage.

The Commission, which, despite its withdrawal from Iraq, still exists, comprises, besides the Executive Chairman and his support office, an Administrative Service and four main divisions—Technical Support and Training; Planning and Operations; Analysis and Assessment; and Information (see figure 1).[11]

The Division of Planning and Operations is responsible for the planning and execution of all monitoring, verification and inspection activities, including proposing sites for inspection, planning the objectives and timing of inspections and deciding the composition of inspection teams. It has four principal units—biological weapons,

Figure 1 **UNMOVIC organisational chart**



Adapted from Organizational plan for the United Nations Monitoring, Verification and Inspection Commission, UN Document S/2000/ 292, 6 April 2000.

chemical weapons, ballistic missiles, and multidisciplinary inspections and operations. The multidisciplinary unit was formed on the recommendation of the 1999 Amorim panel[12] which reviewed UNSCOM's operations and concluded that such teams could better investigate sites hosting multiple activities. The division also has responsibility for the verification and monitoring of any proscribed items imported by Iraq and investigating any dual-use items, as part of the Export/Import Joint Unit with the IAEA. It also has responsibility for the R-OMV system.

The Division of Information gathers, processes and archives information from several sources, including that garnered from both UNMOVIC and UNSCOM inspections, overhead imagery, open sources (notably from the Monterey Institute and a French research institute) and intelligence provided by UN member states (notably the US and the UK, but also possibly France, Germany and Israel).[13] Because of the long period that elapsed between the end of UNSCOM inspections and the commencement of UNMOVIC inspections, and the resulting paucity of information about Iraq's weapons programmes between 1998 and 2002, information from open sources and intelligence was particularly important.

The Division of Analysis and Assessment is responsible for processing information in order to focus the work of the inspections, provide a basis for the R-OMV and assist the Export/Import Joint Unit. The Division has the same four units as the Division of Planning and Operations and each unit liaises directly with its counterpart to identify new sites for inspection and assess Iraq's compliance.

Finally, the Division of Technical Support and Training provides UNMOVIC with all the equipment and supplies needed for inspections in Iraq, such as logistics, transport, communications and security. These activities were implemented in Iraq from the Baghdad Ongoing Monitoring, Verification and Inspection Centre (BOMVIC) for both UNMOVIC and IAEA inspections. It is also responsible for the Larnaca (Cyprus) and Bahrain field offices and for running the training programmes for staff and inspectors.

The waiting game: UNMOVIC before inspections

A key difference between UNMOVIC and its predecessor was that UNSCOM was launched straight into inspections, while UNMOVIC had the benefit of three years of preparation. UNSCOM arrived in Iraq and performed its first inspection in May 1991, barely a

month after being created by Resolution 687. By contrast, UNMOVIC was able to use the waiting period to determine priority sites for inspection, carefully analyse the information on Iraq's WMD programmes and capabilities, consolidate and learn from the experiences of its predecessor, create a well-trained force of inspectors and refine its monitoring and inspection methods.

As instructed in Resolution 1284, UNMOVIC focused on identifying 'unresolved disarmament issues' and 'key remaining disarmament tasks'. To this end it assembled unresolved disarmament issues into interrelated clusters to obtain a better overall picture of Iraq's WMD programmes and to assess the significance of the gaps in its knowledge and hence what still needed to be verified.[14]

Staff training—which under UNSCOM had been largely the responsibility of member states—was now organised and conducted solely by UNMOVIC (although with some support from governments). The Commission instigated a rolling programme of training on a wide range of topics—the past work of UNSCOM; the origins, mandate and legal framework of UNMOVIC; the scope and nature of Iraq's weapons programmes; monitoring and inspection techniques; and health and safety. It also included a cultural training package which covered the history, economy, politics and society of Iraq with regional, social and religious themes (UNSCOM had been accused of cultural insensitivity). UNMOVIC also ran advanced discipline-specific training courses once experts had been through the initial training course, focusing on biological, chemical or missile inspections. The first training course ran from July to August 2000 and trained 44 experts from 19 countries. With the completion of this and four more courses and the recruitment of 42 professional core staff in New York, UNMOVIC was in a good position by the end of 2002 to commence inspections at short notice. Courses were still running in February 2003, bringing the total of experts on the roster to 380 from 55 nations.

Technology

UNMOVIC also had better technology than UNSCOM. Both the surveys and the inspections conducted in Iraq by UNMOVIC were greatly assisted by significant improvements in technology since 1998. Detection devices were now smaller, lighter, faster and more accurate. They included miniature radiation sensors, portable chemical and biological weapon detectors and ground-penetrating radar. Multi-channel analysers (MCAs) were used to detect and analyse gamma radiation from

radioisotopes and neutron radiation from plutonium, while a gamma spectrometer was used to identify highly enriched uranium. Importantly, as nuclear activities often require exotic metals, X-ray fluorescence spectrometers were used to distinguish between various metal alloys. For its part, the IAEA used environmental sampling techniques developed for improved nuclear safeguards verification to monitor water, air and vegetation. The equipment used to survey Iraq's watercourses was so sensitive that it could detect the permitted use by Iraq of radioisotopes for medical applications. Information technology developments also helped UNMOVIC. For instance, the IAEA and UNMOVIC databases were linked and cross-disciplinary analysis not previously available was used to look for patterns and connections.

UNMOVIC's capabilities were also to be enhanced by the establishment of two regional offices, the freedom to fly into Baghdad rather than an airport several hours' drive away, a fleet of British, Canadian and Russian helicopters, access to colour satellite images, including images from commercial providers, and the use of *Mirage* and U-2 aircraft for extra reconnaissance (although the latter took some time to arrange). It was also planned to obtain data from unmanned aerial vehicles (UAVs), but these were never deployed because of lack of time before UNMOVIC's withdrawal.

The build-up to UNMOVIC's entry into Iraq

The first signs of movement in the Iraqi position on allowing inspectors to return began in the early part of 2002, prompted by US and British intimations that the use of force could not be ruled out if Iraq continued to defy the Security Council. The Foreign Minister of Iraq held talks with the UN Secretary-General, Kofi Annan, on 7 March and again on 1 and 3 May. Technical talks were also held between UNMOVIC and an Iraqi delegation, headed by General Amer Al-Sa'adi, the main point of contact for UNSCOM on chemical and biological weapons. Pressure was increased by the US release in September of intelligence information on Iraq's alleged import of aluminium tubes for use in uranium enrichment centrifuges. The now infamous British dossier on Iraq's alleged WMD was published on 24 September 2002.[15]

On 8 November 2002 the Security Council unanimously adopted Resolution 1441, declaring that Iraq had been and continued to be in 'material breach' of its

obligations and calling on it to co-operate 'immediately, unconditionally and actively' with UNMOVIC. It ordered Baghdad to provide UNMOVIC and the IAEA with 'immediate, unimpeded, unconditional, and unrestricted access to any and all, including underground, areas, facilities, buildings, equipment, records, and means of transport which they wish to inspect'. The two bodies could impose no-drive and no-fly zones around suspect sites and could destroy, impound or remove any armaments, materials or records. They were also entitled to receive comprehensive lists of and 'immediate, unimpeded, unrestricted, and private access to all officials and other persons' whom they wished to interview in a mode or location of their choosing, without the presence of Iraqi observers. Gone were the special procedures for the inspection of the eight presidential sites of Iraqi President Saddam Hussein—negotiated by Kofi Annan in February 1998[16]—as were the confidential 'understandings' previously reached with Iraq by the first UNSCOM Executive Chairman, Rolf Ekéus. The inspectors' premises were to be protected by UN guards, and UNMOVIC and IAEA personnel were to have unimpeded entry to, and exit from, Iraq, and the right to import and export any equipment and material they required.

Not only was UNMOVIC's mandate now tougher and more intrusive than that of UNSCOM; it was also politically more compelling. Unlike Resolution 687 establishing UNSCOM, Resolution 1284 established UNMOVIC specifically under Chapter VII of the UN Charter, leaving no doubt that compliance with the resolution was mandatory. It was also, unlike the initial UNSCOM resolution, adopted unanimously (even Syria voted in favour). Resolution 1441 also explicitly stated that failure to comply at any point 'shall constitute a further material breach of Iraq's obligations', which would be reported to the Security Council for immediate assessment, with the possibility of 'serious consequences'. This was the first time such a direct threat of force had been made in a resolution concerning the UN inspection regime. Previously, it had been linked indirectly as part of Iraq's ceasefire obligations.[17]

Several deadlines were imposed by Resolution 1441. Iraq was given seven days to notify the Security Council that it would comply and 30 days to provide a 'currently accurate, full and complete declaration of all aspects of its programmes to develop chemical, biological and nuclear weapons, ballistic missiles, and other delivery systems'. UNMOVIC was to begin inspections within 45 days and report to the Council 60 days thereafter, but earlier if Iraq was failing to comply.

On 13 November 2002 Iraq informed the Security Council of its decision to comply with the resolution 'without conditions'. An advance team of 30 staff lost no time in travelling to Baghdad with Dr Blix and IAEA Director General Dr Mohamed ElBaradei on 18 November for talks with Iraqi officials on the practical arrangements for the return of inspectors and to prepare premises and organise logistics to permit the resumption of operations. On 7 December a crucial deadline was met when Iraq provided, more than 24 hours before it was required to do so, what purported to be the required 'accurate, full, and complete declaration'. Comprising over 11,807 pages, with 352 pages of annexes and 529 megabytes of data, the declaration was detailed, technical and partly in Arabic.

The inspectors return: 27 November 2002–17 March 2003

The first inspectors arrived in Iraq on 25 November. Although they numbered only 11, they covered all areas of UNMOVIC's work. This paved the way for inspections to begin early—just two days later, on 27 November, when three sites previously inspected by UNSCOM were visited. Several more inspections were conducted, unimpeded by the Iraqis, on successive days. These early inspections were low-key affairs, designed to test Iraqi co-operation, while also attempting to re-establish a baseline of information ('re-baselining') to facilitate future inspections. On 3 December the first presidential site was inspected, again without serious incident, although access was delayed.

The first two weeks yielded only a few inspections per day and were general rather than discipline-specific. They were carried out by the small advance team from UNMOVIC and the IAEA's Iraq Action Team—renamed the Iraq Nuclear Verification Office (INVO). However, as the number of inspectors in Iraq grew, inspections steadily intensified.[18] From 14 December they began in earnest, averaging eight per day, with discipline-specific teams focusing on their own particular area of interest. Each inspection team contained on average eight inspectors, but their numbers ranged from as many as 40 and as few as two.

In its 111 days in Iraq, UNMOVIC conducted 731 inspections at 411 sites—of which 88 had not been inspected previously[19]—while the INVO conducted 237 nuclear inspections at 148 sites, including 27 new sites, covering over 1,600 buildings.[20] Of the UNMOVIC inspections, 219 (30 percent) were conducted by missile teams,

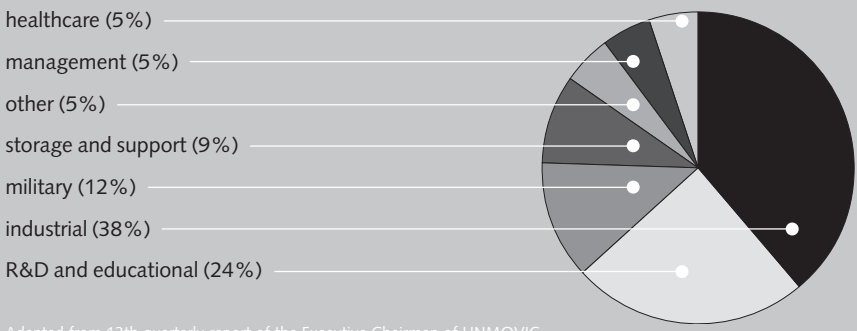
205 (28 percent) by biological, 161 (22 percent) by chemical and 146 (20 percent) by multidisciplinary teams.

Figure 2 provides a breakdown of the types of site inspected by UNMOVIC. Industrial sites represented the majority (which included food, medicine, ammunition and missile-related production plants[21]) followed by research and development and military sites. Most of the sites were located around Baghdad or the northern city of Mosul, inspections of the latter being facilitated by the opening of a regional field office there. Another regional field office was planned for the city of Basra but the inspectors left before it could be established. This would have opened up the southern part of Iraq to more thorough inspection and monitoring and increased the element of surprise. In the end only seven sites were inspected in the southern third of the country.

In addition to inspections, the INVO also conducted 125 surveys, including 42 at locations not previously visited by the IAEA. The surveys included land- and vehicle-based sampling, the teams travelling over 8,000 km to visit state-run industrial and military locations as well as urban areas. The INVO also conducted a radiometric survey of Iraq's main watercourses from 9 to 19 December.

The pattern of inspections by UNMOVIC and the INVO shows two distinct phases. From November until the beginning of 2003, the focus was on re-establishing a baseline for the declared sites by assessing any changes in activity, personnel or equipment since inspectors left in 1998. Newly declared sites were also visited in this phase and all sites were assessed against Iraq's 7 December declaration. From

Figure 2 **Types of sites inspected by UNMOVIC**



Adapted from 13th quarterly report of the Executive Chairman of UNMOVIC to the Security Council, UN Document S/2003/580, 30 May 2003.

mid-January onwards UNMOVIC and the INVO began an investigative phase designed to identify and pursue leads obtained from inspections, Iraqi documents or information from other sources, including intelligence. This phase was characterised by the re-inspection of key sites. Among those inspected on several occasions were:

- Al Qa Qaa, a large industrial complex responsible for the explosive filling of long-range missile warheads; it was inspected by nuclear, chemical, missile and multidisciplinary teams (30 inspections);
- Tuwaitha, the former main site of Iraq's nuclear programme (18 inspections by INVO teams);
- the Al Mamoun plant, involved in making missile propellant (18 inspections);
- the Al Kadhimiyah plant, producing guidance and control systems for missiles (16 inspections); and
- Al Mutasim, involved in making missile motors (16 inspections).

The inspectors were still fully engaged in this phase of their operations when they were withdrawn.

The extent of Iraqi co-operation

In sharp contrast to their handling of UNSCOM, the Iraqis did not prevent entry to any site that UNMOVIC sought to visit and delays in gaining access were minimal, even when inspections were no-notice or undeclared. Iraq also assisted UNMOVIC with infrastructure such as premises. UNMOVIC used a variety of intrusive techniques, including air, chemical and radiological sampling, photography and video, tagging of equipment and document collection, without Iraqi interference. Iraq also established two commissions to search for proscribed items and documentation. The first, appointed on 20 January 2003, allegedly located four 122mm chemical warheads and two aerial bombs for biological agents.

There were two key areas where Iraq was unco-operative and used delaying tactics. The first concerned helicopter flights and surveillance flights by U-2 and *Mirage* aircraft, despite the fact that similar aircraft had been used by UNSCOM. Iraq eventually conceded on allowing all UNMOVIC aircraft to operate freely in Iraq, including in the no-fly zones.[22] The first U-2 flight took place on 17 February. A French-supplied *Mirage* aircraft conducted its first mission on 26 February. The two aircraft procured digital imagery that could be delivered to UNMOVIC headquarters

within hours. UNMOVIC intended to supplement these sources with Russian surveillance aircraft with a night-vision capability and German-supplied UAVs. UNMOVIC also leased helicopters which were used for aerial surveillance as well as transporting inspectors around the country.

The second area of difficulty related to interviews with technical and scientific personnel without the use of tape recorders or the presence of Iraqi minders—a key demand of the Security Council. Iraq eventually relented and 26 interviews—14 by UNMOVIC and 12 by the IAEA—were conducted from 5 February until the end of inspections, all under the conditions stipulated by UNMOVIC and the IAEA.

In his reports to the Security Council, Hans Blix was careful to distinguish between Iraq's co-operation in process and co-operation in substance. While co-operation in the former was good, in the latter Iraq continued to be evasive and misleading. Its supposed 'currently accurate, full and complete declaration' of 7 December was farcical, mostly comprising a compilation of Iraq's past supposedly accurate full and complete declarations. In his briefing to the Council on 7 March 2003 Blix identified at least 100 unanswered questions, many relating to uncertainty surrounding the amounts of anthrax and VX nerve agents that Iraq had declared but had not adequately accounted for.[23]

Iraq was clearly continuing to engage in a campaign of deception and denial, and one that was apparently more sophisticated than ever, thanks to its experience in handling UNSCOM and the intervening years that it had had to prepare for the inspectors' return. Ironically, though, this time the Iraqis had much less to hide, since they had not been as successful in reconstituting their WMD programmes as had been alleged. The US-led Iraq Survey Group (ISG), comprising Australian, American and British inspectors, still in Iraq at the time of writing, may eventually reveal the real extent of both their WMD plans and their campaign of denial and deception.[24]

UNMOVIC's achievements

Findings

In their four months of inspections, UNMOVIC and the INVO found little evidence that Iraq either still possessed WMD or was engaged in new or reconstituted programmes to produce them.[25] Some proscribed items were uncovered but they were

not the 'smoking gun' that had been alleged to exist. No stockpiles of chemical or biological weapons were found. While US intelligence had alleged the existence of mobile BW laboratories, UNMOVIC could find no trace of them. The vehicles it did discover turned out to be mobile agricultural research units. Although the US subsequently found more vehicles after its invasion of the country in March 2003, it appears now that their purpose was as Iraq had claimed—filling hydrogen balloons to assist in weather forecasting for artillery use.[26] With regard to the US allegation that Iraq had developed UAVs for WMD delivery (under Resolution 687, UAVs were subject to the same 150 km-range limit as missiles), UNMOVIC concluded, after discovering one, that instead they were likely to have been for surveillance purposes.

The IAEA concluded, for its part, that Iraq had been unable to reconstitute its nuclear weapons programme. It also arrived at negative findings on two specific issues. First, it concluded that the aluminium tubes illegally imported by Iraq, allegedly for use in centrifuges for uranium enrichment, were in fact for use in rockets. Second, it quickly determined that documents obtained from US intelligence alleging an Iraqi attempt to obtain yellowcake (milled uranium oxide, U_3O_8) from Niger were crude forgeries.[27] While it is now widely agreed that the documents were fakes, the UK continues to maintain that it had independent intelligence about such a bid, although it is not clear whether it shared this with the IAEA.

The most prominent discovery by UN inspectors resulted from analysis of Iraq's six-monthly declaration, provided in October 2002, before inspections started, which revealed information on two types of surface-to-surface missiles, the Al Samoud 2 and the Al Fatah. Flight test data were analysed in February 2003 by a panel of international experts from China, France, Germany, the UK, Ukraine and the US, convened by UNMOVIC,[28] which concluded that the Al Samoud 2 was capable of exceeding the 150 km-range limit. Iraq also declared the acquisition of a large number of surface-to-air missile engines, which violated the arms embargo imposed by Resolution 687. The engines could also be modified for use as longer-range missiles.

It was also discovered that the casting chambers at the Al Mamoun facility, which had been destroyed by UNSCOM because they were intended to be used in producing the proscribed Badr-2000 missile, had been refurbished and were judged to be able to produce missile motors capable of ranges greater than 150 km.

Disarmament activity

The scale of disarmament of Iraq by UNMOVIC was minor compared to the complex and large-scale destruction activities overseen and undertaken by UNSCOM. Between 1 and 17 March 2003, when inspections ceased, UNMOVIC supervised the destruction at Al Taji of 72 missiles, along with 74 empty warheads, five engines, three launchers and three command and control vehicles. This still left a further 25 missiles, 38 warheads, six launchers, six command and control vehicles and 326 engines remaining to be destroyed. Inspectors also verified the destruction of numerous other items associated with the missile programme, such as drawings and manufactured parts, at Al Wazariyah, the Al Samoud Factory and the Al Fatah Factory. The same process at several other sites—Al Kadhimiyah, Al Qudis and the Al Fedaa Hydraulic Factory—had not yet commenced when inspectors were withdrawn from Iraq. The two casting chambers at Al Mamoun were destroyed under UNMOVIC supervision by cutting each into at least 16 pieces which were then buried and encased in concrete.

UNMOVIC was also able to complete disarmament tasks that were started but never finished by UNSCOM because of its withdrawal. Fourteen 155mm artillery shells filled with mustard gas were destroyed at the Muthanna State Establishment. The remaining 49 litres of agent and empty shells were also destroyed. UNMOVIC chemical teams also discovered and destroyed a litre of a mustard gas precursor (thiodiglycol) at the Al Basil Jadriya complex in January 2003. Iraq claimed, probably truthfully, that the chemical had been left by the previous occupants of the site and was not being used by the current scientific staff. No further evidence was found that work was being carried out on the precursor or mustard gas.

Another inspection team found 12 undeclared 122mm rockets with empty chemical warheads at the Al Ukhaider ammunition depot, while Iraq itself 'located' four more warheads at Al Taji. An UNMOVIC inspection of this site turned up two more warheads. Although some of the warheads contained liquid, analysis revealed that it was simply water. All 18 were due for destruction before the inspectors were withdrawn.

UNMOVIC's record

By 17 March 2003, differences in the Security Council over continuing Iraqi non-compliance reached a head. China, France, Germany and Russia on the one hand

and the US and UK on the other clashed heatedly over whether a second resolution was needed to authorise the use of force if Iraq were found to be in non-compliance with Resolution 1441. The impasse led to the US declaring its intention of acting unilaterally. On 18 March, two days after Washington advised the UN that the inspectors should leave for their own safety, UNMOVIC and the IAEA withdrew from Iraq. So ended the second round of international inspections. Bombing by US and British aircraft began on 20 March and the coalition invasion began soon after.

Many observers and significant numbers of Security Council member states, including China, Russia, France and all the non-permanent members, felt that UNMOVIC had not been given enough time to fulfil its mandate. While Iraq had not been proactive in assisting the inspectors and had continued to prevaricate about its past programmes, it had nonetheless co-operated sufficiently to permit UNMOVIC and the IAEA to carry out their tasks unhindered and had consistently backed down on specific issues when pressure was applied by the Council.

UNMOVIC had barely been in the country three months. It had not yet completed its second phase, had only just begun receiving overhead imagery and had not installed monitoring equipment. It had yet to open an office in Basra and had interviewed only a tiny number of the scientists and officials that it wished to interview. While it had received some intelligence from UN member states, it was clear that more was available and might be provided in the coming months. The failure of US and coalition forces and the ISG so far to uncover much more than UNMOVIC did has retrospectively enhanced the latter's reputation.[29] Calls for the ISG to be given more time and vastly greater resources reinforce the notion that UNMOVIC itself should have been afforded these. The difficulty for UNMOVIC, even if had been given more time and resources, was the perennial challenge that all verifiers, including the ISG, face—verifying a negative, in this case the absence of Iraqi WMD capabilities.

UNMOVIC appeared at all times to act professionally and efficiently, despite the adverse conditions. Among these were the failure of Western states to provide adequate intelligence early enough and fully enough to permit it to move more quickly. Also difficult for UNMOVIC were the insinuations and carping from critics within or associated with the US Administration about its alleged shortcomings. Blix, as the head of an international organisation that was supposed to balance

the interests of all UN member states, including Iraq, could clearly not engage in an open, all-out debate with his critics without further harming UNMOVIC's reputation. On the contrary, his official reports to the Security Council and public comments were models of tact, balance and diplomacy.

This was despite the intense pressure endured by UNMOVIC from the US and the UK to provide more critical language in the reports in order to emphasise Iraq's lack of compliance. Before Blix's 14 February 2003 report, the US National Security Advisor, Condoleezza Rice, met him in New York to insist on reports which were more specific and would declare Iraq in violation of Resolution 1441 to provide a pretext for war. Further pressure was exerted by US Secretary of State Colin Powell in his 5 February 2003 presentation to the Security Council. He presented evidence that Iraq was continuing to hide weapons and deceive inspectors to demonstrate that Iraq had not accepted the Security Council's offer of a 'final opportunity' to disarm. An attempt by France, Germany and Russia to bolster the inspections with a plan to treble the number of inspectors in Iraq was swiftly rejected by both the US and the UK. UNMOVIC thus faced demands from all sides of the Security Council to achieve results faster and more definitively. But, even as the inspections in Iraq intensified, so too did the US build-up of forces—a telling sign that time was running out for UNMOVIC and further compounding the pressure.

One failure by UNMOVIC to fulfil its mandate that was much criticised by US officials was Blix's understandable reluctance to attempt to remove Iraqi scientists (accompanied, presumably, by their families) from Iraq for interview. Plans were, however, being developed, before UNMOVIC's withdrawal, for them to be interviewed in another Arab state or possibly Cyprus. Some commentators suggest that this would not have helped much. Scientists might still have felt too intimidated by the Iraqi regime to divulge much information of use. Since the invasion of Iraq, the US appears to have had little success in inducing Iraqis to talk, and those who have agreed to do so have revealed little or have actually denied the existence of WMD programmes or plans.

UNMOVIC's future?

It seems unlikely that UNMOVIC will be allowed to return to Iraq to complete its mandate. Hans Blix retired at the end of June 2003 and, although he has been

replaced in the interim by the Deputy Executive Chairman, Dr Demetrius Perricos, there is no indication that a permanent head is to be appointed. Security Council Resolution 1483 of 22 May 2003 postponed a decision on the mandates and future responsibilities of UNMOVIC and the IAEA in Iraq, tacitly accepting the role of the US and the UK in further verification work there.

UNMOVIC nonetheless continues to exist and is maintaining a readiness to return to Iraq if requested. Despite some looting, BOMVIC remained intact after the conflict and could be made operational at reasonably short notice. Even with a reduced staff and logistical capability, UNMOVIC could support between five and eight inspection teams and conduct 10 site visits per day, drawing on the more than 300 inspectors that remain on its roster. However, the continued lack of security in post-war Iraq, including for UN personnel, means that it is unlikely that the UN Secretary-General would allow UNMOVIC to return to the country in the foreseeable future, even if the US agreed.

The UNMOVIC case has demonstrated that an international inspection body can perform creditably. It was able to prepare itself well, deploy quickly, use technology skilfully, organise itself efficiently, maintain its impartiality and produce sober, balanced reports of a high technical standard. It was also able to successfully follow intelligence leads and reach quick and decisive conclusions. Unlike UNSCOM, it successfully avoided being taken advantage of by any UN member state, avoided unnecessarily offending Iraqi sensibilities and managed to parlay strong Security Council support into Iraqi co-operation, if not proactive engagement and full compliance.

The UNMOVIC experience demonstrated once more that the full support of the Security Council, or at least of its permanent membership, is essential for such a multilateral verification endeavour to succeed. In the UNSCOM case, one cause of failure was French and Russian reluctance to press Iraq to comply and to give UNSCOM full political support for its intrusive inspections. In the case of UNMOVIC, failure was caused by impatience on the part of the US and ultimately a preference for military means. The US played a contradictory game, providing initial strong political support and technical assistance to UNMOVIC while at the same time withholding and delaying its provision of crucial intelligence information and tolerating unsupported criticism of UNMOVIC from within the Administration.

For the moment UNMOVIC is in limbo. France and perhaps Russia will not permit it to be abolished, but the new overlords of Iraq, the UK and the US, will not permit it to redeploy, despite the fact that it could carry out useful work, presumably in co-operation with the ISG. Meanwhile, the European Union is considering how UNMOVIC's expertise and experience might be retained for future use. For example, UNMOVIC's rosters of experts could be maintained and combined with those the UN already has, for use by the Security Council when needed. Consideration could also be given to storing basic monitoring and verification equipment and other capabilities in the same way that the UN has stores of military materiel for peacekeeping operations. Whether the idea of a permanent UNMOVIC as a standby mechanism for future Iraq-type cases is feasible remains to be seen. It may have a certain deterrent value and actual utility if urgent action is needed. However, its relationship to other verification and inspection organisations and arrangements would need to be carefully considered to avoid harming them. In addition, the expense of maintaining an UNMOVIC-in-waiting that is constantly ready for use might be too high for UN member states to contemplate at the present stage.

A further consideration is that, as the cases of Iraq, North Korea and Iran show, solutions to non-compliance problems tend to be unique. The UNMOVIC experience itself further demonstrates—in political, operational and technical terms—both the exciting possibilities of, and the potentially daunting constraints on, multilateral verification endeavours.

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Endnotes

[1] For a review of UNSCOM see Stephen Black, 'Verification under duress: the case of UNSCOM', in Trevor Findlay (ed.), *Verification Yearbook 2000,* The Verification Research, Training and Information Centre (VERTIC), London, 2000, pp. 115–129.

[2] Iraq had permitted routine inspections of its declared peaceful nuclear facilities and material in accordance with its IAEA safeguards agreement, but not the intrusive 'challenge' inspections mandated by the Security Council after the Gulf War.

[3] UN Security Council Resolution 687, 3 April 1991.

[4] Summarised in United Nations, 'Report of the First Panel established pursuant to the Note by the President of the Security Council on 30 January 1999 (S/1999/100), concerning disarmament and current and future ongoing monitoring and verification issues', UN document S/1999/356, 27 March 1999.

[5] United Nations, 'Letter dated 27 January 1999 from the Permanent Representatives of the Netherlands and Slovenia to the United Nations addressed to the President of the Security Council', UN document S/1999/94, 27 January 1999.

[6] First mandated in UN Security Council Resolution 715, 11 October 1991.

[7] United Nations, 'Letter dated 26 January 2000 from the Secretary-General addressed to the President of the Security Council', UN document S/2000/60, 27 January 2000.

[8] United Nations, 'Fourth consolidated report of the Director General of the International Atomic Energy Agency under paragraph 16 of the UNSC Resolution 1051 (1996)', as presented to the Security Council in 'Note by the Secretary General', UN document S/1997/779, 8 October 1997.

[9] The membership comprised representatives of Argentina, Brazil, Canada, China, Finland, France, Germany, India, Japan, Nigeria, Russia, Senegal, Ukraine, the UK and the US, and of the United Nations Department for Disarmament Affairs.

[10] Richard Butler, *Saddam Defiant: The Threat of Weapons of Mass Destruction, and the Crisis of Global Security,* Phoenix, London, 2000, p. 239.

[11] The organisational plan for UNMOVIC was presented in United Nations, 'Note by the Secretary General', UN document S/2000/292, 6 April 2000.

[12] United Nations, 'Report of the First Panel established pursuant to the Note by the President of the Security Council on 30 January 1999 (S/1999/100), concerning disarmament and current and future ongoing monitoring and verification issues', UN document S/1999/356, 27 March 1999.

[13] By its very nature, information about such intelligence sources is difficult to confirm.

[14] The unresolved disarmament issues were listed in the form of clusters in 'Unresolved disarmament issues: Iraq's proscribed weapons programmes', UNMOVIC working document, 6 March 2003, which was presented informally to the Security Council. A draft work programme was submitted to the Security Council for its approval on the very day that UNMOVIC completed its last inspections before leaving Iraq. 'Draft work programme', UNMOVIC document, 17 March 2003.

[15] British Government, *Iraq's Weapons of Mass Destruction: The Assessment of the British Government,* The Stationery Office, London, 24 September 2002, available at www.official-documents.co.uk/document/reps/iraq/iraqdossier.pdf.

[16] 'Memorandum of Understanding between the United Nations and the Republic of Iraq', 23 February 1998.

[17] UN Security Council Resolution 1154 of 2 March 1998 had come close to threatening the use of force in asserting that 'any violation would have severest consequences for Iraq'.

[18] For a detailed log of the inspections see VERTIC's online database of UNMOVIC and IAEA weapons inspections at www.vertic.org/onlinedatabase/unmovic.

[19] United Nations, '13th quarterly report of the Executive Chairman of UNMOVIC to the Security Council', UN document S/2003/580, 30 May 2003.

[20] '15th consolidated report of the Director General of the International Atomic Energy Agency under paragraph 16 of the UNSC Resolution 1051 (1996)', UN document S/2003/422, 14 April 2003.

[21] The breakdown of industrial sites inspected was as follows: processing and production plants: 49 percent; food and medicine production plants: 22 percent; ammunitions production plants: 9 percent; missile-related production plants: 16 percent; other production facilities: 4 percent. United Nations, '13th quarterly report of the Executive Chairman of UNMOVIC to the Security Council'.

[22] Iraq sent a letter on 10 February 2003 to UNMOVIC approving the use of U-2 and other aircraft for surveillance without any conditions.

[23] Hans Blix, 'Briefing of the Security Council, 7 March 2003: Oral introduction of the 12th quarterly report of UNMOVIC', UNMOVIC, 7 March 2003; and United Nations, '12th quarterly report of the Executive Chairman of UNMOVIC to the Security Council', UN document S/2003/232, 28 February 2003.

[24] The Iraq Survey Group (ISG) replaced the US Army's 75th Exploitation Task Force in Iraq from 7 June 2003 and assumed the task of searching for and eliminating WMD. In addition to WMD, the ISG was tasked to collect and exploit documents and media related to terrorism, war crimes, prisoners of war and persons missing in action, and other matters relating to the former Iraqi regime. See 'Briefing on the Iraq Survey Group', US Department of Defense, available at www.defenselink.mil/transcripts/2003/tr20030530-0231.html.

[25] See 'Implementation of United Nations Security Council resolutions relating to Iraq', IAEA General Conference document GOV/2003/50-GC(47)/10, 8 August 2003; and United Nations, '13th quarterly report of the Executive Chairman of UNMOVIC to the Security Council'.

[26] Peter Beaumont and Antony Barnett, 'Blow to Blair over "mobile labs"', *The Observer,* 8 June 2003, Guardian Unlimited, http://observer.guardian.co.uk/iraq/story/0,12239,973195,00.html.

[27] Mohamed ElBaradei, 'Status of nuclear inspections in Iraq: an update', Statement to the UN Security Council, 7 March 2003.

[28] The Russian expert was unable to attend.

[29] Frank Ronald Cleminson, 'What happened to Saddam's weapons of mass destruction?', *Arms Control Today,* vol. 33, no. 7, September 2003, www.armscontrol.org.

4

North Korea: the challenge of verifying a moving target

Kenneth Boutin

North Korea's apparent admission in October 2002 that it had a functioning clandestine uranium enrichment programme precipitated a crisis for nuclear arms control and disarmament. Concerns regarding the country's nuclear intentions were heightened by its subsequent expulsion of International Atomic Energy Agency (IAEA) inspectors and the reactivation of mothballed nuclear facilities, combined with the 10 January 2003 announcement of its withdrawal from the 1968 Nuclear Non-Proliferation Treaty (NPT).[1] This crisis comes at a critical juncture for a nuclear nonproliferation regime that is already under considerable stress. Suspect nuclear activities in other states parties to the NPT, such as Iran and Iraq, and the emergence of non-traditional secondary nuclear suppliers like Pakistan threaten to undermine it. How the international community addresses the dangerous precedent set by North Korea's efforts to free itself from the constraints imposed by the NPT will have a major impact on the future integrity of the nuclear nonproliferation regime.

Effective verification of North Korea's nuclear programme will be crucial to any lasting solution to this crisis. The requirement for verification is reinforced by the lack of inherent transparency in the country, where the ruling regime exercises tight control over all sources of information. This factor, coupled with North Korea's history of non-compliance with nonproliferation agreements and its poor record of co-operation with the IAEA, which is responsible for verifying compliance with the NPT, means that any agreement that fails to provide for effective verification is unlikely to receive the backing of the international community and to defuse tensions on the Korean Peninsula. As US Ambassador to the United Nations (UN) John Negroponte noted: 'It's not just a matter of getting the North to give up its nuclear weapons ambitions. North Korea must also accept a reliable verification regime'.[2]

Designing a regime to verify North Korean compliance with its obligations under the NPT and any subsidiary agreement to terminate its probable nuclear weapons programme with the degree of assurance necessary to satisfy the international community presents particular difficulties. Past attempts to secure North Korean adherence to the nuclear nonproliferation regime have foundered on the rocks of verification. Its stark threat perceptions and distrust of other states render it highly reluctant to subject itself to the scrutiny of external observers. North Korea is deeply suspicious of the objectives of multilateral organisations, which it considers to be mere instruments of hostile states. It has referred to the IAEA, for example, as the 'cat's paw' of the US.[3] North Korea's identification with what US President George W. Bush labelled the 'axis of evil' has done nothing to improve its view of the international community.[4]

This chapter examines the obstacles to verifying North Korean compliance with its obligations under the NPT and any subsidiary accord negotiated to roll back its nuclear weapons programme. It considers the political and technical aspects of a potential verification regime for North Korea and recommends approaches to meet the demanding requirements that this will involve. If it is to be viable, any verification regime for North Korea will need to be sensitive to the country's security concerns, without compromising the standard of verification established by the IAEA in the context of the NPT safeguards system.

The roots of the present crisis

North Korea has had a difficult relationship with the nuclear nonproliferation regime in the short time since it entered its fold. It was a relatively late recruit to the cause of nuclear arms control: it concluded a safeguards agreement for two nuclear research facilities in 1977, but only acceded to the NPT on 12 December 1985; and a comprehensive NPT safeguards agreement for North Korea only entered into force on 10 April 1992. The scope and focus of its nuclear programme soon generated concern within the international community, but North Korea's inflexibility on security-related issues, its relative isolation, and its resistance to many traditional policy instruments have limited the options for engaging it on this issue. As a result, there has been far greater toleration of violations of the spirit, if not the letter, of nuclear nonproliferation commitments made by North Korea than

by other states, and the international community has been forced to improvise in its dealings with North Korea.

Attempts to verify North Korean compliance with its nuclear nonproliferation obligations have led to confrontations with the international community. Controversy first erupted in 1993, soon after the country's comprehensive safeguards agreement entered into force, when routine IAEA inspections to verify the initial data declaration (submitted by North Korea in accordance with its safeguards agreement) revealed disturbing inconsistencies.[5] This developed into a crisis when North Korea proved unable or unwilling to address satisfactorily the concerns of the IAEA. Following the Agency's unprecedented invocation of the special inspection procedure in February 1993 in an effort to gain access to two sites of particular concern, and the IAEA Board of Governors' 1994 determination that North Korea was in non-compliance with its obligations under the NPT, North Korea announced its withdrawal from the treaty, although it subsequently 'suspended the effectuation' of its withdrawal.[6]

The manner in which the North Korean nuclear crisis of 1993–94 was defused sowed the seeds of the present crisis. The 1994 US–North Korea Agreed Framework that was negotiated to resolve the first crisis was intended to supplement the NPT and its safeguards by bringing North Korea into compliance with the obligations that it assumed when it acceded to the treaty. Under this accord, North Korea agreed to freeze its existing nuclear programme and to accept IAEA safeguards in return for assistance in meeting its energy needs, diplomatic and economic benefits, and security assurances.[7] Energy assistance to North Korea took the form of the provision of two light-water reactors (LWRs) and monthly supplies of fuel oil in the interim. This aid has been channelled through the Korean Peninsula Energy Development Organization (KEDO), a consortium comprising the European Union (EU), Japan, South Korea and the US.

Yet, while the 1994 Agreed Framework succeeded in keeping North Korea within the NPT fold, it failed to address the underlying issues. The accord deferred their resolution by sacrificing the standard of verification on the altar of political expediency, leaving serious questions about the scope and focus of North Korea's nuclear programme unanswered.[8] The Agreed Framework did not result in the expected application of IAEA safeguards to important segments of North Korea's nuclear programme, including activities at sites that remained operational after 1994.[9]

The Agreed Framework also did not prompt North Korea to take the initiative in addressing outstanding questions regarding its nuclear programme. Consequently, it failed to return North Korea to a state of compliance with its NPT safeguards obligations and did not lay suspicions about its nuclear programme to rest. IAEA Director General Mohamed ElBaradei has noted that North Korea has been in a state of 'chronic non-compliance' since 1993.[10]

The current crisis

The current crisis is more acute than that which confronted the international community a decade ago. Both North Korea and the US have abandoned the Agreed Framework, while North Korea has repudiated the bilateral Joint North–South Declaration on the Denuclearization of the Korean Peninsula, which it issued with South Korea in 1992.[11] North Korea has backed up claims of its 'entitlement' to develop nuclear weapons with specific measures to terminate such monitoring of its nuclear infrastructure as had survived the crisis of 1993–94. As well as expelling resident IAEA monitors, North Korea has disabled surveillance cameras and removed seals placed by the IAEA in the Yongbyon nuclear complex.

The seriousness of the crisis has been heightened by the growth of North Korean military power projection capabilities and by changes in the international environment. North Korean threats of retaliation in the event of 'aggression' are made much more credible by its development of the *Taepo-dong* series of intermediate-range ballistic missiles, as well as by the extent of progress in its efforts to develop nuclear weapons. The country now potentially possesses the capacity to strike targets throughout and well beyond Northeast Asia. An unchecked North Korean nuclear weapons programme, coupled with a viable delivery system, cannot fail to have a negative impact on regional security: it is unlikely that regional states will fail to respond to a threat of this magnitude. At the same time, the post-11 September international environment is far less tolerant of the activities of 'rogue states' than it was a decade ago, increasing the potential for a military solution to the crisis.

Resolving the present crisis is complicated by the high degree of ambiguity surrounding North Korea's clandestine nuclear programme. While there has been considerable speculation from a variety of sources regarding specific activities and the level of progress, many of these reports are second- or even third-hand and offer conflicting

information: there is little about the state of North Korea's nuclear programme that can be declared with any certainty. This uncertainty extends to the motivations driving North Korea's nuclear weapons programme. Opinions differ as to whether its primary objective is defensive, to develop a nuclear capability sufficient to deter any attempt by the US to impose its will on the country, or whether the primary value of nuclear weapons to North Korea lies in their capacity to leverage concessions from the international community, particularly the US. North Korea has contributed to this confusion by sending mixed signals regarding its conditions for renouncing the development and possession of nuclear weapons.

The North Korean verification challenge

The present North Korean verification challenge is much greater than that of a decade ago. If North Korean declarations and informed analysis are correct, the international community now confronts the prospect of having to verify nuclear disarmament as well as nuclear nonproliferation. The requirement to verify the inventory and the dismantling of what could be a substantial arsenal of nuclear weapons (one source places North Korea's production capacity at up to 253 warheads by the end of the decade), in addition to an extensive nuclear infrastructure, will greatly increase the complexity and burden of verifying North Korea.[12]

Efforts to verify North Korea's nuclear programme must contend with a major dilemma: the mistrust of North Korea by other states makes a high standard of verification all the more necessary, while North Korea's mistrust of other nations discourages it from agreeing to what most members of the international community would consider to be an acceptable standard of verification. Developing a successful verification regime for North Korea will require balancing the measures necessary to provide a high level of assurance that its nuclear industry is not engaged in the development or production of nuclear weapons, and that any nuclear weapons and fissile material that it has produced are accounted for or disposed of, against the not inconsiderable demands of acceptability from the North Korean perspective.

Designing a verification system for North Korea assumes that, potentially, the country is prepared to abide by the norms of the global nuclear nonproliferation regime and that it is willing to accept verification of its nuclear activities and materials. Both assumptions remain problematic, but there are indications that North Korea

may be prepared to commit itself to verifiable nuclear nonproliferation. A number of North Korean statements have suggested that it would consider renouncing its nuclear weapons programme if this would help it to attain key objectives.[13] The regime has been somewhat less forthcoming on verification, but has left the door open to some level of monitoring and inspection. North Korea's Ambassador to Russia, Pak Ui-chun, for example, has been quoted as saying that North Korea was 'ready to prove' that the Yongbyon plant was not involved in a clandestine nuclear weapons programme.[14]

Although North Korea and the international community consider it essential to supplant the 1994 Agreed Framework, this accord may provide a basis for the development of a more lasting verification regime. There is some support in the US, North Korea and in other states, such as Japan, for the Agreed Framework's general formula, which provided for North Korea to renounce any nuclear weapons programme and accept verification of its compliance with its nonproliferation obligations, and for it to receive assistance from concerned members of the international community.

Any arrangement to resolve the present crisis will need to avoid the pitfalls associated with the Agreed Framework. The latter's ultimate collapse resulted from its failure to generate the expected results. North Korea and the international community entered into the agreement believing that it committed the other side to particular undertakings—obligations that each side believes the other failed to fulfil. There remains a wide gulf between the position of North Korea and that of the international community on the trade-off involved. While Pyongyang apparently feels that it should be compensated for agreeing to abide by nuclear disarmament and nonproliferation norms, concerned members of the international community balk at paying it to satisfy such commitments, which it assumed voluntarily. In July 2003, for instance, US Under Secretary of State for Arms Control John Bolton declared in reference to North Korea that '[t]he days of blackmail are over'.[15]

The key to resolving the North Korean nuclear crisis will be finding a way to provide for the denuclearisation and verification that the international community is pursuing and to offer the assistance that North Korea is seeking without forcing either side to compromise unduly or to be seen to be capitulating to the other. Negotiating such a solution will necessitate overcoming a number of major obstacles concerning the subject and modalities of verification and the returns to be made

to North Korea for adhering to the norms of the nuclear nonproliferation regime, including accepting effective verification of its nuclear programme.

The subject of verification

Given the potential range and level of advancement of North Korea's nuclear industry, the possibility that it has already produced and deployed a small number of nuclear weapons, and the country's known penchant for establishing redundant capabilities and facilities wherever possible, an effective regime to verify North Korean compliance with nuclear disarmament and nonproliferation commitments will need to be comprehensive and intrusive. Verification will have to address the full scope of North Korea's nuclear infrastructure, involving an extensive array of facilities and activities spanning the entire spectrum of the nuclear fuel cycle from uranium mining and milling to fuel fabrication, enrichment and waste storage. This is not to mention the likely requirement for the verification of activities specific to the development, production and deployment of nuclear warheads.

Although our understanding of North Korea's weapons-oriented nuclear infrastructure is far from complete, the available evidence suggests that nuclear weapons-related research and development (R&D) is conducted at multiple centres situated at widely separated locations. An excellent example of North Korean efforts to maximise its chances of success is provided by its dual-track approach to acquiring the fissile material for nuclear warheads: it is known to have initiated efforts to produce high enriched uranium, as well as attempting to extract plutonium.

In order to ensure that the entire range of North Korea's nuclear-related R&D and production activities and facilities and any sites that may house completed weapons are subject to verification, it will be necessary to establish an accurate baseline of its existing nuclear programme. The effectiveness of disarmament and post-baseline verification will depend on the success of this stage. The baseline will provide the foundation for terminating any proliferation-related activities and for verifying subsequent North Korean compliance with its disarmament and nonproliferation commitments. This will offer the necessary assurance of its commitment to nuclear nonproliferation and of the irreversibility of any disarmament measures that are deemed necessary. Establishing an accurate baseline will have the added benefit of helping to resolve the inconsistencies revealed by the IAEA's 1993 inspections, which remain outstanding.

Mapping North Korea's nuclear history will be a formidable task: its nuclear programme has been underway for decades and many details of its evolution, successes and failures remain shrouded in secrecy. The contributions of foreign sources of expertise, technology and materials will be particularly difficult to chart, due to the sensitivity of the subject in the countries concerned. The precedent set by the IAEA's effort to baseline South Africa's nuclear weapons programme is instructive in this regard. Even with the co-operation of the South African authorities, determining the outlines of its apartheid-era nuclear programme proved to be a very difficult exercise.[16]

The effectiveness of efforts to establish an accurate baseline of North Korea's nuclear programme will depend to a large extent on the degree of support provided by North Korea. Proactive North Korean co-operation will be essential due to the relative dearth of knowledge on its nuclear programme, the extremely limited level of transparency in the country, and the probability that corroboration of information from external sources will not be forthcoming. Any relevant information obtained from external sources would help to confirm that provided by North Korea, as well as helping to develop a baseline of its nuclear programme.

Measures to verify ongoing North Korean compliance with the NPT and any agreement required to address a nuclear weapons programme similarly will need to include the full range of nuclear facilities and activities and any military facilities and activities associated with operational nuclear weapons. Given the apparent scope of North Korea's nuclear programme, this will constitute a considerable burden for whichever body assumes responsibility for verification. Hence, it may be necessary to prioritise facilities and activities for the purpose of verification. Providing for differing levels of intensiveness of verification would help to counterbalance the costs involved and to allow for the most efficient use of resources. Verification of North Korea's nuclear programme could be structured on two distinct levels: more intensive measures for higher-priority targets, and less intensive measures for those of secondary importance.

More intensive verification measures could be applied to facilities and activities that are legitimate from the perspective of the NPT, but which could potentially make a major contribution to a nuclear weapons programme. Such a focus is in keeping with the traditional objective of comprehensive NPT safeguards agreements,

which is to deter and, if necessary, detect the diversion of civilian nuclear resources to military projects. Given North Korean claims to have reprocessed spent nuclear fuel, it will be critical, for example, to ensure that spent fuel storage facilities, such as those at Yongbyon, are subject to particularly close scrutiny.

Less intensive measures could target decommissioned facilities or facilities and activities of secondary importance. These could include any facilities associated with operationally-deployed nuclear weapons, such as storage depots or missile sites, and facilities that were formerly engaged exclusively in nuclear weapons R&D, but which are required to be closed under a future North Korean disarmament agreement. The plutonium reprocessing facility at Yongbyon, which was shut down under the Agreed Framework, but which now appears to have been returned to operational status, would be a prime candidate. This level of verification would need only to confirm the non-active status of establishments formerly associated with a nuclear weapons programme or the non-nuclear nature of military facilities that once housed nuclear weapons.

It will be important to resist the temptation to attempt to develop a single verification regime to cover potential nuclear delivery systems as well as nuclear weapons and related activities and materials. While the country's ambitious ballistic missile R&D and production programme is the cause of considerable concern for neighbouring states and others, and its verifiable termination would enhance regional security, this is best undertaken independent of efforts to address North Korea's nuclear industry. North Korea's ballistic missile-related industrial infrastructure is distinct from that of its nuclear weapons programme. Tackling the problem of North Korea's missile industry will require particular solutions with discrete verification requirements.[17] Existing multilateral missile- and technology-control mechanisms, such as the 1987 Missile Technology Control Regime (MTCR), provide a sound framework for the effective verification of an end to North Korea's efforts to develop and produce ballistic missiles.

How North Korea is to be verified

The actual verification of North Korean compliance with its NPT and any other nuclear-related disarmament and nonproliferation commitments can be accomplished through the use of established measures. The IAEA has an extensive repertoire of approaches to verifying compliance through nuclear safeguards, many of which

are applicable to the North Korean case. These include accountancy measures designed to ensure the accuracy of declared holdings of fissile materials. There are also passive measures like installing surveillance cameras in sensitive locations in nuclear facilities and placing seals on containers of nuclear materials. Active verification measures include on-site inspections (OSIs) and environmental sampling.

The choice of specific verification instruments for North Korea will depend on a number of factors, such as the facilities and activities that are to be subject to verification, what verification North Korea is willing or can be convinced to accept, and the resources available for verification. It is worth noting that the employment of many of the potential measures outlined above in the context of a verification regime established to support a resolution of the current North Korean nuclear crisis would not represent a radical departure from the past. The IAEA applied a wide range of verification measures to the North Korean nuclear programme following entry into force of its comprehensive safeguards agreement in 1992. Some of these survived the first nuclear crisis and continued to function until their unilateral termination by North Korea at the end of 2002.[18]

The major difference between past efforts to design a verification system to address the North Korean nuclear programme and the development of a verification regime to support a new agreement to rein in or roll back North Korea's nuclear programme lies in the changed political context. North Korea is now far more wary of verification than it was before the nuclear crisis of 1993–94—it is possible that it did not realise at that time just how effective it could be. Any North Korean apprehensions on this point have been reinforced by the regime's questioning of the impartiality of verification and the objectives of those who are attempting to impose it on the country. North Korean sensitivity to verification is particularly evident with regard to intrusive measures like OSIs. The IAEA's request for special inspections in 1993–94, which, on the basis of available evidence, it was entitled to make, may have contributed to this. As noted above, this request contributed to Pyongyang's decision to withdraw from the NPT.

There are a number of possible approaches to minimising the negative aspects of verification from North Korea's perspective without compromising its potential effectiveness. The most basic of these involves making extensive use of non-intrusive verification measures, which avoid the need for inspectors to enter sensitive locations.

Environmental sampling, which does not necessarily require admission to target facilities, could play a particularly valuable role. The utilisation of satellite-based sensors could also contribute to non-intrusive verification. Infrared sensors based on board satellites can offer an indication of the level of activity in nuclear establishments, thereby providing a basis for directing the application of other verification measures, such as OSIs.

The employment of non-intrusive verification measures in the context of new arrangements for North Korean nuclear disarmament and nonproliferation could build on current efforts by North Korea's neighbours and other interested parties, like the US, to monitor nuclear developments there in the absence of North Korean co-operation. Environmental sampling of North Korea is currently undertaken from South Korea and by US measurements and signatures intelligence (MASINT)-gathering aircraft flying in international airspace to the east of the country. Satellites similarly are making a valuable contribution to the international community's efforts to track North Korea's nuclear programme.

As it will not be possible to dispense entirely with intrusive measures if the verification of North Korea is to be credible, it will be important to structure them in such a way as to minimise North Korean concerns. It will be particularly important to address Pyongyang's apprehensions regarding OSIs. While there is little that can be done about the level of intrusiveness involved in OSIs if they are to provide the assurance necessary to allay the fears of the international community, there are approaches that can minimise their negative impact from North Korea's standpoint. Pyongyang's concerns about OSIs might be assuaged by 'managed access' provisions, such as those that have been successfully employed in the context of verifying the 1993 Chemical Weapons Convention. Under managed access, the inspection of discrete facilities sharing common infrastructure is governed by separate agreements, which limit unannounced admission to facilities in the course of inspections of co-located facilities. Managed access also involves measures like the turning off of computers and the shrouding of equipment, and the random selection of rooms for inspection.

Another potentially useful approach to addressing North Korean concerns over OSIs centres on the composition of the inspection teams. Ensuring that they include personnel from states that are considered less of a threat by North Korea should

help to offset the participation of staff from states whose motives it particularly suspects. The inclusion of US personnel in inspection teams will be especially worrisome for North Korea. Other states that may be of particular concern to North Korea in this regard include Japan and at least some EU members. Inspectors from China and possibly Russia should prove much more acceptable to North Korea.

Who is to verify North Korea

The body or group of states to be given responsibility for verifying North Korean compliance with its nuclear nonproliferation obligations is a particularly sensitive matter. As noted above, North Korea is deeply suspicious of the motives of other states and does not trust even independent multilateral organisations like the IAEA, which it sees as an instrument of the US and other hostile states.

This issue is complicated by the wide gap between North Korea and the international community on the question of how to handle the crisis. North Korea's preference is to address nuclear issues bilaterally with the US—what it refers to as 'direct negotiations'—while the US and other concerned states support a multilateral solution. It is not clear if North Korea's preference for dealing with the US extends to verification itself, but it has been suggested that it is seeking to limit this to the US alone.[19] If this is the case, it intimates that North Korea envisages restricting the verification to accountancy and passive and non-intrusive active measures, as inspectors from the US would be particularly difficult for North Korea to accept. The US, for its part, has steadfastly maintained that the crisis must be addressed within a multilateral framework. This apparently extends to verification as well as to the negotiation of a mutually acceptable solution to the crisis.

If North Korea is prepared or can be convinced to accept a significant role for multilateral organisations, then the IAEA is the natural choice for verifying its compliance with nuclear nonproliferation and disarmament commitments, given its mandate and expertise. The IAEA has sought, since the onset of the crisis, to engage North Korea on the nuclear issue and to re-establish a basis for its compliance with its nonproliferation obligations and for verification. It has also been relatively lenient towards North Korea.

Unfortunately, the Agency may now be too tarnished in North Korea's eyes to be acceptable for the verification role. In North Korea's view, the independence and objectivity of the IAEA has been compromised by its perceived support for the US

position. Nonetheless, North Korea has displayed some willingness to discuss safeguards issues pertinent to the crisis with IAEA officials, although it does not seem to regard the IAEA as the key to a lasting solution.

It may be necessary to create a dedicated body to verify North Korea's nuclear programme, as with KEDO, which was founded to implement the assistance provisions of the 1994 Agreed Framework. While this may help to satisfy North Korean concerns regarding the objectivity of verification, developing a specific instrument for North Korea will require more resources than if an established IAEA mechanism were used. There is also the problem of how a new body will develop the necessary expertise. Developing a unique verification mechanism should make it more acceptable to North Korea, but it would likely be less efficient and more costly. In fact, Japan and the US apparently are considering establishing such an independent verification mechanism, involving inspectors from China, Russia and South Korea, in addition to themselves. They envisage, however, that the inspection teams will co-operate with the IAEA.[20]

There is also considerable scope for developing a bilateral North Korea–South Korea verification mechanism along the lines of that created for Argentina and Brazil. The Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC) provides for each state to inspect the other's nuclear facilities and activities. The nuclear industries of South Korea and North Korea provide a basis for reciprocal monitoring and inspections in an environment that would likely be much less threatening from the perspective of the latter. The international community's concerns could be met by having the parties conclude a joint safeguards agreement, and by having this bilateral body report to the IAEA, as is the case with ABACC.

China could be crucial to resolving the dilemma concerning North Korean suspicions of the international community and multilateral organisations like the IAEA. China is in the best position to push North Korea towards compromise due to the fact that it is its only significant long-term ally and is its most important trading partner. China could also potentially play a valuable role in helping to verify North Korean compliance with nuclear nonproliferation agreements, as noted above in the context of the composition of inspection teams. It is in China's interest to prevent regional nuclear proliferation, and Beijing is clearly quite concerned about

the North Korean nuclear crisis. It has supported both a peaceful resolution of the dispute and the return of North Korea to the realm of the nuclear nonproliferation regime. China brokered talks on the subject between North Korea and the US in April 2003, and has taken the initiative in attempting to foster further dialogue between North Korea and the international community.

North Korea seems prepared to accept China as an intermediary, and has not rejected China's attempts to bridge the gap between it and the international community. Such progress as has been made to date—particularly the 'trilateral' talks of April 2003—has been achieved with China's assistance. Its influence seems to be responsible for North Korea's gradual shift towards a position of willingness to consider multilateral talks on its nuclear programme. Over the space of a few months, North Korea's stance evolved from refusal to consider anything other than direct discussions with the US to multilateral talks, albeit restricted to China and the US, to multilateral talks involving Japan, Russia and South Korea, as well as China and the US.[21]

China may similarly be in a position to play a pivotal role in any verification regime that is developed for North Korea's nuclear programme. Its willingness to assume a prominent role might go far in reassuring North Korea and encouraging it to agree to verification. The inclusion of Chinese personnel in inspections of North Korea should not create particular difficulties for the broader international community, as long as they were part of a sufficiently diverse mixture of staff. China's experience as the recipient of OSIs under agreements like the CWC and its experience in providing personnel to multilateral verification organisations, such as the Provisional Technical Secretariat of the 1996 Comprehensive Nuclear Test Ban Treaty, should enable it to fulfil such a role effectively.

The only question regarding China's potential role as an intermediary between North Korea and the international community concerns its continued acceptability to North Korea. There is a danger that China's credibility with, and its influence over, North Korea will decline as a result of its attempts to push the country in the direction of accepting a multilateral solution and verification. North Korea may suspect the objectivity of China given its perceived support for the general position of the US and other members of the international community. North Korean perceptions of China's role may be coloured by the fact that China has traditionally either

supported North Korea's stance on security-related matters, or has at least remained aloof from them.

What North Korea is to receive in return for accepting verification

The question of what, if anything, North Korea should receive in return for reining in its nuclear programme and accepting a standard of verification sufficient to satisfy the international community, and even how to characterise what in the view of many is an inherently distasteful exercise, represents another obstacle to resolving the dispute. There is a very wide gap between North Korea and the international community on this point.

Offering North Korea material or other incentives in exchange for adhering to nuclear nonproliferation norms and accepting effective verification of its nuclear programme has been attempted before. It is noteworthy that even the former Soviet Union was forced to employ this approach with North Korea. In 1985, for example, it secured North Korea's commitment to the NPT and to international safeguards in exchange for agreeing to construct three LWRs.[22] North Korea has, in the past, responded positively to the offer of incentives, but its perceived failure to live up to its side of the bargain under the Agreed Framework has discouraged the international community from continuing with this strategy.

North Korea clearly expects a *quid pro quo* in return for scaling back its nuclear programme and accepting a comprehensive verification regime. In fact, there is a substantial body of opinion that its nuclear weapons programme is intended primarily to generate political leverage and concessions from concerned states, such as Japan, the US and EU members. One North Korean diplomat apparently indicated that it was prepared to 'reconsider' its withdrawal from the NPT in exchange, for instance, for the resumption of fuel oil deliveries, which are currently suspended.[23] North Korea's expectations of appropriate compensation apparently include economic incentives, particularly in the form of food and energy assistance, an end to 'hostile' measures by the US, including those that restrict trade, investment and development co-operation, diplomatic rewards in the shape of enhanced ties with the US, and security assurances.[24] In terms of the latter, North Korea has consistently demanded the conclusion of a formal non-aggression treaty with the US.

The international community is understandably quite reluctant to engage North Korea at this level. The US, for example, has indicated that it is not prepared to

return to the negotiating table and to compensate North Korea for fulfilling undertakings that it believes have already been compensated for under the Agreed Framework, although it has suggested that it is prepared to respond favourably to North Korean moves to terminate and accept verification of its nuclear weapons programme. White House Press Secretary Ari Fleischer stated in January 2003 that: 'there'll be no pot of gold at the end of the rainbow until there is verifiable dismantling of their nuclear weapons'.[25] Reports have suggested that US support to North Korea following its return to the nuclear nonproliferation fold could take the form—as was the case under the Agreed Framework—of helping the country to meet its energy needs.[26]

The promise of incentives, material and otherwise, will be crucial to securing North Korean agreement to curb its nuclear programme and to subject it to a standard of verification acceptable to the international community. It will be important to ensure that North Korea is not encouraged to continue attempting to use its nuclear programme to leverage concessions from the international community.

Additional Protocol plus for North Korea?

The Additional Protocol safeguards standard established by the IAEA following the post-Gulf War inspections of Iraq in the early 1990s provides a logical basis for a North Korean verification regime. The requirement to establish a baseline for North Korea's nuclear industry is consistent with the 'cradle-to-grave' data reporting obligations assumed by states that have signed Additional Protocols to their NPT safeguards agreements with the IAEA, and would provide a strengthened basis for the employment of verification measures, including greater access for inspectors. Given the nature of concerns over North Korea's nuclear programme, its history of non-compliance with its nuclear nonproliferation obligations, and the increasing acceptance of the Additional Protocol as constituting the gold standard of nuclear verification, it will be difficult for the international community to accept anything less than this.

The Additional Protocol alone may not provide an acceptable solution to the demanding verification requirements of this case, however. It was not designed with the verification of nuclear disarmament in mind. As a result, it does not provide a basis for the breadth of verification required in this respect, including inspections, which will be necessary if the international community is to be satisfied about the

sincerity of North Korea's commitment to the nuclear nonproliferation regime. If the Additional Protocol is used, it will be necessary to augment it with measures tailored to the particular circumstances of verifying North Korea.

The international community should still strive to secure North Korea's agreement to sign an Additional Protocol. This would help to shift North Korea's point of contact with the international community on this subject from a small group of states centred around the US to the wider international community represented as members of the NPT and the IAEA.

Conclusion: getting from here to there

Arriving at an arrangement to bring North Korea's nuclear programme into the nuclear nonproliferation regime, with weapons-related aspects eliminated and provision for an internationally acceptable standard of verification, will be difficult, but not impossible. There exists sufficient common ground between North Korea and the international community to suggest that it may be possible to resolve the present standoff without heightening tensions. But neither the US nor North Korea wishes to appear to be conceding to the other by taking the first step: the US wants to see North Korea take the initiative in resolving concerns about its nuclear programmme, after which it appears willing to offer aid. North Korea, though, seems determined not to move until assistance is provided.

The fact that the obstacles to a resolution of the North Korean nuclear crisis are more political than technical or technological offers hope. This suggests that the proper political environment could enable the parties to overcome their differences, given political will. A number of measures would help. The situation would benefit considerably from both North Korea and the US being publicly less confrontational. The broader international community could facilitate North Korea's acceptance of nuclear nonproliferation, disarmament and verification through a low-key approach. In addition, it would help considerably if North Korea were to state its support for global nuclear nonproliferation norms in an unambiguous manner.

While the international community is understandably hesitant to provide assistance to North Korea in advance of a successful resolution of the crisis, there are measures that it could take that would reassure North Korea of its good intentions. A US offer to provide security assurances to North Korea in the form of a non-aggression

treaty would go far towards addressing the latter's security concerns. There are indications that Washington is considering making such an offer, which would involve no economic and few political costs.[27] The US and other members of the international community could also work to engage North Korea more in economic and political fora, which would have the added benefit of eroding negative North Korean stereotypes of the West.

A third measure involves members of the international community offering to accept greater, even if symbolic, verification of their nuclear facilities and activities. This would help to assuage North Korean concerns about the independence and objectivity of verification. The greatest impact would derive from offers from states that have been at the forefront of the international community's attempts to encourage North Korea to accept comprehensive verification of its nuclear programme. Scope for this is provided by membership of the IAEA. As a member state, North Korea could contribute inspectors to the IAEA's routine verification of compliance by other member states, such as the US. The IAEA could encourage North Korea to supply inspectors as part of efforts to return it to the NPT fold.

Any attempt by the international community to employ negative incentives will almost certainly prove counterproductive. North Korea traditionally has resisted efforts to force it to follow undesired courses of action. North Korea recently indicated, for instance, that it would consider the imposition of economic or political sanctions as tantamount to an act of war.[28]

There is a major challenge involved in developing a verification regime for North Korea that is sufficiently robust to deal with the concerns of the international community and is acceptable to North Korea. It is critical, though, that the process is successful. Not only does the dispute have the potential to destabilise Northeast Asia, but the international community's success or failure in addressing it will set an important precedent for future cases of nuclear proliferation.

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Endnotes

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5

Back to basics: verification and the Biological Weapons Convention

Jez Littlewood

Few would disagree with the assessment of the United States that 'the biological weapons threat is real, growing, extremely complex, and extremely dangerous',[1] particularly in a period when the threat of mass casualty terrorism is a serious security problem, when anthrax has been disseminated through the US postal system and when the US and its 'coalition of the willing' have gone to war in the name of nonproliferation and enforced disarmament. Nevertheless, the attention focused on biological weapons (BW) in 2003 and the preceding couple of years belies the lack of substantive multilateral action to deal with the BW problem.[2]

In her account of developments relating to the Biological Weapons Convention (BWC) in last year's *Verification Yearbook,* Jenni Rissanen aptly summed up the events of 2002: 'The process of attempting to strengthen the BWC has continued on a ruinous path'.[3] Ten years of effort initiated at the 1991 Third Review Conference of BWC states parties had come to nought, including the 1992–93 verification experts (VEREX) meetings, the 1994 Special Conference and, finally, the attempts of the Ad Hoc Group (AHG) from 1995 to 2001 to negotiate a BWC verification protocol. The principal problems with the BWC, in particular the paucity of its verification and compliance mechanisms, were well known in 1991 and remain unresolved today. Hence, 1991–2001 can be considered a lost decade for the convention.

By the end of 2002, however, the states parties to the BWC had set themselves on a new course. One year overdue, the Fifth Review Conference agreed a timetable and agenda of work for the states parties for 2003–2005.[4] This 'new process' consists of a series of expert and annual meetings in each of the three years, the outcome and conclusions of which will be considered at the Sixth Review Conference in 2006. On one level the agreement to hold annual meetings must be considered

a success after the divisions which emerged in 2001 and 2002 about how to strengthen the treaty.[5] At least one state party had indicated that its preference was to abandon multilateral discussions in the BWC context until 2006.[6] However, the new process is clearly an interim strategy, and how it will actually work, as well as what it will actually do, remained and remains unclear.

Such a minimalist outcome underlines the peripheral role being played by the BWC in tackling the current biological weapons problem. The BWC is not the centre of efforts to counter the proliferation of such weapons. Strengthening the BWC through a verification agreement is off the agenda and the negotiation of any new legally binding agreement is unthinkable for the foreseeable future. Although the next three years could provide the BWC with some kind of recovery strategy that puts it at the centre of meaningful multilateral efforts to roll back the proliferation and threat of BW, failure of the new process may well sound the death knell of the convention itself.

This chapter picks up where last year's *Verification Yearbook* chapter left off and charts the course by which the states parties reached agreement on how to proceed. It then moves on to consider and analyse what the new process might achieve through an assessment of one particular aspect of the BWC—national implementation measures. That element has been chosen as an example because it was the first topic discussed in the experts' meeting in August 2003 and was the focus of many proposals at the initial session of the Fifth Review Conference in November 2001. The final section of this chapter suggests that all is not lost on the verification front for the BWC. However, our understanding of verification will have to change significantly if there is to be any progress over the next three years. In particular, the focus must be on the basics and attention must turn to national-led verification efforts.

This is where states parties implement policies based on self-reporting with a view to increasing transparency about their actions so that other parties can informally 'verify' such information and improve their assessments of a state's compliance. National-led efforts are more informal than international-led verification based on established rules and procedures and depend on each individual state's willingness to enhance transparency. Given the paucity of established verification mechanisms and the professed support of nearly all states parties for their develop-

ment, this chapter argues that these states parties must now make the best use of what is available rather than wait for a formal system to be developed. The assumption should now be that any state that fails to take the opportunity to demonstrate its compliance should be treated with the utmost caution. States parties should use the mechanisms available to them, for example, bilateral consultations or the provisions of Article V of the BWC, as tools to encourage such other states parties to submit the necessary information in order to enhance transparency.

Concluding the Fifth Review Conference

If 2001 represented the nadir of the BWC's life so far—because of the failure of the convention's Ad Hoc Group to agree on a legally binding protocol, the increasing awareness of the BW threat resulting from the anthrax attacks in the US and the suspension of the Fifth Review Conference on its final day—2002 offered at least some hope of recovery. During January–March 2002, most states parties were still reeling from the attempt by the US to terminate the AHG. By July any attempt to reconvene the Review Conference from the point where it had broken off—in the last stages of negotiations on the Final Declaration—had been effectively abandoned. A new American position indicated that the US could no longer support even a limited process before 2006 and that it wanted the resumed session of the Review Conference simply to meet in order to agree that the Sixth Review Conference be held no later than 2006.[7] Whether or not the new American position could be taken at face value or simply as a hard-line negotiating tactic to force a new deal on the BWC based on US preferences, is still unclear. However, the position was unsustainable given the rhetoric about Iraq and other states' alleged BW programmes, as well as other weapons of mass destruction (WMD) capabilities and ambitions.

In early September the Western Group made clear to the US that it could not accept its new proposal, which by this point had found its way into the public domain. This unified line adopted by the remaining members of the Western Group against the American proposal, together with attempts to seek a satisfactory and convincing answer to the question why the US had abandoned even its minimal position of November 2001, allowed the Western Group to coalesce in a search for alternative solutions and attempt to roll back the American position.

Those states that were truly committed to the BWC were not quite ready to give up and, more importantly, the president of the conference, Ambassador Tibor Tóth of Hungary, was willing and able to outline some ideas around which a compromise might be formed. Feasible ideas for taking the BWC forward that had emerged during the last quarter of 2001 and the first half of 2002 were thrown into the melting pot by Ambassador Tóth.[8] The outcome of that exercise was released to states parties at the end of October. As recounted in other assessments of the Review Conference, the proposal, made on a take-it-or-leave-it basis, was an attempt at a minimal working compromise which all could support.[9] The resumed session of the Fifth Review Conference was therefore a low-key affair, with all the key business undertaken in private meetings and regional groups. On 14 November the Fifth Review Conference agreed to adopt a programme of work put forward by Tóth, and the new process was begun.[10]

Under this work programme the conference decided to hold annual meetings of its states parties, commencing in 2003 and continuing until the Sixth Review Conference (which must be convened by the end of 2006), 'to discuss, and promote common understanding and effective action on' the following specific issues:

- (a) national measures to implement the prohibitions set forth in the convention, including penal legislation;
- (b) national mechanisms related to the security and oversight of pathogenic microorganisms and toxins;
- (c) international capabilities to respond to, investigate and mitigate the effects of alleged use of biological or toxin weapons or suspicious outbreaks of disease;
- (d) national and international institutional efforts related to the surveillance, detection, diagnosis and combating of infectious diseases affecting humans, animals and plants; and
- (e) codes of conduct for scientists.

The annual meetings of states parties will reach any conclusions or results by consensus and will in each case be preceded and prepared by a two-week meeting of experts. Items (a) and (b) were to be considered in 2003, (c) and (d) in 2004, and (e) in 2005. Although the meetings of experts will prepare factual reports describing their work, only the Sixth Review Conference can decide on any further action.

The new process: what can it deliver?

What the new process actually delivers depends on how states parties interpret and implement the decision itself and what happens at the Sixth Review Conference. Nevertheless, there is considerable scope for progress. Like the convention itself the decision has within it a number of latent possibilities.

First, the annual meetings are 'to discuss, and promote common understanding and effective action on' the five issues under consideration. This is not, therefore, intended to be just a talking shop. Concrete work is required in the form of diplomatic effort in all three areas: participants will have to discuss issues, rather than talk past each other; find a method of achieving (and recording) their common understandings; and agree on formal guidance, recommendations or decisions which support effective action and provide additional authority to implement certain activities at the national or any other level. Second, although the requirement for consensus could stymie the process, the flexibility inherent in 'any conclusions or results' permits a wide range of options to be explored and leaves the actual outcome—what 'effective action' might actually constitute—up to the states parties themselves. The depth of the new process is potentially greater than might appear, even though all understand that it will not negotiate or agree any legally binding commitments.

One factor which will influence the success or failure of the new process will be whether or not states parties approach it with the objective of developing new commitments additional to those already in existence or seek to improve the implementation of existing commitments. In an ideal situation, where states parties were collectively more reform-minded, both additional commitments and improving existing implementation would be on the agenda, but the BWC is in a far from ideal situation. New commitments that bind all states parties would require negotiation at some level and that is currently off the agenda. To convince sceptics that the BWC has a meaningful role to play, it is necessary to concentrate on its basic and fundamental provisions. States parties must get the basics right before they can move forward.

Nicholas Sims has made a persuasive argument that, in the current political climate, what is needed is not so much new commitments as the implementation of existing ones: 'What is needed in the BWC review process is the more systematic and reliable

implementation of the decisions of past Review Conferences'.[11] Even though the new process is not formally part of a review process, it is here that the first experts' meeting in August 2003 was able to make an impact. By focusing its efforts on an assessment of existing obligations, how their fulfilment might be improved and how the modalities of implementation might be developed, the experts' meeting was able to identify the means by which particular obligations in the BWC could be strengthened. It is a practical approach, but it also assuages the concerns of those who are reluctant to agree to new commitments and fear that attempts to introduce them will be attempts to develop a protocol by stealth.

National implementation measures

What this means in practice is best illustrated by considering the first of the five topics under discussion, national measures to implement the convention, and in fact only one subset of issues under that topic. Article IV of the BWC requires states to 'take any necessary measures to prohibit and prevent the development, production, stockpiling, acquisition or retention of' biological and toxin weapons within their own territory, in territory under their jurisdiction or anywhere under their control.[12] Such measures are to be undertaken in accordance with the constitutional provisions of the state party, and are therefore subject to some variance. There is no single model or solution, but the requirement for national implementation measures is neither ambiguous nor voluntary; it is a clear legal obligation.

Historically, few states parties appear to have actually fulfilled this requirement, but the benefits of knowing which states have enacted the necessary measures and how they have done so were recognised immediately. Hence, at the First Review Conference in 1980, states parties were invited to submit their legislation or other regulatory measures to the United Nations as background information.[13] Similar invitations were made at the second and third review conferences, and in 1991 an additional confidence-building measure (CBM) was added, asking states parties to provide an annual declaration on legislation, regulations and other measures adopted to implement the BWC.[14] The scope and importance of national measures were further underlined in 1991 when each state party was invited to consider the application of such measures to actions taken anywhere in the world by its nationals.[15]

The evolution of Article IV and the cumulative nature of the process of strengthening it are illustrated in table 1, which summarises the politically binding commitments

states parties have already agreed to. In the context of the new process it is significant that states parties have repeatedly urged the adoption and implementation of national measures and called continuously for information about national legislation and regulations pertaining to the BWC to be submitted. Yet, as the documentation of the fourth and fifth review conferences reveals, the rate of return for all the CBM declarations is abysmal.[16] Taking the declaration on national regulations, CBM Form E, as an example, in 2001, of the then 143 states parties to the BWC, 109 submitted no information, five submitted a declaration with 'nothing to declare', 20 had 'nothing new to declare', and only nine submitted a full declaration. Hence, 29 states parties indicated that they had implemented Article IV, while the other 114 implied that they had no national legislation or regulations to report. In 2002, of 146 states parties, 113 submitted no information, four indicated 'nothing to declare', 18 responded 'nothing new to declare' and only 11 submitted a full declaration.

If these returns are indicative of the real state of play, then 80 percent of states parties have not fulfilled their obligations under Article IV of the BWC. Putting it another way, 80 percent of states parties may be assumed to be in non-compliance because they have not provided evidence of their compliance. While this is (deliberately) a very harsh assessment of the CBM returns, it is illustrative of the work states parties need to undertake to ensure that existing commitments are realised. It is in this area that the new process can make—and is already making—a constructive contribution to the BWC.

Those who follow the BWC closely know that the actual situation is not as dire as the above analysis of the CBM returns would imply. VERTIC's project on national implementation legislation for the BWC has revealed that 95 states parties have some kind of national implementation measures in place (63 percent).[17] Moreover, at the meeting of experts in August 2003, 45 of the 66 working papers submitted by states parties provided information on their national legislation, and, in the 'Information Repository' CD-ROM prepared by the BWC Secretariat, 63 states parties plus the European Union provided information on over 440 measures taken, including legislation, to implement the BWC.

Even so, if a non-governmental organisation (NGO) had not sought information or the Secretariat had not initiated such a request on behalf of the states parties, much of the most basic information on national implementation would still be

Table 1 **Article IV measures in BWCRC final declarations**

	1st 1980	2nd 1986	3rd 1991	4th 1996	5th 2001
Noted requirement to take any necessary measures	–	–	–	–	–
Called upon states parties which have not taken necessary measures to do so immediately	–	–	–	–	–
Invited states parties to submit their legislation and regulations to UN for consultation	–	–	–	–	–
Noted the importance of legislative, administrative and other measures designed to guarantee compliance within the territory of a state party and in territory under its jurisdiction or control		–	–	–	–
Noted the importance of legislation regarding the physical protection of laboratories etc., to prevent unauthorised access to or removal of agents, toxins or materials		–	–	–	–
Noted the importance of education and the inclusion in textbooks of the prohibitions relating to BW		–	–	–	–
Invited states parties to consider the application of its necessary measures to apply, if possible, to actions taken anywhere by its nationals			–	–	–
Welcomed agreement on an additional CBM on 'Declaration of legislation, regulations and other measures'			–	–	–
Invited states parties to provide any useful information on their measures			–	–	–
Welcomed regional measures, e.g., the 1991 Mendoza Declaration			–	–	–
Reaffirmed the commitment of states parties to take necessary national measures				–	–
Recognised the need to ensure that legislation and regulations exclude the use of biological/toxin weapons in terrorist or criminal activity				–	–
Reaffirmed that use of BW under all circumstances is effectively prohibited by the convention				–	–
Encouraged the adoption without delay of measures to prevent terrorists from acquiring agents, toxins, equipment and information that could be used for BW*					–
Stressed the importance of efforts by industry and the scientific community to develop codes of conduct and/or ethical standards for work relevant to the BWC and its prohibitions*					–
Called for the adoption of measures to establish protection of agents and toxins which the state party believes to be dangerous and relevant to the BWC, including regulations on their possession, acquisition, handling and transfers, and enforcement of such measures by penal measures*					–
Urged the provision of appropriate legal assistance in criminal proceedings, and enhancement of the ability to prosecute and extradite individuals where appropriate*					–

* Although no Final Declaration was agreed at the 2001 Fifth Review Conference, the final draft indicated no outstanding disagreement over Article IV measures. These have therefore been included here to demonstate the potential for continued evolution of the article's implementation.

unknown, 23 years after the First Review Conference requested states parties to circulate information to others via the UN. Putting it simply, most states parties did not fulfil their politically binding obligations under successive review conferences or submit CBM returns on national implementation measures.[18]

Through the documentation submitted at the first experts' meeting, the new process has already gone a long way towards rectifying this particular deficiency. The first meeting of the new process has in fact galvanised states parties into making an effort to fulfil existing politically binding commitments and, by providing a forum for reviewing and discussing them, improvements in implementation have already been achieved. The existence of such a forum allowed states parties to focus on concrete and politically uncontentious issues.

Although the above assessment covers only Article IV, the approach is applicable to most elements of the new process. By first identifying what politically binding agreements have already been made in the final declarations for each of the five areas—and elements of agreement do exist for each of the five areas under discussion between 2003 and 2005, as table 1 shows—states parties can take concrete steps to fulfil them. Therefore, handled correctly, the new process can deliver significant practical benefits. Whether or not it will fulfil that promise remains to be seen, but in August 2003 it did get off to a good start.[19] Things might go awry in November 2003 when the states parties need to undertake a political assessment of the technical work done in August in order to devise 'effective action'. Problems may also arise in 2004 and 2005, but if real engagement with this process continues it could provide a feasible framework within which to take the BWC forward, albeit only in small steps.

The implications for verification

Although there are many different definitions and interpretations of what actually constitutes 'verification', the three general purposes were reiterated in the *Verification Yearbook 2000* as:[20]

- detecting non-compliance;
- deterring parties that might be tempted not to comply; and
- providing compliant parties with the opportunity to demonstrate their compliance convincingly.

Under a well-constructed verification regime, such as that provided for in the 1993 Chemical Weapons Convention (CWC), all three purposes can be achieved. Although the high-level political focus is usually on detecting non-compliance and on the deterrence aspect of the particular verification system, the day-to-day success of verification is built on the requirement for states parties to demonstrate their compliance convincingly to an organisation or other states parties, as they do under the nuclear safeguards agreements of the International Atomic Energy Agency (IAEA) or to the Organisation for the Prohibition of Chemical Weapons (OPCW). All are aware that the BWC does not have an elaborate verification system, and there will be no opportunity to develop one in the near future. Verification of certain aspects of the BWC, however, is not impossible, and the convention already has rudimentary provisions that could be used to deal with concerns about non-compliance or with non-compliance itself (Articles V and VI).[21] Together with the extended interpretations of what procedures and mechanisms are available to states parties, as recorded in the final declarations of successive review conferences, basic improvements to verification of the BWC could be made immediately. This would require a change in thinking and a revised approach to the treaty.

A new approach

To engender a new approach to verification of the BWC, states parties should use the new process to provide themselves with the opportunity to review their own implementation and demonstrate their compliance to others both continuously and convincingly. States parties would have to interpret their obligations under the BWC and the subsequent politically binding obligations contained in the final declarations of the review conferences as an instruction which requires them to submit information to other states parties in order to demonstrate their compliance.

This is not a great leap forward or a fundamental change of approach. Existing agreement and practice since 1980 are that at each review conference states parties may submit information to the UN outlining their fulfilment of the obligations contained in the BWC.[22] In addition, the CBMs incorporate this approach—the submission of information on relevant activities to other states parties. The difference rests on interpretation—states parties should now initiate the submission of information themselves instead of being requested to do so by consensus agreement—and on the periodicity of the submissions, because all relevant information would

be submitted annually rather than at five-year intervals under the review conference formula or only on the basis of the CBM requirements. At one level this would simply be a self-initiated use of the consultation and clarification procedures inherent in Article V of the BWC, albeit a progressive interpretation and one that would effectively require a national authority in each state party to take charge of BWC implementation.

The opportunity to submit information is inherent in the new process and has already been taken up by many states parties at the first experts' meeting. Any state party that now fails to avail itself of the opportunity to enhance transparency and offer evidence of its compliance should be considered as being potentially in non-compliance. From here on, such states should be treated with the utmost caution and, in some cases, suspicion.

This is not to say that every state party which does not submit information is in non-compliance. The technical or financial difficulties of fulfilling existing obligations may be a legitimate explanation for a number of small or least developed states failing to do so. Such an approach would require those states that are able and willing to submit information to recognise their responsibilities and offer implementation assistance to those which cannot do so for technical or financial reasons. However, most states parties could meet their politically binding commitments and submit information without excessive effort. The paucity of submissions indicates their failure to take such commitments seriously and, by extension, their failure to take the BWC seriously.

Implementation assistance, diplomatic liaison or correspondence, démarches where appropriate, regional and co-ordinated pressure, the application or withdrawal of technical assistance or benefits of peaceful co-operation, and the use of Article V as a standard consultation process—all present themselves as tools to encourage submission by a greater number of states parties.

To fulfil these basic requirements, each state party should deliver to the BWC Secretariat in Geneva copies of all their legal provisions, regulations and administrative arrangements as well as any measures they have implemented nationally and internationally through which they give effect to the provisions of the BWC for each of the five areas identified for consideration in the new process. Only with such information can a meaningful discussion and common understanding be fostered. The submission of information is the starting point, not the end point

of an effective new process. It would allow states parties to demonstrate their compliance with the BWC. The current mandate is focused on particular issues for a reason and only if it proves to be a success will a new set of meetings focused on other issues be useful or achievable. States parties must make this new process work in order to make a convincing case for additional work after 2006.

Although states parties should concentrate on fulfilling their existing commitments, they should also recognise that the new process does not preclude any state party from taking action on its own to strengthen the BWC or agreeing further action to improve implementation of the BWC at the regional level or together with like-minded states. There is nothing to prevent a state party from examining ideas discussed at the Fifth Review Conference in order to improve national implementation and adopting them. Others would do well to follow the US example and adopt measures to improve the protection and security of dangerous pathogens.[23] Exogenous to the BWC, states could adopt regional measures or standards for pathogen security. Such measures are permitted under the new process. Development of such a system would require consultations and co-operation among such states. They would, therefore, be able to enhance confidence in their compliance through such a process.

The five topics identified cut across the commitments and obligations of the convention, including Articles I, III, IV, V, VI, VII and X. Progress, and particularly some progress in the verification area, can be achieved if states parties use the opportunity before them. Such an approach does mean that the hard cases, those suspected of not complying with the treaty, will still be able to hide behind the lack of legal requirements but, if the majority of states parties to the BWC take up the opportunity and the challenge of the new process by 2006, a significant amount of information will be in the public domain which will serve to underline further who the hard cases are. The burden will fall on the compliant, and the immediate likelihood is that the compliant states parties will be making assessments of other states parties that they already believe are in compliance. However, it is example-setting and, in the absence of a formal legal verification regime, the only way forward.

Societal verification

A further development that is pertinent to the issue of verification of the BWC in 2003–2005 is that individuals and NGOs have lost faith in the ability and willingness of even reform-minded states to take the BWC forward. Despite the UK, for example,

having strongly supported the BWC verification protocol and the AHG mandate from the 1994 Special Conference onwards, it has now effectively abandoned the legally binding route of strengthening the BWC.[24] It is by no means the only state party to have done so and, in the face of the unwillingness of states parties to lead efforts in verification, the question of societal verification—verification from below—must come into play.[25] While no substitute for formal legally binding bilateral or multilateral verification, societal verification, if done correctly, is better than nothing.

This is relevant to the BWC given the dual-use nature of the agents, pathogens and materials, as well as the knowledge, required to develop and produce biological and toxin weapons. Civil society can pressure a state to live up to its commitments. To take the UK as an example, enquiries could be made to members of parliament about the timely submission of the UK CBM declaration. Requests could be made to view the UK's information on its CBMs, since there is nothing to stop an individual state making its submission publicly available, as Australia does via a website.[26] Even if data on civil industry facilities were removed because of concerns that commercial-in-confidence information could be derived from a public version of a CBM declaration, the ability to review the data on government facilities would still be a step forward. Likewise, the use of appropriate mechanisms to ensure that laboratories are abiding by the security requirements for pathogens, the reporting of unusual outbreaks of disease, the disclosure of information on past offensive or defensive BW programmes, the assessment of procedures for export licensing, and the reviewing of the implementation of national legislation and guidelines are all amenable to societal verification in one form or another.

The VERTIC national implementation project induced states parties to submit information on their national measures, and societal pressure in other areas could produce the same results, including in each of the five identified topics under consideration up to 2005. Societal pressure can contribute to ensuring national compliance, and the responses (evidence) provided by the state to answer the legitimate questions of its own citizens would go some way towards a demonstration of compliance.

This approach does, of course, depend on the existence of a free civil society, but democratic states could embrace these efforts, not only to assure their own citizens that they are complying with their obligations but also to lead by example. Once more, in the absence of legal measures that are applicable to all states parties, the

burden of doing this will fall on some states parties, but if the BWC is to be taken forward the states that are in compliance will have to bear such a burden and the costs involved. Efforts by organisations such as the BioWeapons Prevention Project (BWPP), which aim to nurture and empower global civil society in order to reinforce the norm against BW, are a step in the right direction. States parties may choose to support such efforts either through co-operation with them or through the provision of support, financially or in other ways.[27]

A preliminary judgement

The above analysis is positive in terms of both the potential of the new process and the first meeting of experts in August 2003. On the plus side, the new process keeps the BWC moving forward and on the international agenda. The process is very flexible and as a result has already demonstrated significant potential.[28] Co-operation between states parties on specific issues, which was signalled during the final stages of the first experts' meeting, is tangible progress.[29] Moreover, the onus is already on the Sixth Review Conference to do something much more concrete.[30] The secondary, or knock-on, benefits should also not be ignored. Annual BWC meetings were a principal objective of Western states in 2001. Agreement to hold such meetings brings the BWC into line with the current practice of states parties to the CWC and the 1968 Nuclear Non-Proliferation Treaty.[31] It also makes annual BWC meetings the norm rather than the exception, because by 2006 they will have been held, in various guises, in 18 of the last 21 years.[32] The difference in the BWC context is that such meetings are specific, focused and ad hoc, but given the depth of the BWC's problems more meetings will surely be needed after 2006. As long as they remain specific and focused, a rationale exists for their continuation, providing they deliver practical results.

The new process also goes some way towards to reducing the institutional deficit: de facto by 2006 institutional support for the BWC will have been provided for nine years.[33] Continuation of that arrangement remains at the mercy of the states parties. However, with the delivery of the 'Information Repository' on CD-ROM and the effort put in by the Chairman and the Secretariat in 2003, no state can claim that this support to the Secretariat has been a significant financial burden on it or that it has not delivered a positive contribution to the BWC or its states parties.

No analysis, however, can ignore the scale of the problems facing the BWC. It is difficult not to agree with Marie Chevrier's assertion that 'states parties are now mired in a diplomatic staging of *Waiting for Godot.* Delegations meet, spend money, argue semantics and report back to capitals, justifying continued talk while the spectre of biological warfare and bioterrorism hover in the background with ever growing menace'.[34] The much broader questions identified by Chevrier, as well as verification and compliance, scientific developments, universality and institutional arrangements, should have been included for consideration in the new process. Without doubt, the new process is a lowest common denominator outcome given the global BW context.[35] Furthermore, the lack of a final declaration at the 2001 Fifth Review Conference and consequent loss of important discussions and understandings among states parties (for instance, on hostile use, bio-control agents and their use on the territory of other states, and the scope of the BWC in the light of scientific developments) also mean that the bigger picture is ignored. And, not least, the status and mandate of the AHG have not been formally decided. These bigger questions are important to some, if not all, states parties' perceptions of the relevance and utility of the BWC to their security. The failure explicitly to address them does nothing to arrest the continued erosion of confidence in the convention.

By focusing on a number of specific issues the new process, if successful, can go some way towards revitalising the convention in 2006, but no one should forget that it was the only available strategy to move the states parties forward after the ruinous course identified by Rissanen. It kept the BWC alive. After the holding of the first meeting, it is clear that the potential for progress does exist and the new process can deliver concrete benefits to the BWC and its states parties. Whether or not the states parties collectively realise that potential remains to be seen, but to be really successful the new process will have to move states parties towards a much broader and much more coherent approach to dealing with the weakness of the BWC. The 2003–2005 process is only a new starting point, not an end in itself.

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Endnotes

[1] US Department of State, Bureau of Arms Control, 'New ways to strengthen the international regime against biological weapons', Fact sheet, Washington, DC, 19 October 2001, available at www.state.gov/t/ac/bw/fs/2001/7909.htm.

[2] By substantive multilateral action I mean collective action by all states parties to the BWC. Many states parties have taken action at the national level—for instance, action on the US controls on select agents—or with like-minded states parties (which may be interpreted as 'multilateral' action). Examples are the activities of the Australia Group, the Group of Eight industrialised countries (G8) initiative and the new Proliferation Security Initiative. The latter has been undertaken by Australia, France, Germany, Italy, Japan, the Netherlands, Poland, Portugal, Spain, the UK and the US and is designed to interdict WMD-related materials en route to state and non-state actors of proliferation concern. See http://usinfo.state.gov/topical/pol/terror/texts/03090431.htm.

[3] Jenni Rissanen, 'Continued turbulence over BWC verification', in Trevor Findlay and Oliver Meier (eds), *Verification Yearbook 2002,* The Verification Research, Training and Information Centre (VERTIC), London, December 2002, p. 88.

[4] United Nations, 'Fifth Review Conference of the states parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction: final document', BWC/CONF.V/17, Geneva, 2002, available at http://disarmament.un.org:8080/wmd/bwc/pdf/bwccnfv17.pdf.

[5] Daniel Feakes and Jez Littlewood, 'Hope and ambition turn to dismay and neglect: the Biological and Toxin Weapons Convention in 2001', *Medicine, Conflict and Survival,* vol. 18, no. 2, 2002, pp. 164–174.

[6] 'News chronology', *CBW Conventions Bulletin,* no. 58 (December 2002), p. 33 (entry for 2 September 2002).

[7] Kerry Boyd, 'US attempts to sink BWC Review Conference', *Arms Control Today,* vol. 32, no. 8, October 2002, p. 27.

[8] The UK Green Paper on the BWC brought together a number of proposals. See United Kingdom, Secretary of State for Foreign and Commonwealth Affairs, *Strengthening the Biological and Toxin Weapons Convention: Countering the Threat from Biological Weapons* (Cm 5484), The Stationery Office, London, April 2002. See also the working papers submitted at the Fifth Review Conference in 2001, available at www.opbw.org, for numerous formal proposals for the inter-review conference period.

Milton Leitenberg claims that the US invited its European partners to make a counter-proposal and that several did so, and goes on to claim that once such proposals had been cleared by Washington they were passed to Ambassador Tóth, who worked them up into the one-page 'take-it-or-leave-it' proposal. See Milton Leitenberg, 'Biological weapons and bioterrorism in the first years of the twenty-first century', *Politics and the Life Sciences,* vol. 21, no. 2, September 2002, p. 9. This author's understanding and interpretation of events differ slightly from Leitenberg's.

[9] Graham S. Pearson, 'The Biological and Toxin Weapons Convention Review Conference: report from Geneva', *CBW Conventions Bulletin,* no. 58, December 2002.

[10] BWC/CONF.V/17.

[11] Nicholas A. Sims, 'Return to Geneva: the next stage of the BWC Fifth Review Conference', in *Strengthening the Biological Weapons Convention,* Review Conference Paper no. 5, University of Bradford, Bradford, 2002, p. 15.

[12] Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction, 1972, Article IV. The text of the convention is available on the BWC website at www.opbw.org.

[13] United Nations, 'Review Conference of the parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction, Final document', BWC/CONF.I/10, 21 March 1980, p. 7.

[14] United Nations, 'Third Review Conference of the Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction, Final document', BWC/CONF.III/23, Geneva, 1992, pp. 14, 43.

[15] BWC/CONF.III/23, p.12.

[16] United Nations, 'Fifth Review Conference of the states parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction: background information on the participation of states parties in the agreed confidence-building measures (CBMs), 1997–2001: status as of 28 September 2001', BWC/CONF.V/2, 3 October 2001, and 'Background information on the participation of states parties in the agreed confidence-building measures (CBMs), 2002: status as of 16 October 2002', BWC/CONF.V/2/Add.1, 25 October 2002; and United Nations, 'Fourth Review Conference of the parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction: background information on the participation of states parties in the agreed confidence-building measures (CBMs), 1992–1996, status as of 26 August 1996', BWC/CONF.IV/2, 28 October 1996, and Corr. 1, Corr.2, Corr.3, Corr.4 and Corr.5, 27 November–6 December 1996.

[17] The Verification Research, Training and Information Centre (VERTIC), 'Time to lay down the law: national legislation to enforce the BWC', VERTIC, London, October 2003, p. 11, available at www.vertic.org/whatsnew.html.

[18] The 2003 CBM document, based on the submissions made by the April 2003 deadline, indicates that only 26 of the 150 states parties made some kind of return for any of the CBMs. Thus 124, or 82 percent of the 150 states parties, did not make a return on time. See United Nations, Department of Disarmament Affairs, 'Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction: annual information exchange of states parties on confidence-building measures, as agreed at the Third Review Conference of the parties to the convention', UN document DDA/BWC/2003/CBM (undated).

[19] Jez Littlewood, 'Substance hidden under a mountain of paper: the BWC experts' meeting in 2003', *Disarmament Diplomacy,* no. 73 (forthcoming). Note in particular the closing remarks of the Chairman: 'We have made a good start: let's continue in the same vein'.

[20] Trevor Findlay, 'Introduction: the salience and future of verification', in Trevor Findlay (ed.), *Verification Yearbook 2000,* The Verification Research, Training and Information Centre (VERTIC), London, December 2000, p. 16.

[21] Under Article V of the BWC, states parties 'undertake to consult one another and to cooperate in solving any problems which may arise in relation to the objective of, or in the application of the provisions of, the Convention . . . [and] . . . through appropriate international procedures within the framework of the [UN] . . . '. Note that '*any* problems' is interpreted by states parties as being applicable to any issue related to the BWC, including the CBM submissions. A formal consultative committee meeting was called by Cuba in 1997 in relation to a non-compliance allegation it made against the US. Under Article VI, a state party may lodge a complaint with the UN Security Council if it suspects a breach of the BWC. The Council will consider such a complaint and may initiate an investigation in accordance with the UN Charter. However, the veto power of the Council's five permanent members (the P-5) effectively stymies this provision.

[22] The Preparatory Committee for the (First) Review Conference of the BWC 'decided to request the Secretariat to prepare a background paper on compliance by States Parties with all their obligations under the Convention'. The paper dealing with compliance reproduced 'the substantive parts of the replies received [from States Parties]'. See United Nations, 'Background paper relating to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction', BWC/CONF.I/4, 20 February 1980, for a description of the process. The invitation to states parties to provide any useful information on their national implementation measures has been followed by all subsequent review conferences.

[23] US Department of State, 'US efforts to combat the biological weapons threat', Fact sheet, 14 November 2002, available at www.state.gov/t/ac/rls/fs/15150pf.htm. For an overview of US efforts see also John D. Steinbruner and Elisa D. Harris, 'Controlling dangerous pathogens', *Issues in Science and Technology,* spring 2003, pp. 47–54.

[24] United Kingdom, Secretary of State for Foreign and Commonwealth Affairs, *Strengthening the Biological and Toxin Weapons Convention: Countering the Threat from Biological Weapons* (Cm 5484), The Stationery Office, London, April 2002.

[25] Dieter Deiseroth, 'Societal verification: wave of the future?', in *Verification Yearbook 2000,* pp. 265–280.

[26] For a copy of the 2002 CBM declaration, see the Australian Department of Foreign Affairs and Trade website at www.dfat.gov.au/security/biological_weapons.html.

[27] See the BioWeapons Prevention Project website at www.bwpp.org.

[28] Littlewood, 'Substance hidden under a mountain of paper: the BWC experts' meeting in 2003'.

[29] The closing remarks of Ambassador Tóth at the first experts' meeting on 29 August indicated that various offers of assistance had been made by states parties to help others with their national implementation efforts. Information obtained by author, who was present at the closing plenary session.

[30] At the closing plenary session of the first experts' meeting, statements from Cuba, Iran and Brazil reiterated what the Non-Aligned Movement (NAM) statement of November 2002 made clear: this process must lead to a more holistic package of measures to strengthen the BWC. These states parties thus showed that the Sixth Review Conference in 2006 and future efforts are at the forefront of their attention.

[31] Treaty on the Non-Proliferation of Nuclear Weapons (NPT), available at http://disarmament.un.org:8080/wmd/npt/npttext.html.

[32] Over the 21-year period from the 1986 Second Review Conference to the Sixth Review Conference in 2006, states parties will have met in the technical experts' meeting to devise the CBMs in 1987, at the Third Review Conference in 1991, in VEREX in 1992 and 1993, at the Special Conference in 1994, in the AHG between 1995 and 2001, at the Fifth Review Conference in 2001 and 2002, in the new process from 2003 to 2005, and at the Sixth Review Conference in 2006. They did not meet in 1988, 1989 or 1990.

[33] States parties have paid for the provision of additional assistance to the AHG (1997–2001) and the Fifth Review Conference (2001–2002), and earmarked funds for the new process (2003–2005).

[34] Marie Isabelle Chevrier, 'Waiting for Godot or saving the show? The BWC Review Conference reaches modest agreement', *Disarmament Diplomacy,* no. 68, December 2002/January 2003, pp. 11–16.

[35] See for example the statements issued immediately after the adoption of the new process and its mandate. United Nations, 'Fifth Review Conference of the states parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction: Statement on behalf of the Group of the Non-Aligned Movement and Other States', BWC/CONF.V/15, 18 November 2002; and 'Statement on Behalf of the Western Group', BWC/CONF.V/16, 18 November 2002.

6

Reviewing the Chemical Weapons Convention: gently does it

Robert J. Mathews

The 1992 Chemical Weapons Convention (CWC) was heralded as a major breakthrough in multilateral arms control.[1] It was the first comprehensively verifiable multilateral treaty that completely banned an entire class of weapons and it went further than any previous treaty in the depth, extent and intrusiveness of its verification. Verification under the CWC[2] includes compulsory national declarations about relevant industrial and military activities, destruction of chemical weapons within a time frame with intrusive verification, and a regime of routine inspections of declared industrial and military facilities. Additional features are provisions for challenge inspections, whereby a state party can request an inspection of any site in another state party at short notice, and provisions for the investigation of alleged use of chemical weapons.

The convention specifies that conferences to review its operation should be held 'no later than one year after the expiry of the fifth and the tenth year after entry into force of this Convention'. Such reviews 'shall take into account any relevant scientific and technological developments'.[3] In addition, the convention specifies that, during the First Review Conference (RevCon), its provisions related to the declarations and verification of the 'other chemical production facilities' (OCPFs) producing discrete organic chemicals (DOCs) are to be re-examined in the light of a comprehensive review of the overall verification regime for the chemical industry on the basis of the experience gained, and that the RevCon shall make recommendations so as to improve the effectiveness of the verification regime.[4]

The first CWC RevCon was convened at the headquarters of the Organisation for the Prohibition of Chemical Weapons (OPCW) in The Hague from 28 April to 9 May 2003.[5] This chapter considers the preparations for the first RevCon, its conduct

and its outcome, with particular emphasis on verification, and concludes with an assessment of the potential value of the RevCon in guiding the activities of the OPCW over the next five years.

Preparations for the RevCon

In May 2001, the Sixth Conference of States Parties (CSP) to the CWC tasked the Executive Council with beginning preparations for the First RevCon. To this end, at its 26th session in September 2001, the Executive Council (EC) established an open-ended Working Group for the preparation of the Review Conference (WGRC).

The OPCW had intended that preparations for the RevCon would have been a major focus of activities for the 19 months from September 2001 until the convening of the RevCon in late April 2003. However, despite the early commencement of such preparations, there were a number of distractions in the latter part of 2001 and for most of 2002. In particular:

- The replacement of the original Director-General, José Bustani of Brazil, took several months and caused considerable tensions within the OPCW.[6]
- The negotiation of the 2003 OPCW budget, following the financial crisis in 2001, resulted in lengthy and time-consuming budget negotiations between April 2002 and the conclusion of the Seventh CSP in October 2002.[7]
- The 11 September 2001 terrorist attacks on the US led to the establishment of an OPCW anti-terrorism working group in December 2001, which met several times to discuss how the OPCW could assist in raising the barriers to chemical terrorism and in providing emergency assistance following a chemical terrorism incident.
- There was also a sense in many capitals that the CWC was working reasonably well and that there were more important security issues facing defence and foreign ministries, including terrorism and issues relating to the 1972 Biological Weapons Convention (BWC).[8]

By October 2002, the WGRC had met several times and discussed administrative arrangements for and the objectives and methodology of the RevCon. In particular, it had agreed that, rather than the traditional article-by-article review, the RevCon would review the CWC thematically. The themes would be: implementation of the convention (including universality, changes in the security environment and terror-

ism); destruction of chemical weapons (CW) and former CW production facilities; nonproliferation measures; verification; assistance; and international co-operation.

However, substantial discussion of the various issues did not begin until after the Seventh CSP had concluded in October 2002. At that time, the Chair of the WGRC, Ambassador Alberto Davérède of Argentina, supported by the Technical Secretariat (TS), began developing drafting notes which became the focus of discussions in the WGRC and ultimately formed the basis of the draft Political Statement and draft Review Document that were submitted to the RevCon.

Background review documents were also prepared by the Director-General,[9] the Scientific Advisory Board (SAB)[10] and the TS.[11] However, once again, because of the distractions discussed above, the final versions of these papers were not available until a couple of weeks before the start of the RevCon. There were also 32 national papers on various topics, prepared by 17 states parties.[12]

Useful workshops were also conducted in the lead-up to the RevCon, including an International Union of Pure and Applied Chemistry (IUPAC) Workshop held in Bergen, Norway, in June 2002,[13] a North Atlantic Treaty Organisation (NATO) workshop held in Bratislava, Slovakia, in October 2002,[14] and Pugwash (Pugwash Conferences on Science and World Affairs)[15] workshops. They reviewed developments in science and technology and changing industry practices that may have an impact on the CWC. Topics included the development of novel methods of production of toxic chemicals (including through biologically mediated processes) and novel toxins, and the development of new monitoring techniques, including miniaturised sensors and portable chemical analysis equipment.[16] The NATO and Pugwash workshops also reviewed the OPCW verification procedures on the basis of the early experiences of the OPCW Inspectorate, including issues related to access to records, the extent of access to chemical industry plant sites, and sampling and analysis.[17] These workshops also resulted in useful background papers for the RevCon.

The Review Conference

The RevCon commenced with a message from the UN Secretary-General, Kofi Annan, and a statement by the recently appointed Director-General, Rogelio Pfirter of Argentina.[18] This was followed by the General Debate, which began with a provocative statement by the US in which it alleged non-compliance by Iran and

concerns about Sudan[19] (this was in spite of the declared intentions of key delegations that the RevCon should be conducted in a harmonious, constructive atmosphere). However, following Iran's robust response to the American allegations,[20] the remaining couple of days of national statements were uneventful.

Following the General Debate, work began in the Committee of the Whole (COW), chaired by Ambassador Marc Vogelaar of the Netherlands, on finalising the Political Declaration[21] and the Review Document,[22] which had been drafted during the lengthy preparatory process. While the COW retained the central role in negotiating and redrafting these documents, a so-called Friend of the (COW) Chair 'editing group' (chaired by the Ambassador Dato' Noor Farida Ariffin of Malaysia) was allocated responsibility for 'fine-tuning' both documents.

The Political Declaration was finalised first, in the middle of the second week of the RevCon, following six days of difficult negotiations. At that stage (only two days before the end of the RevCon), it had become clear that the editing group would not have time to finish redrafting the longer Review Document. To expedite drafting, the US, the UK, India and Iran (assisted by the Director-General) formed a 'small drafting group' which developed agreed language on the controversial elements. This agreed language was then incorporated into a revised draft document which was returned to the COW for consideration, where it was subsequently adopted with relatively minor modifications. The document was then endorsed by the RevCon, allowing it to finish shortly before midnight on the final day.

In addition to the formal conference sessions, an Open Forum entitled 'Challenges to the Chemical Weapons Ban' was held at The Hague Peace Palace on the afternoon of 1 May. This forum, organised by the TS and non-governmental organisations (NGOs), discussed a number of issues, among them CW destruction, industry issues and scientific developments, including non-lethal weapons. For many delegates, the opportunity for free-ranging discussion of scientific and technical issues during the Open Forum was the highlight of the RevCon.

Major issues and conference recommendations

Measures to ensure universality of the CWC

The fact that the CWC had attracted 151 states parties[23] within six years of its entry into force was hailed by the Director-General and several member states as evidence

of significant progress towards universal adherence.[24] While it was recognised that some countries (particularly in the Middle East) were claiming that they could not yet accede to the CWC because they believed it might harm their national security, several statements also cited a perception among some developing countries that there was a lack of tangible benefits from treaty membership to entice them to join.[25] The Review Document recommended that the EC, with the co-operation of the TS, should develop and implement a plan of action in order to further encourage, in a systematic and co-ordinated manner, accession to the convention and to assist states that were ready to join the CWC in their national preparations to implement it.[26]

The functioning of the OPCW

The OPCW has had its share of challenges in its first six years. These include the financial crisis in 2001, which resulted in the need to impose 'austerity measures' for several months, and the replacement of the original Director-General, which also took several months and caused considerable tensions within the OPCW and among states parties. Since his appointment in July 2002, Ambassador Pfirter has undertaken an active programme to improve the transparency of the Technical Secretariat's management procedures, ensure a greater sense of common purpose between states parties and the Secretariat, and ensure adequate and proper use of financial resources. His positive influence was apparent during the Seventh CSP in October 2002 and even more so during the subsequent preparations for the RevCon. By the time of the RevCon, there was a strong sense that the states parties and the OPCW had moved beyond the difficult situation they had faced in 2002.

The Executive Council, which has oversight of the operations of the OPCW on behalf of the states parties, has notched up substantial achievements since entry into force. However, there has also been disappointment in that it has not been able to reach decisions on many issues considered important for the effective operation of the OPCW, including some dating back to the tasks that the Preparatory Commission (PrepCom) was requested to complete before entry into force.[27] The unresolved issues include legal and technical ones related to industry declarations and verification.[28] The Review Document expressed concern about these delays and urged the Council to increase its momentum and strive to conclude all unresolved issues.[29]

Judging from a number of national statements as well as comments from delegates in the margins of the RevCon, there has clearly been a high level of satisfaction with respect to the functioning of the OPCW inspectorate.[30] However, because of the recently implemented staff tenure policy, many of the most experienced OPCW staff (including the originally recruited inspectors) will leave the organisation in the next few years.[31] While there are reasonable arguments in favour of a maximum term of seven years for general management and administrative staff, it is unfortunate that the same tenure rule is to apply to the specialist staff who manage the organisation's verification functions and to the inspectors themselves. Not only will this add significantly to the cost of maintaining a properly trained and experienced inspectorate, but unless the process is managed carefully the loss of these highly experienced staff may substantially reduce the effectiveness of the inspections.

Clearly, the budget planning process has caused considerable difficulties for the Executive Council in the OPCW's first six years. A major obstacle in developing the annual budgets has been the lack of agreement on the size of the OPCW, with some states parties (primarily some of the major financial contributors) arguing that the OPCW should only have limited (if any) growth, while the TS has argued that for the OPCW to fulfil its mandate there will need to be a substantial increase in its size, requiring an increase in its budget. A related issue that the EC continues to grapple with is how the OPCW should allocate the available resources between the competing demands of: verification of destruction of CW and of CW production facilities (treaty articles IV and V); industry verification (Article VI), including the allocation of resources for inspections of Schedule 1, Schedule 2 and Schedule 3 facilities and OCPFs; and international co-operation and assistance, including support for member states in developing their national legislation (Article VII), assistance protection (Article X) and economic and technological development (Article XI).

National implementation measures

Each CWC state party is required to adopt a range of domestic legislative and administrative measures to enable it to enforce its international obligations at the national level, including the collection of information required for declarations, and enabling the OPCW inspectors to conduct inspections in its territory. The Director-General and some states parties have expressed concerns that six years after entry into force many states parties have failed to adopt any national implementation measures.[32]

The Director-General has suggested an action plan to develop a proactive, effective and well-targeted programme of implementation support.[33]

The RevCon confirmed the essential role of national legislation in the proper functioning of the convention. It called on states parties that have not already done so *inter alia* to designate a National Authority and inform the OPCW by the Eighth CSP (in October 2003) of the status of their national implementation measures. The Review Document also encouraged the TS, as well as states parties, to develop partnerships with relevant regional organisations that could provide implementation support to states parties.[34]

Another national implementation issue raised was that some states parties have focused exclusively on specific CWC obligations, such as establishing a National Authority, and have not developed legislation relevant to the more general requirements of the treaty, such as those in Article I which embodies the prohibition on CW. An important issue in this regard is implementation of the general purpose definition of CW, which recognises that, in addition to the chemicals listed in the CWC schedules, other toxic chemicals could be used as CW, either as part of a state CW programme or by a terrorist group.[35] The Review Document emphasised that for effective implementation it is necessary for states parties to adopt a broad perspective on what constitutes 'CWC-relevant chemicals',[36] which clearly goes beyond the chemicals listed in the three schedules.[37]

Destruction of CW and former CW production facilities

The two main CW-related issues raised in the General Debate were the importance of adhering to the CWC destruction timelines and the level of inspection resources currently being used for verification of CW destruction.

The US, India and the Republic of Korea (South Korea) have each destroyed a substantial portion of their Category 1 CW.[38] Russia, which is having considerable difficulty in destroying its weapons, announced during the RevCon that it had recently completed the destruction of 1 percent of its CW arsenal—three years after it was originally scheduled to do so.[39] This disappointing result occurred despite the fact that Russia is currently receiving both technical and financial assistance from several states parties, including the US and some members of the European Union (EU). Another state party, Albania, recently discovered CW agents on its territory and has declared itself as the fifth CW possessor state.[40]

While most references in national statements to the need to meet the convention's CW destruction timelines were expressed in general terms,[41] the UK expressed disappointment at Russia's performance.[42] Yet it is important to keep this issue in perspective. The 10-year time frame for the destruction of all CW was agreed in Geneva in the late 1980s at a time when the US and the former Soviet Union were both confident that they could destroy all their CW within 10 years of entry into force. The RevCon itself took a pragmatic approach, stressing the secure storage of all CW stockpiles while they await destruction—a matter of increasing importance in the light of heightened concerns about chemical terrorism.[43]

The majority of inspections conducted so far by the OPCW inspectorate have been associated with verification of destruction of CW.[44] There are two major reasons for this. The first is that the US and Russia never concluded the bilateral destruction agreement that had been anticipated during negotiations on the CWC, which would have seen the bulk of the verification of destruction of the American and Russian CW stockpiles being conducted by bilateral inspection teams, with OPCW inspectors providing only complementary verification.[45] The second reason is the interpretation of the CWC text adopted by the PrepCom with respect to the continuous monitoring of destruction efforts, which has resulted in the continuous presence of inspectors, as well as continuous monitoring with on-site instruments.[46]

There will be a substantial increase in the inspection workload for verification of CW destruction facilities (CWDFs) in the next few years as several additional CWDFs begin destruction operations.[47] There are concerns that there will not be enough resources in the OPCW inspectorate to provide the level of verification of destruction based on currently agreed procedures. As the Director-General pointed out to the conference, the 'verification methodology applied at CWDFs needs to be reviewed if the verification regime as a whole is to remain sustainable and affordable'.[48]

The Review Document reaffirmed the obligation of the CW possessor states to destroy their CW stockpiles within the CWC-specified timelines and urged them to exploit scientific and technological developments to enable more effective use of verification resources.[49] It also called on other states parties to support these efforts and provide assistance where possible. The RevCon also reiterated the obligation of states parties possessing converted former CW production facilities to report annually for 10 years on the activities at those sites and to open them to inspection.[50]

Chemical industry declarations

The overall poor rate of submission of initial Article VI declarations, related to activities not prohibited under the CWC, was a major disappointment in the first few years after entry into force.[51] While most states parties have now provided initial and annual declarations, a considerable number are incomplete. It has also been recognised that the declaration requirements for states parties are complex and that some have experienced technical difficulties in compiling the required information.[52] The TS, in co-operation with a number of interested states parties, has been assisting other states parties which have had difficulty in completing their declaration requirements. The Secretariat has also been undertaking clarification procedures, comparing declared information with chemical production information available from open sources, to identify additional industry facilities which should have been declared.

In the area of Article VI declarations, the Director-General identified three issues that need further attention: the quality of national implementation; the agreement on outstanding declaration issues (including unresolved 'industry issues'); and an increase in the effectiveness of the system (for example, through the introduction of 'nil declarations' in those cases where a state party has nothing to declare).[53] With respect to Article VI declarations, the Review Document called on all states parties to submit complete and accurate declarations in a timely manner.[54]

Routine inspections of chemical industry

When the CWC was being negotiated, it was recognised that it would be necessary to review and adjust, as appropriate, the proportions of inspection effort devoted to inspections of Schedule 1, Schedule 2, Schedule 3 and DOC facilities. Accordingly, the Article VI regime, under which these inspections fall, was designed to be flexible and open to future adjustment in the light of practical experience and changes in chemical technology and chemical industry operations.[55]

During the first few years after entry into force there was an understandable focus on the initial inspections of Schedule 1 and 2 facilities in order to meet specific convention timelines. Following completion of these initial inspections, a greater proportion of the available resources has been devoted to Schedule 3 and DOC inspections.[56] In addition to spreading the inspection load over a greater number of states parties, this also results in more inspections being conducted at 'CW-capable'

facilities which many experts regard as most relevant to possible illicit CW programmes.[57] Overall, there has been a high degree of satisfaction on the part of the OPCW, states parties and industry facility personnel with the way industry inspections have been conducted.[58] Fortunately, no OPCW routine inspections have been delayed so far because of lack of national legislation.

Since entry into force, 58 states parties have declared a total of almost 4,000 inspectable OCPFs. Of these facilities, around 100 had received inspections by the end of 2002. The Technical Secretariat has concluded that these inspections have shown that some of the OCPFs 'are highly relevant to the object and purpose of the convention. These facilities produce chemicals that are structurally related to Schedule 1 chemicals. Of particular relevance to the Convention are facilities that combine this kind of chemistry with production equipment and other hardware designed to provide flexibility and containment'.[59]

The Scientific Advisory Board, in its study of developments in the production of CWC-relevant chemicals, concluded that OCPFs are the area where the impact of recent technological developments was most relevant and recommended that it would be prudent to increase the number of inspections of such facilities.[60]

These assessments were not fully shared by all states parties.[61] However, based on the recognised relevance of OCPFs, the Review Document referred to the need to 'take account of the OCPFs declared by states parties, of their technical characteristics and activities, and trends in science and technology that impact on these parameters, to increase the number of OCPF inspections to the extent found appropriate as the budget unfolds in the ensuing years'. The Review Document also advocated improving the selection algorithm by fully implementing all parts of the selection mechanism for OCPF inspections,[62] which should result in industry inspection being redirected towards those OCPFs considered most relevant to the CWC. Such measures should increase confidence in the verification results obtained under Article VI and in the deterrent effect of the Article VI regime.

Consultations, co-operation and fact-finding

A number of states parties have used the informal bilateral consultation procedures, provided for in Article IX of the treaty, to consult and seek clarifications from a number of states parties on the information provided in their declarations. For example, in its national statement, the US stated that it 'has utilised the consultative

provisions of Article IX on numerous occasions to address our compliance concerns often with great success'.[63] In its national statement, the UK also stated that it had made use of these clarification provisions.[64] However, no state party has yet utilised the formal consultation procedures involving the EC.[65]

No challenge inspections had been requested or conducted by April 2003.[66] However, several practice challenge inspections had been conducted, including a number in collaboration with OPCW inspectors.[67] The TS has also put into place the necessary internal procedures so that it can react rapidly and effectively when a request for such an inspection is made by a state party. In relation to inspection team members, approved equipment and logistical support, a state of readiness is maintained that would allow the Secretariat to dispatch an inspection team at short notice.

No investigations of alleged use (IAU) had been requested or conducted by April 2003. However, a number of training exercises on IAU and delivery of assistance have been conducted by the OPCW and states parties. These have highlighted the importance of human factors, such as interviewing techniques and the collection of evidence, and the need for appropriate equipment. As in the case of challenge inspections, the Secretariat has put in place the necessary internal procedures for an IAU to allow it to dispatch an inspection team at short notice.

A number of national statements referred to challenge inspections. The key issue raised was whether a state party could request a challenge inspection without having undertaken prior consultations about the compliance concern. The UK made clear its interpretation of the convention text, stating that: 'The UK would not wait for prior consultations if concerns were serious and urgent enough to warrant an immediate Challenge Inspection'.[68] However, the Non-Aligned Movement (NAM) and China proposed that challenge inspections 'should be undertaken as a last resort and as part of the process of consultation and fact-finding'.[69]

This issue has been bubbling away since the end-game of the negotiations on the CWC and was a major issue in the PrepCom. Clearly, Article IX allows for a challenge inspection to be requested without prior consultation.[70] Since it was not possible to obtain agreement on this issue during the RevCon, the Review Document, after emphasising the importance of challenge inspections, simply repeated the relevant parts of the convention text (in particular the first sentence of Article IX, para. 2).

Sampling and analysis

The CWC has general provisions permitting sampling and analysis during OPCW inspections, together with more specific requirements for particular types of inspection. To implement these, the TS (with the support of states parties) has developed and tested procedures for sampling and analysis, established a quality system, purchased equipment (including five transportable gas chromatography–mass spectrometer systems) and built up an analytical database. However, sampling and analysis has so far played a less prominent role in the conduct of OPCW inspections than was originally anticipated, which is partly a reflection of the requirements of initial inspections and partly a result of technical, logistical and cost constraints.[71]

During the IUPAC workshop, recent technical developments in analytical chemistry methodologies were reviewed, with a focus on those that may be applicable to routine and challenge inspections as well as investigations of alleged use of CW. The RevCon recognised the importance of sampling and analysis, including encouraging the EC and the TS to work towards improving the effectiveness of industry inspections through sampling and analysis procedures.[72] However, there was no detailed discussion of previous decisions which would limit the utility of the sampling and analysis, such as the use of 'blinded analytical instruments'[73] and the limiting of the OPCW analytical database to chemicals listed in the CWC schedules and their degradation products.[74]

Protection of confidential information

One of the difficult issues faced by the OPCW since entry into force has been finding an acceptable balance between the need for transparency in its operations and the need to protect sensitive information. The Review Document reiterated the importance that states parties attach to the need for the OPCW to thoroughly protect confidential information, in accordance with the provisions of the convention; noted that there had been minor incidents which had not compromised the effectiveness of the OPCW's regime to protect confidentiality;[75] and encouraged the TS and states parties to review their respective practices in assigning levels of classification of information with the intention of reducing the quantity of classified information. This would facilitate the smooth functioning of the OPCW system for protecting confidentiality.[76]

Review of relevant scientific and technological developments

As discussed above, there were substantial reviews of relevant scientific and technological developments in a number of workshops during the 12 months prior to the formal two-week session of the RevCon, and a number of useful documents were prepared. The findings of the Scientific Advisory Board have been provided to the Executive Council for review. Unfortunately, apart from the half-day Open Forum, there was only limited opportunity to discuss these issues during the formal two-week RevCon session because of the priority given to concluding the drafting of the Political Declaration and the Review Document.[77]

Other issues

While the primary objective of this chapter is to focus on verification, other aspects of the CWC which were reviewed during the RevCon have an impact on verification issues to varying degrees.

With respect to protection assistance (Article X), it was noted with concern that only 42 states parties had provided information on national protective purposes programmes.[78] The requirement to evaluate the various assistance measures that states parties have offered if CW are used against one of them was also recognised.[79] The Director-General and a number of national statements referred to the importance of Article X, including in response to heightened concerns about CW terrorism, as well as the need to co-ordinate with other relevant international organisations.[80]

The terrorist attacks on the US on 11 September 2001 increased the international community's awareness of the threat posed by non-conventional forms of terrorism, including chemical terrorism. Several national statements referred to the importance of universality, full compliance of all states parties with the CWC national implementation measures, and criminalisation of the convention's prohibitions as means to raise the barriers to chemical terrorism.[81] Providing emergency assistance under the provisions of Article X was also recognised as a key role for the OPCW in responding to an incident of chemical terrorism. The RevCon reaffirmed the decision of the Executive Council on the OPCW's contribution to the global struggle against terrorism and noted that this work was continuing in the OPCW's working group on terrorism.[82]

With respect to economic and technological development (Article XI), the RevCon reaffirmed the commitment of states parties to implement the provisions of the convention fully and stressed the importance of international co-operation and

assistance (ICA) in the promotion of the convention as a whole, including universality, in keeping the chemical industry aware of the CWC and maintaining its commitment to the full implementation of the convention. Despite the progress to date with various ICA projects, a number of states parties were critical of these achievements and argued for more ICA activities to take place. On the issues of 'free trade' in chemicals and trade regulations, the RevCon saw a repeat of the debate which dates back to the CWC negotiations as to whether the export licensing system of the Australia Group represents a legitimate means of assisting CWC states parties in fulfilling their nonproliferation obligations under the convention, or whether the existence of the group is inconsistent with the provisions of the CWC and should be abolished.[83] Given the differences of view being expressed, the RevCon chose to simply reiterate the relevant parts of Article XI in the Political Declaration and the Review Document, and urged the EC to 'continue its facilitation efforts to reach early agreement on the issue of the full implementation of Article XI'.[84]

Other issues which may have implications for future verification activities are those of non-lethal weapons (including riot control agents) and the use of toxic chemicals for law enforcement. As the Director-General stated, 'These issues need to be carefully analysed so as to prevent any potential harm to the Convention'.[85] These issues were referred to in the report of the SAB[86] and were discussed at length during the Open Forum. While there was no agreement to include specific mention of them in either the Political Declaration or the Review Document, they will need to be carefully considered by states parties in the near future.

Conclusion

At the conclusion of the RevCon there were mixed feelings. On the one hand, there was a sense of relief among delegates that the meeting had not collapsed in disarray but had been able to finish almost on time, with an agreed Political Declaration and Review Document, and without the acrimony and ill will displayed during the 2001–2002 BWC RevCon.

On the other hand, some delegates questioned whether a thorough review of the convention had actually taken place, some commenting in the margins of the meeting that 'this RevCon is like an annual Conference of States Parties without the budget negotiations'. This was a quite understandable remark for capital-

based officials who had not been involved in the preparatory work and had only become fully engaged when the formal two-week session commenced.

One outside observer judged that: 'With respect to states parties having critically evaluated their own individual and collective performance in implementing the CWC, there was a clear trend towards papering over shortcomings'.[87] He noted that 'the similarity between topics raised and positions held during the most recent regular session of the CSP last October and the Review Conference is revealing, suggesting that a large number of delegations were stuck in "business-as-usual" mode, not inclined to take the step back necessary to look at the CWC's operation in more generic terms'. With respect to two of the most important issues under review, he commented that the RevCon 'seems to have resolved little in respect of the Article VI inspection allocation debate' and that 'the disagreements and differences in approach amongst states parties to Article XI are still unresolved'.[88]

Disappointment was expressed by NGOs at what they perceived to be their limited opportunity to contribute to the RevCon,[89] noting that 'increased participation by NGOs, academics and the industry representatives active in the CBW community, at an earlier stage, would be a welcome initiative'.[90] However, NGOs did play a key role in the substantive review of critical questions in the lead-up to the RevCon, in the IUPAC, NATO and Pugwash workshops, including in relation to CW destruction, industry, scientific developments relevant to the CWC and non-lethal weapons. These workshops permitted useful informal interaction between NGOs and government officials which helped form national positions.

Without question, the major focus of the two-week formal session was the final negotiation and drafting of the Political Declaration and Review Document. The RevCon was therefore not a particularly enlightening experience.[91] It was disappointing for those states parties, NGOs and the International Committee of the Red Cross (ICRC), which had been hoping for substantive outcomes on issues such as riot control agents and non-lethal weapons.

Taking into account the magnitude of the task of reviewing a treaty as complex as the CWC, the RevCon did achieve a substantial review of most of the aspects of the operation of the CWC in the light of the changing international climate, the early experience of the OPCW, and scientific and technological developments, even though most of the substantive review took place well before April 2003.

Just over 10 years after it was opened for signature, and six years after entry into force, the CWC is still regarded as setting the benchmark for verification in a multilateral arms control treaty and, despite the problems experienced so far, the OPCW has performed remarkably well for a young international organisation. However, the OPCW faces a number of serious challenges in the coming years, including: achieving universality for the CWC; gaining the full adherence of all states parties to the CWC's legislative requirements; improving decision making by the Executive Council; maintaining the competence of the Technical Secretariat (in particular, the inspectorate) while implementing the tenure policy; balancing the competing priorities within the limited OPCW budget; making optimal use of new monitoring techniques to make verification of CW destruction less resource-intensive; maintaining a credible number of industry inspections with a broad geographic distribution; gaining a better appreciation of export licensing issues; further developing the OPCW response to chemical terrorism; and greater transparency in the the OPCW's operations.

The 64,000-dollar question is therefore whether the Review Document will assist the OPCW and states parties in addressing these challenges over the next five years. The Review Document, while not particularly ambitious, does provide a useful 'roadmap' to assist the OPCW in meeting these challenges.

Another useful outcome of the RevCon was its remarkably harmonious atmosphere during its latter stages, thanks in no small part to the very positive influence of the recently appointed Director-General. At the conclusion of the RevCon, there was a strong sense that the states parties and OPCW had moved beyond the difficulties they had faced during the PrepCom and in the early years after entry into force, and that the first review had indeed been a useful process which will guide the OPCW towards maturity in the next five years. However, despite what appear to be promising outcomes, the OPCW will only mature as an organisation and fulfil the objective of a world free of chemical weapons if all states parties demonstrate maturity and resolve to follow the roadmap. Only time will tell.

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Endnotes

[1] The views expressed in this chapter are those of the author and do not necessarily reflect those of the Australian government.

[2] Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction (CWC), opened for signature 13 January 1993; entered into force 29 April 1997, www.opcw.org/html/db/cwc/eng/cwc_frameset.html.

[3] CWC, Article VIII, para. 22.

[4] CWC, Verification Annex, Part IX, para. 26.

[5] Of the (then) 151 states parties, 113 attended the RevCon. Also in attendance were 2 signatory states (Haiti and Israel) and 2 non-states parties (Libya and Angola). In addition, the RevCon approved the attendance of 5 international organisations—the European Space Agency (ESA), the International Committee of the Red Cross (ICRC), the Permanent Court of Arbitration, the Comprehensive Nuclear Test Ban Treaty Organization (CTBTO) Preparatory Commission and the United Nations Institute for Disarmament Research (UNIDIR)—as well as 22 NGOs and 6 industry associations.

[6] For details see Robert J. Mathews, 'The OPCW at five: balancing verification in evolving circumstances', in Trevor Findlay and Oliver Meier (eds), *Verification Yearbook 2002,* The Verification Research, Training and Information Centre (VERTIC), London, 2002, pp. 53–73.

[7] For a detailed discussion of the budget issues, see Mathews, 'The OPCW at five', pp. 55–56.

[8] See chapter by Jez Littlewood in this volume.

[9] 'Note by the Director-General to the First Review Conference', OPCW document RC-1/DG.1, 17 April 2003.

[10] 'Note by the Director-General: Report of the Scientific Advisory Board on developments in science and technology', OPCW document RC-1/DG.2, 23 April 2003.

[11] 'Background paper on the conduct of inspections under the Chemical Weapons Convention and related issues', OPCW document RC-1/S/1, 17 April 2003; 'Background paper on international cooperation programmes', OPCW document RC-1/S/2, 22 April 2003; 'Implementation support', OPCW document RC-1/S/3, 13 April 2003; 'Background paper on assistance and protection programmes', OPCW document RC-1/S/4, 24 April 2003; 'Background paper on universal adherence to the Chemical Weapons Convention', OPCW document RC-1/S/5, 25 April 2003; 'Background Paper: consolidated unclassified verification implementation report (April 1997–31 December 2002)', OPCW document RC-1/S/6, 25 April 2003; and 'Background paper on the implementation of the confidentiality regime', OPCW document RC-1/S/7, 25 April 2003, all available on the website of the OPCW at www.opcw.org.

[12] The national papers are available at www.opcw.org.

[13] International Union of Pure and Applied Chemistry (IUPAC), 'Impact of scientific developments on the Chemical Weapons Convention: Report by the International Union of Pure and Applied Chemistry to the Organisation for the Prohibition of Chemical Weapons, *Pure and Applied Chemistry,* vol. 74, no. 12, 2002, pp. 2323–2352.

[14] For a summary of the conclusions from the workshop, see Graham S. Pearson, 'Maximising the security benefits from the First Review Conference of the Chemical Weapons Convention', First CWC Review Conference Paper no. 2, University of Bradford, Department of Peace Studies, December 2002.

[15] On the Pugwash conferences, see www.pugwash.org.

[16] Further development of such items may reduce the current levels of 'inspector presence' deemed necessary at CW-related facilities and allow development of rapid screening methodologies using portable analytical equipment to support verification.

[17] It was recognised that it would be necessary to review current verification procedures to ensure that the convention remains effective. For example, many verification-related decisions were adopted on an interim basis on the understanding that the issues would be further considered and refined as the OPCW gains experience.

[18] 'Opening Statement by the Director-General to the First Review Conference', OPCW document RC-1/DG.3, 28 April 2003.
[19] United States, 'US national statement to the First Review Conference of the Chemical Weapons Convention by Assistant Secretary of State for Arms Control, Stephen G. Rademacher', The Hague, 28 April 2003. The statement also alleged that 3 states not party—Syria, Libya and North Korea—are developing CW.
[20] 'Statement by the delegation of the Islamic Republic of Iran, exercising the right to reply in response to the US delegation statement', The Hague, 28 April 2003.
[21] The Political Declaration was a 23-paragraph document intended to be accessible to those without an in-depth understanding of the convention or CW.
[22] The Review Document, item 7 of the report of the RevCon, was a detailed 134-paragraph document containing the outcomes and recommendations following the substantive review of the operation of the convention. 'Review Document, as approved by the First Special Session of the Conference of the States Parties to review the operation of the Chemical Weapons Convention', para. 18 (excerpted from OPCW document RC-1/COW.1, 9 May 2003), available at www.opcw.org.
[23] Since the RevCon, two more states (Timor Leste and Tonga) have become parties, bringing the total number of states parties to 153.
[24] The 151 states parties as of April 2003 included the US and Russia (the two largest possessors of CW); the major chemical-producing and -exporting states of Europe and Asia; and many of the major developing states with chemical production capability. There were still 25 signatory states which had not ratified, and 18 countries had not signed. A particular source of unease is that a number of countries of CW proliferation concern, including Egypt, Iraq, Libya, Syria and North Korea, have not even signed the CWC. A significant number of developing countries also have yet to ratify it.
[25] This was based on the fallacious argument that 'developed' countries have more to gain than 'developing' countries in terms of security benefits, and that developing countries would need a 'carrot' in the form of increased funding for international co-operation activities to give them an incentive to join the CWC.
[26] 'Review Document', para. 18.
[27] Robert J. Mathews and Antony S. Taubman, 'Preparing for implementation of the Chemical Weapons Convention: progress during 1993', in *Verification 1994,* The Verification Technology Information Centre (VERTIC), London, 1994, pp. 111–128.
[28] The following outstanding issues are currently being considered in the 'industry issues cluster': low concentration limits for Schedule 2A and 2A* chemicals; captive use; boundaries of production; transfers of Schedule 3 chemicals to non-states parties; and the development of proposals by states parties for the selection of OCPF sites for inspection.
[29] 'Review Document', para. 123.
[30] The first OPCW inspection began on 1 June 1997 (just over one month after entry into force). As of 28 March 2003, the TS had carried out 1,407 inspections at 602 sites in 52 states parties. The breakdown of inspections is as follows: 325 inspections at CW destruction facilities; 274 to CW production facilities; 199 to CW storage facilities; 20 to abandoned CW sites; 43 to 'old CW ' sites; 5 to destruction of hazardous chemicals sites, 1 to an emergency destruction of chemical weapons site; 115 to Schedule 1 facilities; 208 to Schedule 2 plant sites; 101 to Schedule 3 plant sites and 115 to discrete organic chemicals (DOC) plant sites; and 1 other. OPCW inspectors had spent a total of 79,244 person-days on missions.
[31] There was agreement at the Fourth CSP in 1999 that the maximum tenure of TS staff should be 7 years, based on the agreement among states parties that the OPCW should not offer 'career positions'. The decision on the starting date for the introduction of the policy, 2 July 1999, was finally adopted by the CSP's Second Special Session on 30 April 2003. The agreement included the possibility that the Director-General could, as an exceptional measure, in order not to compromise the effectiveness of the OPCW, be permitted until 1 January 2009 to extend the contracts of individual staff members beyond 7 years.

[32] As stated in the report on national implementation measures dated 17 March 2003, only 82 states (representing 52 percent of states parties) had made submissions in compliance with Article VII, para. 5 obligations. Only 42 (28 percent of states parties) reported having legislation covering all key areas. For 108 states parties, there is no legislation in place, there are gaps in the legislation or the legislative situation is not known. See *CBW Conventions Bulletin,* no. 59, March 2003, p. 7.

[33] 'Note by the Director-General to the First Review Conference', OPCW document RC-I/DG.1, 17 April 2003, para. 4.9.

[34] 'Review Document', para. 83.

[35] Indeed, a more pragmatic view has been taken by many states parties as a consequence of the greater recognition of the potential terrorist threat arising from toxic chemicals that are not on the convention's schedules.

[36] However, the expression 'comprehensive nature of the prohibition of chemical weapons' was used instead of the more familiar 'general purpose definition'. See 'Review Document', paras 21–23.

[37] This issue has been recognised for some time. For example, in a 1996 PrepCom Working Paper Iran recognised the relevance of a number of non-scheduled chemicals for export licensing purposes. (Islamic Republic of Iran, 'Implementation of Article XI in the field of chemical trade', PC-XV/B/WP.6, 5 November 1996.)

[38] By March 2003, OPCW inspectors had verified the destruction of approximately 7,305 tonnes of chemical agents and approximately 2 million munitions. India and the Republic of Korea are expected to meet the CWC 10-year CW destruction deadline. However, some semi-official American sources have suggested that the US may have difficulty in meeting its 10-year timeline.

[39] 'Statement by the Russian Federation at the first session of the Conference to review the functioning of the Chemical Weapons Convention', 28 April 2003. The first intermediate destruction deadline calls for 1 percent destruction. According to Part IV (A) of the CWC's Verification Annex, this target should have been met 3 years after entry into force. The EC granted Russia an extension to this deadline in 2000.

[40] However, the approximately 15 tonnes of CW agents recently declared by Albania are apparently no longer useable and their destruction should not pose major problems.

[41] For example, the US stated that: 'Destruction of chemical weapons, on the whole, is not proceeding at the rate foreseen in the Convention, and this lack of progress must concern us all'. See United States, 'US national statement to the First Review Conference of the Chemical Weapons Convention by Assistant Secretary of State for Arms Control, Stephen G. Rademacher', The Hague, 28 April 2003, p. 5.

[42] See United Kingdom, 'First Review Conference of the Chemical Weapons Convention: statement by Dr Denis MacShane MP, Minister of State for Europe, Foreign and Commonwealth Office', The Hague, 29 April 2003.

[43] 'Review Document', paras 10, 42.

[44] Approximately 85 percent of the inspection resources have been used for Article IV and V verification since entry into force ('Background paper on the conduct of inspections under the Chemical Weapons Convention and related issues', OPCW document RC-I/S/1, 17 April 2003, para. 12.1).

[45] In accordance with the CWC, Article IV, para. 13.

[46] This 'convention requirement' is based on a particular interpretation of the words 'verification through continuous monitoring with on-site instruments and physical presence of inspectors', which appear in the CWC Verification Annex Part IV(A), para. 59(b) (with respect to destruction of CW), Part V, para. 40 (with respect to destruction of former CW production facilities), and Part V, para. 83 (with respect to conversion of former CW production facilities). When the text was negotiated, it was this author's understanding that the word 'continuous' referred to 'monitoring with on-site instruments' and that there was no requirement in the convention for the continuous presence of inspectors. During the PrepCom, the more stringent interpretation was adopted.

[47] John Gee, 'The CWC and the task of eliminating Chemical Weapons: the first five years', Opening Address to the International Chemical Demilitarisation Conference, The Hague, 21–23 May 2002, available at www.opcw.org/html/global/speeches/dera_2k2.html.
[48] See 'Note by the Director-General to the First Review Conference', OPCW document RC-1/DG.1, 17 April 2003, p. 7.
[49] 'Review Document', paras 45, 46.
[50] 'Review Document', para. 53.
[51] For example, only 36 percent of initial declarations were submitted within the specified time frame, and by the end of 1999, 26 percent of the states parties still had not submitted their initial declarations.
[52] In addition, many states parties have failed to notify points of entry for inspection teams and/or notification of their National Authority, which complicates inspection planning by the TS.
[53] See RC-1/DG.1, pp. 10–11. Unfortunately, there was no agreement by the RevCon on the Director-General's 'nil declaration' proposal.
[54] 'Review Document', para. 39(b).
[55] As is discussed above, it became apparent during the negotiation of the CWC that, because of uncertainty about the number of facilities that would be declared under schedules 1, 2 and 3 and as DOC facilities, as well as the relative risk they represented to the object and purpose of the CWC, it would be impractical to attempt to develop rigid solutions in the convention text. The practical verification problems involved would only become apparent in implementation of the CWC. See Robert J. Mathews, 'Intention of Article VI: an Australian drafter's perspective', *OPCW Synthesis,* November 2000.
[56] For example, the Seventh CSP agreed a work programme of 132 Article VI inspections for 2003, with 16 Schedule 1, 38 Schedule 2, 18 Schedule 3 and 60 OCPF inspections, compared to the agreed distribution for 2002 of 18 Schedule 1, 40 Schedule 2, 42 Schedule 3 and 32 OCPF inspections.
[57] For example, Iraq used a number of Schedule 3- and DOC-type facilities in its CW production programme in the 1980s. See Robert J. Mathews, 'Intention of Article VI: an Australian drafter's perspective'.
[58] Although minor problems have occasionally arisen in the course of some inspections, for the most part they have been carried out smoothly and with the full co-operation of the inspected state party.
[59] RC-1/DG.1, p. 12.
[60] 'Note by the Director-General: Report of the Scientific Advisory Board on developments in science and technology', OPCW document RC-1/DG.2, 23 April 2003, para. 4.4(a).
[61] For example, Pakistan stated that: 'Increase in emphasis on verification and inspection of facilities producing relatively harmless discrete organic chemicals (DOCs) should not be at the expense of higher risk Schedule 1, 2 and 3 chemicals listed in the Annex to the CWC'. See 'Statement to the First Special Session of the Conference of States Parties to review the operation of the Chemical Weapons Convention by Mr. Mustafa Kamal Kazi, Ambassador and Permanent Representative of Pakistan to the OPCW', The Hague, 30 April 2003.
[62] 'Review Document', para. 69(a) to (d).
[63] United States, 'US national statement to the First Review Conference of the Chemical Weapons Convention by Assistant Secretary of State for Arms Control, Stephen G. Rademacher', The Hague, 28 April 2003, p. 4.
[64] United Kingdom, 'First Review Conference of the Chemical Weapons Convention: statement by Dr Denis MacShane MP, Minister of State for Europe, Foreign and Commonwealth Office', The Hague, 29 April 2003, p. 5.
[65] CWC, Article IX, paras 3–7.
[66] The US has expressed concern that some states parties are not in full compliance but so far has chosen to seek clarification through bilateral consultations rather than request a challenge inspection.
[67] One of these exercises simulated the entire challenge inspection process from the submission of the request and the convening of a special session of the EC through to the preparation of a final report. These

practice inspections are seen as valuable experience for the EC, the TS and states parties in preparing for a real challenge inspection.

[68] United Kingdom, 'First Review Conference of the Chemical Weapons Convention. Statement by Dr Denis MacShane MP'.

[69] 'Statement by Ambassador Noor Farida Ariffin, Permanent Representative of Malaysia to the Organisation for the Prohibition of Chemical Weapons on behalf of the states parties of the Non-Aligned Movement to the Chemical Weapons Convention and China', The Hague, 30 April 2003, p. 5.

[70] The first sentence of Article IX, para. 2 states: 'Without prejudice to the right of any State Party to request a challenge inspection, states parties should, whenever possible, first make every effort to clarify and resolve, through exchange of information and consultations among themselves, any matter which may cause doubt about compliance with this Convention, or which gives rise to concerns about a related matter which may be considered ambiguous'.

[71] Initial inspections of Schedule 1 and 2 facilities have not required sampling and analysis. The transportable gas chromatography–mass spectrometer systems present practical and logistic problems, being heavy and expensive to transport, and having long set-up times at the inspection site. An additional technical issue is how the equipment would be used to verify the 'absence of any Schedule 1 chemical'.

[72] 'Review Document', para. 71(c).

[73] Blinded analytical equipment uses special 'blinded software' and a restricted database to provide only 'presence/absence' information about CWC-related chemicals.

[74] However, the SAB has recommended that the OPCW expand the database to include other chemicals, including certain non-scheduled chemicals which have the potential to be used in chemical warfare. See 'Note by the Director-General: Report of the Scientific Advisory Board on developments in science and technology', OPCW document RC-1/DG.2, 23 April 2003, para. 5.10.

[75] The report on 'Implementation of the confidentiality regime in 2002' noted that in 2002 the Office of Confidentiality and Security had received only 3 reports of minor incidents involving breaches of confidentiality procedures, none of which resulted in the disclosure of confidential information either within or outside the Secretariat. See *CBW Conventions Bulletin,* no. 59, March 2003, p. 4.

[76] 'Review Document', paras III–119.

[77] There were a number of interesting presentations during the lunch breaks at the exhibition area in the basement of the conference building, which unfortunately were not particularly well attended. It would have been useful if one half-day of the RevCon had been allocated for presentations of the key issues by senior TS staff members.

[78] As required by the CWC, Article X, para. 4.

[79] By April 2003, only 65 states parties had complied with this obligation under Article X, para. 7.

[80] 'Review Document', paras 94–101.

[81] In particular, the requirement under Article 1 to destroy all CW would make such weapons less accessible to terrorist groups. The requirements of Article VII to criminalise the prohibitions of the CWC and enact effective penal legislation would reduce the possibility that a CWC state party could inadvertently become a safe haven for those who use CW as a tool of terror, and would hence help reduce the threat posed by chemical terrorism. Likewise, the transfer (export control and monitoring) obligations under Article VI would serve to reduce the risk of diversion of toxic chemicals (weaponised CW, precursors of military chemical agents—including those listed in the CWC schedules—or other toxic chemicals) for terrorist use.

[82] 'Review Document', para. 10.

[83] India, which has been a major advocate of abolishing the Australia Group since the early 1990s, and a number of other states which have been critical of the group have recently adopted their own national export licensing systems, using lists similar to those developed by the Australia Group. Since 11 September 2001, a number of states parties have also put domestic monitoring procedures in place, again based on the

Australia Group lists. This has tended to take the sting out of the arguments for the group's abolition, which, according to informal comments by representatives of various regional groups, had become 'ritualistic'.

[84] 'Review Document', para. 107(a).

[85] 'Note by the Director-General to the First Review Conference', OPCW document RC-1/DG.1, 17 April 2003, pp. 7–8.

[86] 'Note by the Director-General: Report of the Scientific Advisory Board on developments in science and technology', OPCW document RC-1/DG.2, 23 April 2003, p. 15.

[87] Alexander Kelle, 'The CWC after its First Review Conference: is the glass half full or half empty?', *Disarmament Diplomacy,* no. 71, June/July 2003.

[88] 'Where to from here? The First Review Conference and the next five years', *CBW Conventions Bulletin*, no. 60, June 2003, pp. 1–5.

[89] The ICRC expressed great disappointment that it was not permitted to speak during the General Debate, as it is in other international meetings. See 'News chronology', *CBW Conventions Bulletin,* no. 60, June 2003, entry for 30 April 2003.

[90] 'Where to from here? The First Review Conference and the next five years', p. 4.

[91] Indeed, the RevCon emphasised the divide between the 25 or so states parties which are actively involved in the day-to-day activities of the OPCW, using a combination of diplomats based in The Hague and experts from national capitals, and the majority of states parties which do not have the resources to follow the more detailed aspects of the operation of the CWC closely. In my view, the RevCon did not cater particularly well to the latter group.

7

The radiological threat: verification at the source

Klaas van der Meer

Soon after the discovery of radioactivity it became clear that it not only had beneficial properties but could also pose health risks caused by irradiation, from both external contamination of the skin and internal contamination by digestion or inhalation. Safety standards were progressively developed to protect radiological workers and the public against the hazards of ionizing radiation, for example, by ensuring safe work practices and adequate shielding. Such safety measures are intended to prevent accidental exposure to radioactive materials.

But since the dawning of the nuclear age there has also been a preoccupation with the possibility that fissionable nuclear material, such as plutonium and high enriched uranium (HEU), might be used for hostile purposes. In addition to the fact that such materials can be used in nuclear weapons, there has also been concern that they might be dispersed by conventional explosive to cause widespread death and injury. The multilateral disarmament negotiating body in Geneva, the Committee on Disarmament (subsequently the Conference on Disarmament (CD)) attempted for many years to negotiate a Radiological Weapons Convention which would have banned the use of conventionally-dispersed fissionable material for hostile purposes.[1] Such efforts were abandoned in 1993 as a result of the CD's preoccupation with negotiating a Comprehensive Nuclear Test Ban Treaty (CTBT). The negotiations have never been resumed.

By the beginning of the 1990s there was a growing realisation that non-fissionable radioactive sources might also be used for hostile purposes through dissemination by conventional explosives.[2] They could, at the very least, be used to create panic and thereby societal and economic chaos. These factors and the ease with which their component materials could be obtained could make them attractive to terrorists.

Such a device has come to be known as a radiological dispersion device (RDD) or by the general public as a 'dirty bomb'. The terrorist attacks on the United States on 11 September 2001 greatly increased fears that RDDs would be used sooner rather than later. However, despite the notable increase in awareness of the threat, only a few countries have adopted or adapted legislation to deal with it.

The International Atomic Energy Agency (IAEA) plays an important role in the security of nuclear and radioactive materials to prevent terrorist and other malevolent activities, such as the illegal possession, use and transfer of and trafficking in these materials. In September 1994 the General Conference of the IAEA adopted a resolution that called on its members to 'take all necessary measures to prevent illicit trafficking in nuclear material'.[3] In December 1994 the IAEA's then Director General, Dr Hans Blix, called for other radioactive sources to be dealt with in similar fashion.[4] The key role of the IAEA is shown by its management of the recently established Nuclear Security Fund, which aims to reduce the threat of terrorist use of nuclear and other radioactive material; the maintenance of an Illicit Trafficking Database, in which states can register illegal actions regarding nuclear and other radioactive material; and the recent revision of a Code of Conduct on the Safety and Security of Radioactive Sources.[5] The last General Conference of the IAEA in September 2003 asked the current Director General, Dr Mohamed ElBaradei, to continue his efforts to improve nuclear and radiological security and asked the member states to support these efforts.[6]

This chapter examines the nature of RDDs, the threat they pose, and how accounting, monitoring and verification might help deal with the threat. On the basis of the technology and materials needed to construct an RDD, the chapter discusses the relevance of the IAEA safeguards system to the establishment of national measures for preventing the misuse of radioactive sources. It concludes that elements of the IAEA safeguards system can be used as a model.

What is an RDD?

The aim of a radiological dispersion device is to contaminate a large area with radioactive material in order to cause maximum havoc and disruption. The most frequently cited scenario is the dispersal of the radioactive material using conventional explosives, although other means, such as aerial dissemination, could also be used.

The amount of explosive needed for the dispersion appears to be surprisingly low. Only 2.5–5 kilograms (kg) is sufficient if the radioactive material is highly dispersible. This is the case for caesium-137 (^{137}Cs).

The area that will be contaminated depends in part on the effectiveness of the dispersion, which will in turn be determined by factors such as the quantity of the explosive charge, the physical state of the radioactive material, the amount of radioactive material, weather conditions and the type of landscape (for example, a built-up area or open terrain).

Radioactive material

If a terrorist intends to cause maximum havoc and disruption, the radioactive material chosen should have a reasonably long half-life, in the order of a year or longer. The most obvious candidates from this perspective are the beta-gamma

Table 1 **Half-life and type of radiation emitted by isotopes that could be used in an RDD**

Isotope	Half-life	Radiation type
Manganese-54 (^{54}Mn)	312.1 days	γ
Cobalt-60 (^{60}Co)	5.3 years	β, γ
Strontium-90 (^{90}Sr)	28.78 years	β
Silver-110 (^{110}Ag)	249.8 days	β, γ
Cadmium-109 (^{109}Cd)	462.6 days	γ
Barium-133 (^{133}Ba)	10.53 years	γ
Caesium-137 (^{137}Cs)	30.07 years	β, γ
Europium-152 (^{152}Eu)	13.54 years	β, γ
Europium-154 (^{154}Eu)	8.59 years	
Iridium-192 (^{192}Ir)	73.8 days	β, γ
Plutonium-238 (^{238}Pu)	87.7 years	α
Americium-241 (^{241}Am)	432.7 years	α
Californium-252 (^{252}Cf)	2.65 years	α

Note The isotopes are ordered by the number of protons that the nucleus contains.
Source Josef R. Parrington *et al.*, *Nuclides and Isotopes,* 15th revised edn, Knolls Atomic Power Laboratory, San Jose, CA, 1996.

(β, γ)-emitters cobalt-60 and caesium-137, and to a lesser extent the beta (β)-emitter strontium-90 (^{90}Sr) and the beta-gamma (β, γ)-emitter iridium-192 (^{192}Ir). Some of the more 'exotic' radionuclides or mixtures cannot be excluded completely.[7] Table 1 gives some basic data on isotopes that could be used in an RDD. The amount of radioactive material needed to contaminate a large area is estimated to be about 1,000 Curies (Ci) or several grams, depending on the isotope that is used.[8]

Availability

Access to the material would have to be relatively easy and it should be available in sufficient quantities. In terms of availability, cobalt-60 and caesium-137 are the most common isotopes, while strontium-90, iridium-192 and the alpha (α)-emitters plutonium-238 (^{238}Pu), americium-241 (^{241}Am) and californium-252 (^{252}Cf) are also available in large quantities. All are frequently used in medical and industrial equipment. The other isotopes listed in table 1 are less likely to be used for an RDD since they are not produced on an industrial scale.

Physical/chemical state

The physical/chemical state of the radioactive material used is important for the dispersion of the material in an RDD. Cobalt-60 is normally produced in metallic pellets. During an explosion it will be dispersed in small metallic fragments. Cleaning of the contaminated area will be limited to the search for and collection of these particles with the help of Geiger-Müller counters, which are cheap and easy to use. Although time-consuming, the clean-up will be relatively straightforward. Caesium-137, however, takes the form of a powdery salt and is often highly dispersible, so that decontamination of an area would be very difficult and time-consuming. Strontium-90 also occurs in the form of a salt and, like caesium-137, is extremely dispersible. Iridium-192 is produced in the form of metallic pellets and has the same qualities as cobalt-60. The α-emitters plutonium-238, americium-241 and californium-252 are produced in the form of oxides. The oxide particles are not sintered (formed into a hard crust) and therefore have a small diameter (10–50 μm), which makes them highly dispersible.

Containment vessel

The safe transport of a strong radioactive β, γ source requires a shielding container, which would normally be made of lead and weigh several hundred kilograms (kg),

even up to 1,000 kg. Such a container is not easy to handle and has a considerable volume (20–80 litres). Even suicidal terrorists will not be able to handle an unshielded radioactive source with a strength of 1,000 Ci for longer than one hour within a range of 1 metre from the source. Although α radiation requires hardly any shielding, most α-emitters also emit β, γ radiation and therefore require the same shielding as β, γ radiation. On top of that, californium-252 emits neutrons and requires shielding by light materials such as plastics or water. The thickness of this shielding should be about 40–50 centimetres (cm). This will considerably increase the volume of the shielding container and therefore the visual detectability.

Conventional explosive

The conventional explosive used in an RDD could be ordinary trinitrotoluene (TNT). This is readily available to terrorists and has sufficient propellant force for the radioactive material to be dispersed. The amount of explosive needed for an RDD is estimated to be between 2.5 and 5 kg of TNT. Other means of dispersion will not be discussed here, although one possibility is aerial spraying.

Consequences of the use of an RDD

The main consequences of use of an RDD will be loss of life through direct impact of the explosion and contamination. Direct casualties due to the impact of the explosion are likely to be limited and there will probably be no immediate casualties from radioactive contamination (the 'deterministic effects of radiation'). In the long run, however, contamination may cause casualties (through the 'statistical' effects, such as radiation-induced cancer and genetic defects in future generations), but probably fewer than commonly claimed in public discussions.[9]

The types of radiation emitted by the RDD isotopes that are most likely to be used have different effects. When inhaled or ingested, α radiation involves heavy particles that can cause great damage to the human body. It does not pose a health risk outside the human body, since the outer dead layer of the human skin absorbs all its energy. β, γ radiation involves light particles (β) or electromagnetic radiation (similar to light, ultra-violet (UV) light or X-rays) that are more penetrating and therefore harmful for human health, both as an internal and as an external source. They have a longer range and the damage they create in the human body is spread over a larger area than is the case for α radiation.

With respect to the number of likely casualties, an RDD is likely to have no greater impact than a conventional bomb. The real difference lies in the extent of radioactive contamination of a large area. Appreciative dispersion calculations performed to determine the spread of radioactive material after the explosion of an RDD have shown that a large area (0.28 square kilometre) can be contaminated by dispersing a source with a strength in the order of only 1,000 Ci.[10] This aspect of contamination is likely to cause widespread public panic, fear and uncertainty. Depending on the physical state of the radioactive material, the decontamination costs may be very high. Decontamination will be time-consuming and will need to take place immediately after the contamination occurs, since the radioactive particles will increasingly stick to buildings and other surfaces the longer they remain.

There are also likely to be economic effects, such as a loss of real estate value, however temporary, and disruption to economic activity, at least in the immediate area. The Goiania incident in Brazil in 1987, when a radioactive source used for medical applications was illegally dumped in a junk yard, caused a fall in economic activity of 20 percent in Goiana, which the town took five years to recover from. However, relatively large amounts of radioactive source material are needed to contaminate a large area—a fact which will make a monitoring and verification system for controlling radioactive sources likely to be more effective.

Local and national governments play a very important role in reducing public fear of RDDs. The general public needs to be convinced, as shown by the dispersion calculations, that the radiation effects, even in close proximity to the explosion of an RDD, are relatively low compared to those that would result from an accident at a nuclear facility, such as a nuclear power plant. A policy of providing quick, open and reliable information to the public will reduce the likelihood of widespread panic and thereby frustrate the aims of the terrorists.

The likelihood of RDD acquisition and use

The Illicit Trafficking Database of the IAEA, inaugurated in 1996, lists some 330 'incidents' involving illegal trafficking in radioactive material.[11] Half of them involved radioactive material other than fissionable nuclear material (uranium and plutonium). The database includes only incidents that have been officially confirmed; the actual number is probably much higher. On the other hand, the

definition of 'illicit trafficking' used by the IAEA includes any unauthorised act, whether there was an apparent intention to misuse the radioactive material or not. German statistics show that in 13 percent of unauthorised cases the source was stolen with the intention of misusing it.[12] The IAEA database shows a pronounced peak in 1994 and a less pronounced one in 1999–2000. It is not clear whether the decline in the number of incident reports is due to fewer actual incidents or to reluctance to report them, for instance, because this would show weak points in a country's security system.[13]

So far there has been only one confirmed case of an attempt to use radioactive material for terrorist purposes. In 1996 Chechen rebels placed a container containing caesium-137 in a Moscow park, but no dispersion of radioactive material occurred. The action was probably intended as a warning and not a real attempt to disperse the material. In June 2002 one Jose Padilla was arrested in the US and charged with planning a 'dirty bomb' attack in that country.[14] In June 2003 a large quantity of 100 grams (g) of caesium-137 intended for sale to terrorists was intercepted in Thailand. These and other incidents have created growing concern regarding the use of RDDs by terrorists.[15]

Production and presence of radioactive sources

Thousands of radioactive source materials have been produced worldwide. One or a combination of these sources contains sufficient material for an effective RDD. The main producers of radioactive isotopes are Argentina, Belgium, Canada, the Netherlands, Russia and South Africa. Canada is clearly the largest exporter of radioactive isotopes, but it is not easy to determine a clear ranking of the other countries by scale of production, since this depends on which isotope is considered. Moreover, these data are often not revealed for commercial reasons.[16] France is a minor player, while the US has a substantial market share only for some isotopes of concern (notably californium-252). End-users of radioactive sources are spread all over the world and number in the tens of thousands. They include hospitals, oil companies, food irradiators, research institutes and gauging companies. The level of security at most of these facilities, even those with strong radioactive sources, like food irradiators and hospitals, is low, since the emphasis is on safety rather than security. Most of them use sources that are not of concern because of their low activity or short half-life. However, for non-state actors it is easier to obtain

radioactive material for an RDD from such sources than to obtain safeguarded fissile material.

IAEA safeguards: a model for verifying radioactive sources

Elements of the IAEA safeguards system may serve as a verification model for radioactive sources. The goal of IAEA safeguards is to prevent further horizontal nuclear weapons proliferation. The first version of IAEA safeguards system for fissile material was established in 1961.[17] The system has developed gradually into full-scope safeguards for verifying state party compliance with the 1968 Nuclear Non-Proliferation Treaty (NPT).[18] As a consequence of the 1991 Gulf War and the discovery by the United Nations Special Commission (UNSCOM) of Iraq's secret programme to acquire nuclear weapons, which Iraq had managed to pursue even though it was subject to full-scope safeguards, the IAEA developed additional measures to detect similar secret programmes. These measures are in part contained in an Additional Protocol to comprehensive safeguards agreements.[19]

The basis of the IAEA safeguards system is material accountancy. The materials that are verified are plutonium (Pu), uranium (U) and thorium (Th). These materials can be used directly for a nuclear weapon or converted (in a reactor) into material suitable for a nuclear weapon. Several measures are used to support the material accountancy system. The most important are visual inspections, destructive and non-destructive analysis, and containment and surveillance. Recently open source information and environmental sampling have been added to the verification tools.

Similar measures can be envisaged for verifying the non-diversion of radioactive sources. Again, the basis should be a reliable accountancy system to account for all relevant radioactive sources. Non-destructive analysis of sources, for example, by gamma-spectrometry, is an adequate measure to verify that a source is still in its containment vessel. Other measures will not be necessary.

IAEA safeguards are based on the ability to detect diversion of what is called a significant quantity of fissionable material. This is the amount of material that is estimated to be needed for one nuclear weapon. For uranium-235 the significant quantity is 25 kg, for plutonium 8 kg and for thorium 20 tonnes. The latter is the amount of thorium that would need to be irradiated in a nuclear reactor to produce sufficient uranium-233 for a nuclear weapon.

In the case of RDDs, the verification of radioactive sources should be limited to those with sufficient strength to contaminate a large area. Based on dispersion calculations, an initial estimate of the source strength above which measures are needed is 1,000 Ci. Since this type of calculation still suffers from large uncertainties, a large safety margin has to be allowed for. We therefore assume that a source with a strength as low as 100 Ci can cause significant damage. Assuming further that terrorists could construct an RDD using several smaller sources, we arrive at a lower limit of 10 Ci for sources that need some kind of verification. Refinement of the calculations would be necessary to improve this estimate and to use it for safety and verification policy. The number of sources and the total amount of material that pose a high risk and thus need to be controlled are therefore limited.

The frequency of IAEA safeguards inspections is determined by the 'timeliness goal'. This is the time that is needed to convert nuclear material into a form suitable for use in a nuclear weapon. For example, plutonium in irradiated, highly radioactive nuclear fuel needs to be separated from the other radioactive isotopes before it can be processed for use. Another example is HEU in the form of oxide, which has to be converted into a metal before it can be used in a nuclear weapon. HEU and plutonium that are not mixed with other radioactive isotopes are considered 'direct-use material' and should be inspected every month. 'Indirect-use material' such as low enriched uranium is inspected only once a year.

The verification frequency of radioactive sources could depend on the physical/chemical state of the source material. Material that can be easily dispersed could be inspected with a higher frequency, since it is more likely that terrorists would try to obtain such material. It would also be possible to consider relaxing the inspection frequency for sources with intermediate strength, that is, between 10 and 100 Ci. One source would probably not contain sufficient material to contaminate a large area, although several sources would.

National controls on radioactive sources

From a historical point of view, the control of radioactive sources has been designed to prevent hazards to the health of radiological workers and the public arising from accidents. The main concern of legislation was, and in most countries still is, safety. This does not, however, mean that there has been no progress.[20]

In Europe, France, Germany and the UK have established satisfactory procedures for preventing the misuse of high-risk sources. Other countries, such as Belgium, also a major producer of isotopes, still lack a legislative framework and practical procedures for the security and physical protection of high-risk sources. Some East European countries, such as Poland, have also developed at least some practical procedures to detect illicit trafficking of radioactive sources. But a major problem is the cost of implementation. In Russia the legal framework for combatting illicit trafficking exists (including even a finely-tuned definition of fines and punishments), but patchy law enforcement—the result of a lack of financial resources, the size of the country and the extent and porous nature of its borders—is a major problem.

In the Americas, Argentina, one of the main producers of radioactive sources, is working on legislation and is already applying practical control measures. Sources for export are of special concern. The US is late in passing legislation, particularly concerning the export of highly radioactive sources under general licences. This is the case for many other countries.

In Africa the problems are of a different order of magnitude. In most cases a central organisation exists that is responsible for radiation protection, but many countries lack well-trained customs officers who are able to recognise and deal with illicit trafficking. Many African countries are aware of the problem and have requested the IAEA's assistance.

In Asia the situation varies. India, which has an extensive nuclear fuel cycle, implements controls only from a safety point of view and has not yet established measures to deal with illicit trafficking. China is in more or less the same position. It has admitted that even for safety purposes there are occasional problems because of the absence of a safety culture. Although there is little information available for Japan it can be assumed that safety procedures are well established, given that it has an extensive nuclear fuel cycle. However, recent incidents in Japan's nuclear industry raise some doubts with respect to implementation of its safety procedures and thus the monitoring of radioactive sources. The Central Asian states that were formerly part of the Soviet Union have problems that are similar to those of Russia itself.

In the Middle East, Israel has developed a control system for both safety and security reasons. Sources with a high risk are subject to the application of physical

protection measures. Other countries in this region have a more limited approach to safety.

Possible preventive measures

Measures taken for the physical protection of fissile material against theft by terrorists are not an international obligation but a national responsibility. Similarly, measures to prevent the construction and use of a RDD also fall under national law. The IAEA has issued some guidelines about the physical protection of fissile material, but these are only binding during international nuclear transport.[21] No specific guidelines for preventing the use of RDDs have been issued so far, but the IAEA is making sustained efforts to increase the awareness of the danger, for instance, by organising conferences on the subject.

A conference in Dijon, France, in September 1998 concluded that regulatory bodies for the control of radioactive sources must be independent and supported by governments, and must have an overview of all radioactive sources in the particular country; that radioactive sources must not disappear from the control system (the 'cradle-to-grave' philosophy); that efforts must be made to regain control over lost, abandoned or stolen ('orphan') sources; that the capability to detect illegal transport of radioactive sources must be improved; that an effective national regulatory body operating with suitable means is the key to avoiding orphan sources; that governments should create such a body if one does not exist; that governments should provide such a body with sufficient resources; and finally that efforts should be made to improve international co-operation in the effective operation of national regulatory bodies.[22] The conference resulted in the IAEA General Conference in 1998 encouraging all governments to 'take steps to ensure the existence within their territories of effective national systems of control for ensuring the safety of radiation sources and the security of radioactive materials'.[23]

In December 2000 a conference in Buenos Aires, Argentina, concluded that an essential component of improving the safety and security of radioactive sources is knowledge.[24] Training and education are therefore essential for regulatory staff, and developed countries were requested to support developing countries in this respect. It was also recognised that many countries still lack adequate control systems for radioactive sources. The need to establish continuous control of such sources

during their complete lifetime was reiterated. The establishment of storage facilities for disused sources was advocated if disposal facilities were not (yet) available. Like the Dijon conference, the Buenos Aires conference emphasised the danger of orphan sources and the importance of developing national strategies to detect and recover them. The criminal misuse of radioactive sources was already considered an important issue and closer co-operation at both a national and international level was recommended to prevent such activities.

A conference in Stockholm, Sweden, in May 2001 dealt with the illicit use of both nuclear material and radioactive sources.[25] It focused on measures to reduce the possibility of theft, sabotage and illicit trafficking of nuclear materials and other radioactive materials, and concluded that a comprehensive approach to the security of these materials was needed, using technical, administrative and regulatory measures. It emphasised the key role of the IAEA in this.

The most recent conference organised by the IAEA in this respect was the International Conference on Security of Radioactive Sources, held in March 2003 in Vienna, Austria. It produced two major findings. The first was that high-risk radioactive sources that are not under secure and regulated control, including so-called orphan sources, raise serious security and safety concerns. An international initiative to facilitate the location, recovery and securing of such radioactive sources throughout the world should therefore be launched under the IAEA's aegis. The second was that effective national regulatory bodies are essential for ensuring the long-term safety and security of high-risk radioactive sources, and that an international initiative to assist governments in establishing these bodies should be launched under the auspices of the IAEA.

Additional findings were that there is a need to locate and secure high-risk radioactive sources; that the long-term control of radioactive sources must be strengthened; that greater international effort is needed to detect and interdict illicit trafficking in high-risk radioactive sources; that the roles and responsibilities for safety on one hand and security on the other should be clearly defined for the competent national organisations; that radiological emergency plans dealing with illicit use of radioactive sources should be developed; and that the general public's understanding of the nature and consequences of radiological emergencies largely determines its reaction to such emergencies.

Preventive measures in relation to RDDs should focus on radioactive material, since explosives or other means of dispersion can be relatively easily obtained by terrorists, and many states are already trying to control access to such means as part of their general anti-terrorism measures. Keeping track of all potentially harmful radioactive sources requires a series of measures.

First, a national accountancy and verification system for radioactive sources should be established by every country. Like the IAEA safeguards system, such a system should account only for strong sources, since, as we have seen, an effective RDD contains in the order of 100–1,000 Ci. However, smaller sources with activity in the order of 10 Ci should not be excluded since several smaller sources can make up a 100-Ci source. A 'significant quantity' should therefore be defined as being of the order of 10 Ci. As mentioned above, at present only a few countries have such an accountancy and verification system, most of them are voluntary and they are based on safety rather than security considerations.

Verification of both the type and the strength of each source can be performed relatively easily by non-destructive analysis, as is done in the case of IAEA safeguards. As has been seen, the physical state of the radioactive material is important since it determines how dispersible the material is. Sources could be divided into several classes according to their physical state, indicating the risk they pose in terms of potential for being used in an RDD. A verification system would have to take such risk factors into account, for example, by adjusting the inspection frequency.

Second, an inventory of the present sources should be established and brought into the national verification system. Some international co-ordination could be useful, especially participation by the main producers of radioactive isotopes.

Third, a 'return' system for sources no longer being used should be established so that owners are encouraged to send them back. When a source is purchased, a deposit should be paid that will be returned when the source is given back. Unused sources pose a major risk of being stolen because they are probably no longer being closely supervised. This part of a preventive system against RDDs will probably raise most protest among the radioactive source producers, since it will increase the purchase costs of sources and make them less competitive with possible alternatives. Several countries (such as the US) have programmes that encourage the return of unused sources, but their success has so far been limited,

probably because they are voluntary. So far little more than 1 Ci has been returned in the US case.

Fourth, abandoned (orphaned) sources, which are no longer under anyone's control, should be secured. This could be done in a dedicated repository—preferably the national regulatory authority. Such a repository exists, for example, in Belgium.

Conclusion

National accounting and monitoring systems for radioactive sources should be established, but limited to those that pose a significant risk for society if used in or as RDDs. Based on dispersion calculations, an initial estimate of the source strength above which measures are needed is 10–100 Ci (although refinement of the calculations would be necessary to improve this estimate before it could be used for safety and verification policy). The number of sources and the total quantities that pose a high risk and which need to be controlled are thus limited.

The structure of a national control system could be comparable to that long established for IAEA safeguards with respect to material accountancy and verification of the presence and state of radioactive sources. Sources should be categorised according to the risk they pose in terms of their utility in or for an RDD. Aspects that should be included in quantifying this risk include the isotope concerned, its physical/chemical state and the quantity of material.

Local and national governments play a very important role in reducing public fear of the possible use and effects of RDDs. As shown by dispersion calculations, the radiation threat to the public, even in close proximity to the explosion, is relatively low compared to the threat that would result from an accident at a nuclear facility. Making quick, open and reliable information available to the public will reduce the effect of widespread panic and help confound the purposes of terrorists attempting to use RDDs.

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Endnotes

[1] The preoccupation with fissile material in the Radiological Weapon Convention negotiations seems strange. First, there are other materials that are as hazardous as plutonium when used in an RDD, such as americium-241 and californium-252. The hazards of uranium isotopes are small compared to those of cobalt-60, strontium-90, caesium-137 and iridium-192. Second, the security measures in place for plutonium and uranium have always been much tighter than those for other radioactive materials. Third, the amount of plutonium and uranium needed for 1,000 Ci is well above the critical mass of these two elements, so that if a terrorist were to acquire a sufficient amount of plutonium or uranium it would be more attractive for him to make a nuclear weapon than an RDD (even if it is technically more complicated). The home-made character of a plutonium bomb especially will probably make it less effective, but the resulting damage will still be much greater than that from an RDD based on plutonium-239. A home-made nuclear weapon based on uranium-235 is relatively easy to make.

[2] Fissionable or fissile nuclear material such as plutonium or uranium can be used to provoke a nuclear fission reaction. This reaction is used in a controlled way in nuclear power plants and in an uncontrolled way in a nuclear weapon. In shorthand these elements are also called nuclear material. In this chapter the term 'radioactive sources' is used for all radioactive material.

[3] International Atomic Energy Agency (IAEA), 'Measures against illicit trafficking in nuclear material', GC(38)/RES/15, IAEA, Vienna, 15 September 1994.

[4] IAEA, 'Measures against illicit trafficking in nuclear materials and other radioactive sources', GC(41)/21, IAEA, Vienna, 18 September 1997.

[5] IAEA, 'Code of conduct on the safety and security of radioactive sources', IAEA/CODEOC/2001, IAEA, Vienna, 2001.

[6] IAEA, 'Nuclear and radiological security: progress on measures to protect against nuclear and radiological terrorism', GC(47)/RES/8, IAEA, Vienna, 19 September 2003.

[7] Charles D. Ferguson, Tahseen Kazi and Judith Perera, *Commercial Radioactive Sources: Surveying the Security Risks*, Occasional Paper no. 11, Monterey Institute of International Studies, January 2003.

[8] The amount of radioactive material needed for a 1,000-Ci source depends on the half-life of the isotope being considered. The shorter the half-life, the less the amount of material needed for a 1,000-Ci source. For americium-241, with a half-life of 433 years, the amount is about 300 grams. For iridium-192, with a half-life of 74 days, the amount is only 100 milligrams. These figures apply to pure material. If the radioactive isotope is mixed with other isotopes, the amount needed is greater.

[9] NKS Conference on Radioactive Contamination in Urban Areas, Risoe, Roskilde, Denmark, 7–9 May 2003.

[10] The calculations were performed by Alain Solier in November 2002 using the HOTSPOT 2.01 computer code developed by the Lawrence Livermore National Laboratory in California, US. See www.llnl.gov/nai/technologies/hotspot. The results of the calculations are discussed extensively in Alain Sohier and Frank Hardeman, 'Radiological dispersion devices: are we prepared?', NKS Conference on Radioactive Contamination in Urban Areas, Risoe, Roskilde, Denmark, 7–9 May 2003.

[11] Anita Nilsson, 'Security of material: preventing criminal activities involving nuclear and other radioactive materials', International Conference on Security of Radioactive Sources, IAEA-TECDOC-1045, Vienna, Austria, 10–13 March 2003.

[12] Ilona Barth and Renate Czarwinski, 'Unusual events regarding losses and finds of radioactive materials in Germany in the years 1991 to 1997', International Conference on Security of Radioactive Sources, IAEA-TECDOC-1045.

[13] George Bunn and Lyudmila Zaitseva, 'Efforts to improve nuclear material and facility security', *SIPRI Yearbook 2002: Armaments, Disarmament and International Security*, Oxford University Press for the Stockholm International Peace Research Institute, Oxford, 2002, appendix 10D, pp. 598–612.

[14] See 'Radiological weapons I: US authorities arrest alleged "dirty bomber"', Global Security Newswire, 10 June 2002, available at www.nti.org.
[15] See 'Radiological weapons: Thai police block cesium-137 sale', Global Security Newswire, 13 June 2003, www.nti.org.
[16] Ferguson, Kazi and Perera, *Commercial Radioactive Sources: Surveying the Security Risks*.
[17] IAEA, 'The Agency's safeguards', INFCIRC/26, IAEA, Vienna, 9 April 1964, available at www.iaea.org/publications/Documents/Infcircs.
[18] IAEA, 'The structure and content of agreements between the Agency and states required in connection with the Treaty on the Non-Proliferation of Nuclear Weapons', INFCIRC/153 (Corrected), IAEA, Vienna, June 1972, www.iaea.org/publications/Documents/Infcircs.
[19] IAEA, 'Model Protocol Additional to the Agreement(s) between State(s) and the International Atomic Energy Agency for the Application of Safeguards', INFCIRC/540 (Corrected), IAEA, Vienna, December 1998, www.iaea.org/publications/Documents/Infcircs. See also chapter 2 in this volume.
[20] This remark is based on reading several contributions to the International Conference on Security of Radioactive Sources, IAEA-TECDOC-1045, Vienna, Austria, 10–13 March 2003.
[21] IAEA, 'Convention on the Physical Protection of Nuclear Material', INFCIRC/274/Rev. 1, IAEA, Vienna, May 1980, www.iaea.org/publications/Documents/Infcircs. The convention was signed on 3 March 1980 and entered into force on 8 February 1997. It obliges states parties to ensure the protection of nuclear material during international transport, whether within their territory or on board their ships or aircraft. The treaty has 89 parties to date.
[22] International Conference on the Safety of Radiation Sources and the Security of Radioactive Materials, Dijon, France, 14–18 September 1998.
[23] IAEA, 'The safety of radiation sources and the security of radioactive materials', GC(42)/RES/12, IAEA, Vienna, 25 September 1998.
[24] International Conference of National Regulatory Authorities with Competence in the Safety of Radiation Sources and the Security of Radioactive Materials, Buenos Aires, Argentina, 11–15 December 2000.
[25] International Conference on Measures to Prevent, Intercept and Respond to Illicit Uses of Nuclear Material and Radioactive Sources, Stockholm, Sweden, 7–11 May 2001.

8

CTBT radionuclide verification and the British Laboratory

Christine Comley and Owen Price

From the 1958 conference of scientific experts[1] onwards and the first tentative steps towards the 1996 Comprehensive Nuclear Test Ban Treaty (CTBT),[2] the use of forensic seismology[3] dominated proposals for the international co-operative verification of bilateral and multilateral nuclear test ban treaties.[4] However, during the CTBT treaty negotiations from 1994 to 1996 many technologies besides seismology were considered by the Conference on Disarmament (CD) and its expert groups.

Ultimately, four different technologies were chosen as the basis for the treaty's International Monitoring System (IMS). These technologies provide data to an International Data Centre (IDC), located at the Comprehensive Nuclear Test Ban Treaty Organization (CTBTO), currently in nascent form, in Vienna. The data are collated, processed and used to provide detailed event bulletins to states parties to enable them to verify compliance with the treaty. The technologies are intended to operate synergistically to locate and identify a nuclear test, whether it is conducted underground, under water or in the atmosphere.[5] Seismology and hydroacoustics will be used to locate underground and underwater nuclear tests, while infrasound and radionuclide monitoring will detect and locate atmospheric tests.

Of the four IMS verification technologies, radionuclide monitoring is the only one that can provide unambiguous evidence that an event is a nuclear, rather than a conventional, explosion. Hence it can provide conclusive evidence of a nuclear test. If an event were considered by the states parties to be a possible nuclear test, they could approve the conduct of an on-site inspection to locate it and establish who conducted it. During such an inspection, additional technologies, including the gathering of radioactive samples and their examination by means of radionuclide measurements, would be used to provide further evidence of a treaty violation.[6]

This chapter describes the role of radionuclide verification for the CTBT, presents the role of the United Kingdom, and reports on the progress and future plans towards certification of the UK's Radionuclide Laboratory, based at the Atomic Weapons Establishment (AWE), Aldermaston, which has been designated by the treaty as a CTBT laboratory (GBL15).[7]

Radionuclide monitoring for CTBT verification

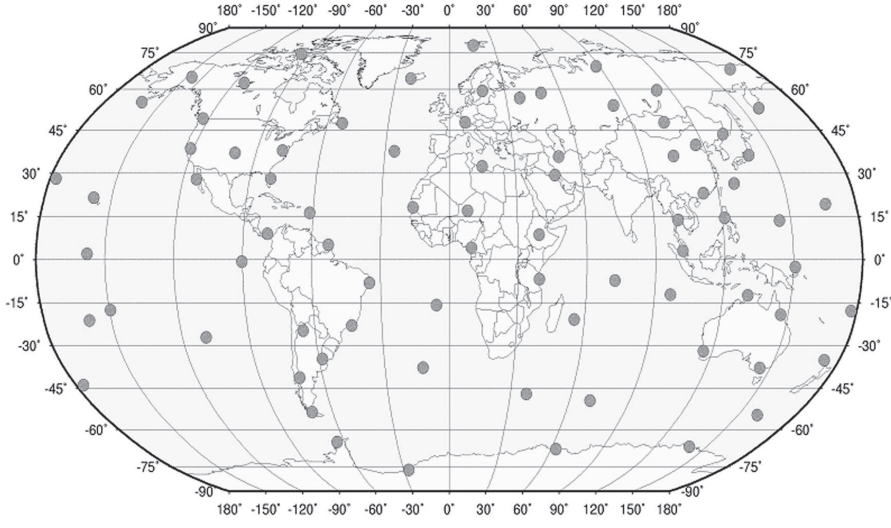
During a nuclear explosion large quantities of debris, including radioactive materials from fission products, activation products and actinides, are produced. In an atmospheric or surface test these are dispersed as plumes high into the troposphere, which can be transported many thousands of miles away. In the case of an underground test, unless the explosion is effectively contained, some of the (volatile) fission products and gaseous debris may be vented into the atmosphere.

Fission products from a nuclear explosion (1.4×10^{23} fissions per kiloton of yield) are highly radioactive and contain a mixture of radionuclides with half-lives ranging from a few seconds to many thousands of years. The radioactivity of the mixture roughly halves as the period of time doubles. Other radioactive materials present include the remains of the fissile materials that comprised the explosive core (such as uranium and plutonium), plus any materials made radioactive by the neutrons produced during the explosion. Meteorological models[8] can predict the dispersion of the debris with time, and are used to track the debris back to the detonation location. In most cases the time of the detonation can be deduced from the gamma spectrometry results from early radioactivity measurements.

As part of its International Monitoring System (IMS), the CTBT provides for the establishment worldwide of 80 stations for global radionuclide monitoring (figure 1).[9] The IMS radionuclide stations are of two types:

- particulate (aerosol) collection and analysis stations, where a high-volume air sampler (capable of collecting more than 500 cubic metres per hour (> 500 m^3/hr) collects radioactive particulate greater than 0.2 microns onto a filter for each 24 hours; and
- noble gas stations, which collect, count and analyse the short-lived radionuclides of the noble gas xenon which is released by a nuclear explosion. Half of the 80 IMS stations may eventually have this additional capability.

Figure 1 **Locations of IMS radionuclide stations**



Source Provisional Technical Secretariat (PTS), CTBTO, Vienna. Permission to reproduce granted by the PTS.

Initial analysis is usually undertaken at the station. After 24 hours' delay, to allow radioactive decay of the natural radioactivity from radon 'daughters' present in the atmosphere, the radioactive particulate collected on the filter is automatically measured using a high-purity germanium (HPGe) gamma detector. The results are categorised according the radionuclides present and their quantities. The data from the stations are sent by a satellite that is part of the CTBTO's Global Communications Infrastructure (GCI) to the IDC in Vienna, where they are merged with data obtained by the other monitoring technologies. Although some data processing will take place at the IDC, the raw data may also be made available, on request, to states parties, to enable them to do their own analysis.

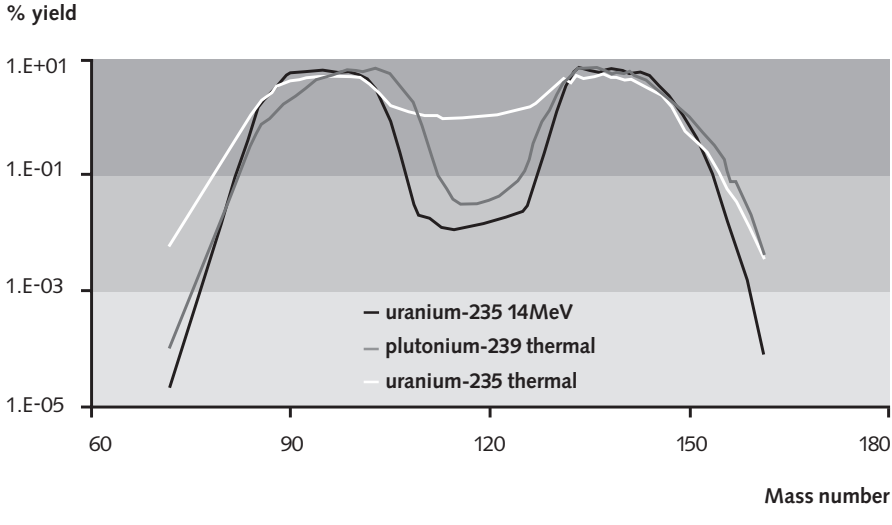
The treaty provides for 16 IMS radionuclide laboratories, located around the world, to be certified for analysing the samples collected by the IMS stations. The 16 host countries are: Argentina, Australia, Austria, Brazil, Canada, China, Finland, France, Israel, Italy, Japan, New Zealand, Russia, South Africa, the UK and the United States. The role of the laboratories includes taking additional, more sensitive measurements or confirmatory measurements of samples from any of the IMS stations. The results are transmitted to the IDC for inclusion in bulletins for states parties.

There are five alert levels for the radioactive measures taken at the IMS radionuclide stations. Alert level 5 applies when certain short half-life fission products, that may be the result of a nuclear explosion, are detected. Level 5 samples are sent to the CTBTO-certified laboratories for further analysis.

Having detected certain short-lived radioactive species, it is necessary to differentiate between a nuclear explosion and nuclear releases from nuclear power reactors, hospitals and industrial processes. The mixture of radionuclides from a nuclear test can be distinguished in several ways. Most reactors operate with neutrons in the thermal region (0.02 electron volts, eV), whereas a nuclear explosion results in fission products from fission spectrum neutrons in the MeV region. This has an effect on the shape of the fission yield curve (see figure 2); the presence of certain fission products in quantity thus becomes a diagnostic signature. Furthermore, reactor material would have been produced over a longer period than a nuclear explosion, resulting in a mixture of short-lived and decayed isotopes. High-yield fission products such as the isotopes barium-140 (140Ba) and molybdenum-99 (99Mo) are present at the peak of the curves in figure 2.

The laboratories will undertake additional measurements on selected samples from the monitoring network, participate in quality and proficiency exercises and, when required, receive and analyse samples from manual monitoring stations. The

Figure 2 **Fission yield curves**



laboratories' role in the measurement of xenon gas samples from the monitoring network is evolving as the equipment is developed to meet the technical requirements. After the CTBT enters into force some laboratories may also be required to analyse samples taken during inspections of sites where a suspected nuclear test may have occurred.

All 16 national radionuclide laboratories are required to be certified by the CTBTO before operating as a laboratory in support of the IMS. At present the Austrian Research Centre (ARC) research laboratory at Seibersdorf, Austria, and the National Radiation Laboratory, Christchurch, New Zealand, are certified. Several more are due for a certification visit by the CTBTO in 2003–2004. About two to three laboratories are expected to be certified a year. Prior to certification, the laboratories are paid a fee for the samples they measure and report on. Following certification, they are paid a monthly or annual fee, which covers activities needed to maintain a state of readiness.

To operate as a CTBTO radionuclide laboratory it is necessary to have in place adequate security and sample traceability, as well as full-spectrometer (HPGe) calibration. Owing to the forensic nature of the work, the very small size of detected samples and the need for the conclusions to be unambiguous, the processes employed need to be carefully managed to the highest standards. This is the basis of the quality system required by the CTBTO and the International Standards Organisation (ISO-17025). The CTBTO's requirements have been set out progressively by the Provisional Technical Secretariat (PTS) in CTBT documentation,[10] along with quality manuals, procedures and instructions for meeting the treaty's requirements. These documents detail requirements relating, for example, to equipment specifications, security, bonding, personnel training, environmental conditions, communications and response times. The documents are provided to states parties through the PTS's Expert Communication System (ECS), which can be accessed by registered personnel via a secure internet site. In order to connect them to the CTBTO laboratory network, two-way satellite communication links to Vienna are being established at the laboratories.

Proficiency test exercises

To ensure that the 16 laboratories operate to common standards and have similar capabilities, the PTS has organised a series of proficiency test exercises, known collo-

quially as 'round robin' exercises, to assess them. Each participating laboratory undertakes analysis of the same samples and reports to the organiser (in the recent exercises the UK's National Physical Laboratory has been contracted to do this for the PTS), which assesses and reports on the results. For each exercise a blank, a calibration source and a reference sample of low levels of radioactivity are provided. Sources are packed as Excepted Radioactive Material[11] and delivered by courier. This procedure tests the rapid transfer of the radioactive materials through customs in accordance with national requirements.

The exercises test the ability of the laboratories to meet the requirements of the treaty, including demonstration of the quality system, traceability and timeliness of reporting. Participation in these exercises forms part of the certification process. The PTS also tests the proficiency of the laboratories in transporting samples to or from a radionuclide station, and their ability to measure filter samples in a timely manner and to provide results of a high standard.

The IMS requires an extremely high standard of performance, which is met by careful attention to the calibration process, the measurement of a reference sample, and expert interpretation and reporting of the results, with corrections for cascade summing, parent–daughter decay and identification of all radioisotopes present. For the latest two exercises, in 2001 and 2002, short half-life fission products were provided, thus simulating real nuclear fallout. Working Group B (WGB) of the CTBT's Preparatory Commission (PrepCom), which handles verification issues, would like renowned radiochemistry laboratories that will not be part of the CTBT system to participate in some future exercises in order to compare the CTBT-designated laboratories with the best in the world.

The UK role in radionuclide monitoring

The UK will host four radionuclide stations, all on British dependent territories, as part of the IMS. These are in the British Indian Ocean Territory, on St Helena, on Tristan da Cunha and at Halley in Antarctica. In 2000 the British government nominated the radionuclide laboratory at the AWE at Aldermaston to participate as a CTBT laboratory.[12] It has been designated by the PrepCom as GBL15.[13]

The UK is fortunate in that the AWE laboratory has had many years' experience of carrying out radionuclide measurements and diagnoses. From 1952 to 1991, radio-

nuclide analysis was a key part of the AWE's nuclear test programme.[14] The AWE Radionuclides Team collected samples from British nuclear tests to provide information vital to the interpretation of warhead performance. Samples needed to be sent from distant nuclear test sites to the AWE as quickly as possible in order to enable analysis of the fission products, activation products and residual device materials.

For many years a small group of AWE scientists has also advised the British government on technical matters relating to nuclear test ban verification. AWE staff joined the British delegation during the CTBT negotiations to provide advice on the terms of the treaty and on-site inspection procedures, as well as the design of the IMS. In addition to the role played by the Blacknest Seismology Team,[15] the AWE Radionuclides Team provided expert input to the technical negotiations leading to agreement on the radionuclide monitoring system. The team staffs GBL15 and the Environmental Monitoring Research Project (EMERGE) which is part of the AWE's Nuclear Arms Control Verification Research Programme.[16] The AWE also supported the Prototype International Data Center at the Center for Monitoring Research (CMR) in Arlington, Virginia, US before its functions were transferred to the IDC in Vienna.

GBL15: progress to date

Since the British government requested the AWE to act as the UK's CTBT radionuclide laboratory, its Radionuclides Team has been preparing for certification by the CTBTO. The team has participated in five CTBTO exercises, as well as related activities, providing valuable experience for the development of the laboratory's procedures.[17] The exercises included a sample transport exercise in 1999; a radioactive sample proficiency exercise in 2000; the ARAME[18] radioactive sample proficiency exercise in 2001; the RASA radioactive sample proficiency exercise in 2002; and a radioactive sample proficiency exercise in 2003.

To date, proficiency test exercises have demonstrated that GBL15 meets the technical performance requirements of the PTS. The demonstration of expertise in counting and analysis through participation in the exercises is a significant contribution to the certification process. GBL15's analysis has consistently ranked in the top 20 percent of the participating laboratories. The results of the first three proficiency exercises for each radionuclide tested show that the British laboratory has performed consistently well for all but three radionuclides.

The laboratory has also been recruiting and training staff, purchasing equipment and making infrastructure modifications, including the establishment of a bonded store. New HPGe gamma spectrometers have been purchased and calibrated on a rolling programme of renewal. The GCI satellite communications equipment, to provide communications between the laboratory and Vienna, has been installed and commissioned. This was not a trivial matter at a sensitive defence site such as the AWE Aldermaston, but represents further progress towards certification.

Most of the outstanding requirements of the PTS as outlined in the CTBT documentation relate to reorganisation of the laboratory's existing procedures. The procedures relate to items such as methods for the operation of the equipment, records of staff competence and work performed, and detailed descriptions of the way in which the quality assurance system meets CTBT requirements. A plan is in place and completion of the documentation is now required prior to the certification review by the PTS in 2004.

The following actions are in progress or remain outstanding in preparing GBL15 for certification review: reviewing the security and bonding infrastructure improvements, and purchasing equipment sufficient for certification of the current facility; documenting the laboratory's activities according to CTBT requirements; acquiring short half-life fission products to calibrate the HPGe gamma spectrometers for extended and close-in geometry; training staff to ensure that a sufficient number of operators are proficient in fulfilling the full duties of GBL15; reviewing formats and protocols for GBL15 participation in the IMS; demonstrating the operation of the GCI system to meet IMS requirements; continuing to participate in PTS proficiency exercises; and hosting a certification review by the CTBTO.

Peer interaction is key to the development of science in any field, and this is particularly true of the development of the IMS and the associated radionuclide laboratories. This work is fully supported by the AWE, which, for example, hosted an international workshop in 2001 for staff from the 16 designated radionuclide laboratories. More recently AWE staff have played a key role[19] in inaugurating a series of international co-operation meetings, known in the CTBTO as the London Process, which highlight the civilian and scientific benefits of the IMS technologies beyond their treaty verification role. The AWE will also host a Royal Society of Chemistry radiochemistry meeting in February 2004 on 'Radiochemistry for treaty

verification'. Such events not only promote peer exchange but are also important for the development and retention of laboratory staff—a perpetual challenge for those involved in running monitoring and verification organisations or agencies. Careful choice of such events and other collaborative activities is seen as a cost-effective way to maintain skills and enhance the science of forensic radiochemistry.

Conclusion

The UK, through its AWE laboratory, is playing its part in the establishment of the IMS network of certified laboratories in preparation for entry into force of the CTBT.[20] The PTS, in setting up the verification technologies for the IMS, has in turn enabled the British laboratory to raise its standards of performance. The fact that GBL15 is at an existing laboratory, where a variety of activities are conducted for the British Ministry of Defence, has helped it develop the skills required for low-level gamma spectrometry at a high level of competence. The standard of science it reports, especially in proficiency exercises, ranks it highly among those of the other participating laboratories. The British laboratory is continuing its efforts to foster international co-operation, as peer interaction provides the only realistic performance benchmark and is fundamental in developing the science of radionuclide monitoring and its role in verification of the CTBT. The laboratory's performance and development of its infrastructure and procedures are thought likely to result in certification in 2004, a milestone in its 50-year history.

Before the CTBT enters into force, much work needs to be done both in the UK and internationally. The IMS needs to be completed and its performance demonstrated, and there is a continuing need to communicate with and educate communities, both among and beyond the CTBT states parties, on the efficacy of the CTBT.

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Endnotes

[1] See United Nations, Secretariat, 'Report on the Conference of Experts to Study the Methods of Detecting Violation of a Possible Agreement on the Suspension of Nuclear Tests (July 1– August 21, 1958)', EXP/NUC/28, Vienna, 1958.

[2] See Peter Marshall, Daniela Rozgonova and Wolfgang Weiss, 'Testing times: the road to a Comprehensive Nuclear-Test-Ban Treaty', *Kerntechnik* (Munich), vol. 66, no. 3, 2001.

[3] On the term 'forensic seismology' see David Booth, 'International honours for a forensic seismologist', *Astronomy and Geophysics,* vol. 43, issue 2, 2002, pp. 2, 6. The term has long been adopted at AWE Blacknest for the application of seismology to the verification of treaties and other legal instruments.

[4] Booth, 'International honours for a forensic seismologist'.

[5] There is provision in the treaty to add further technologies to the IMS as necessary, and technical monitoring data from states parties' National Technical Means (NTM) (e.g., observation of the characteristic 'double flash' of a nuclear explosion by Global Positioning System (GPS) satellites' Bhang meters) could be considered as additional evidence, if submitted.

[6] For further information on the PTS see www.ctbto.org.

[7] Christine Comley, 'Radionuclide monitoring at AWE', *Discovery: The Science and Technology Journal of AWE,* no. 3, 2001, www.awe.co.uk. AWE is the trading name of AWE plc and AWE Management Limited, which manage and operate the United Kingdom Atomic Weapons Establishment under contract to the British Ministry of Defence. Further information on AWE plc may be found at www.awe.co.uk.

[8] Among others, the Meteorological Office at Bracknell, UK, has atmospheric models which can effectively track detected radioactivity to its source.

[9] Murray Matthews and Joachim Schultze, 'The radionuclide monitoring system of the Comprehensive Nuclear-Test-Ban Treaty Organisation: from sample to product', *Kerntechnik,* vol. 66, no. 3, 2001.

[10] Preparatory Commission for the Comprehensive Nuclear Test Ban Treaty Organisation, 'Certification of radionuclide laboratories', CTBTO Documentation of Requirements, Vienna, 2002.

[11] As defined by the International Atomic Energy Agency (IAEA) International Road Transport Regulations.

[12] It is also the home of the UK National Data Centre for the CTBT, co-located with the UK's Forensic Seismology Team. Information about the team and its research may be found at www.blacknest.gov.uk.

[13] It was described erroneously in the treaty as 'AWE, Blacknest Chilton', later amended to 'AWE Aldermaston'.

[14] David Hawkings, *Keeping the Peace: The Aldermaston Story,* Pen and Sword Books/Leo Cooper, Barnsley, 2001.

[15] Alan Douglas, 'Recognising UGTs', *Discovery,* issue 1, 2000, www.awe.co.uk.

[16] Garry George and Martin Ley, 'Nuclear warhead arms control research at AWE', in Trevor Findlay and Oliver Meier (eds), *Verification Yearbook 2001,* The Verification Research, Training and Information Centre (VERTIC), London, 2001, pp. 189–206; Garry George (ed.), *Confidence, Security and Verification*, AWE plc, Aldermaston, 2000, available at www.awe.co.uk; and Owen Price and Garry George, 'Arms control verification: a summary of AWE progress', *Discovery,* issue 7, 2003, www.awe.co.uk.

[17] At WGB sessions, the PTS gives status reports on site surveys, station installations, and certification of stations, and provides a future work plan.

[18] The exercise names were based on the equipment and filter types.

[19] Peter Marshall CMG OBE, former head of the AWE Forensic Seismology Team, has chaired several such meetings, the latest being in Vienna in September 2003.

[20] The AWE is also staffing IMS survey and commissioning work, under subcontract to its strategic partner Guralp Systems Limited (GSL).

[21] The authors wish to thank Peter Marshall CMG OBE for his assistance and advice in the writing of this chapter. Permission to publish this chapter has been granted by the British Ministry of Defence, which retains Crown Copyright.

9

National implementing laws for arms control and disarmament treaties

Angela Woodward

States parties usually need to adopt national laws, along with any other national implementation measures, in order to comply fully with their arms control and disarmament treaty obligations. These laws translate the state's obligations under international law into binding measures enforceable within the state's national jurisdiction. While traditionally it has been assumed that this would be done by states parties as a matter of course, modern arms control and disarmament treaties tend to specifically require them to pass such laws. Whatever the case, this aspect of treaty implementation has long been neglected both by states parties and by observers concerned with treaty implementation.

Not only does the failure to adopt national implementation legislation leave states in non-compliance with their treaty obligations, but it prevents them from effectively outlawing, penalising and deterring banned activities on their territory. In a worst case, it leaves them vulnerable to attack from within by terrorists who are able to take advantage of such legislative inadequacies. The terrorist attacks on the United States on 11 September 2001 have been a catalyst for efforts to improve the national implementation of multilateral arms control and disarmament agreements and to prevent prohibited weapons and materials from being acquired and used by terrorists.

This chapter examines the role of national legislation in the implementation of multilateral arms control and disarmament treaties. It begins by examining the constitutional, treaty and political requirements for the adoption of national implementing legislation. It then assesses challenges to the adoption of effective laws, before outlining how arms control and disarmament regimes monitor the adoption and effectiveness of states' implementing legislation. The chapter compares

the differing experiences of the 1972 Biological Weapons Convention (BWC),[1] the 1993 Chemical Weapons Convention (CWC)[2] and the 1997 Ottawa Convention banning anti-personnel landmines (the Ottawa Convention).[3] Finally, some observations are made as to how the rate of adoption and the effectiveness of national implementation legislation for arms control and disarmament agreements could be improved.

The importance of national implementing legislation

Effective national legislation is crucial for establishing appropriate offences and penalties (together termed 'penal sanctions') for violating treaty obligations not to develop, produce, possess, transfer or use prohibited agents or weapons, to ensure that they are not deployed, and to decommission, deactivate and/or destroy banned items. Without appropriate penal provisions, a state is vulnerable to prohibited activity being carried out on its territory without being able to effectively prosecute and punish transgressions.

Legislation enables a state to enforce the prohibition of activities within its territory or, by extension, in any other area over which it exercises jurisdiction or control.[4] In addition, the state may extend the scope of offences by establishing extraterritorial jurisdiction. This enables it to prosecute its citizens ('natural persons') and companies and other organisations registered in its territory ('legal persons') for offences committed in places outside its legal jurisdiction. Sometimes, although rarely, states have established universal jurisdiction in respect of arms control and disarmament obligations: this enables them to prosecute foreign nationals for offences committed outside their jurisdiction. Such offences may be tried in absentia or once the perpetrator has arrived in the state's territory, either voluntarily or by extradition.

Implementing legislation for arms control and disarmament treaties should apply equally to government officials and military personnel, to avoid the state's witting or unwitting collusion in prohibited activity. It is also vital that offences are established in law to cover the transit of prohibited materials or equipment across the state's territory or through its ports and airports to ensure that its territory is not used for illicit trans-shipment by foreign nationals or entities. Small island states with entrepôt ports are particularly in need of such legislative protection.

The adoption of implementing laws is also a demonstration of the state's political commitment to abide by a treaty. The existence of appropriate laws and measures, combined with their effective enforcement, may also enhance a state's credibility and enhance its international relations in other areas. This is particularly so where trade in restricted materials is confined to those states that are able to demonstrate effective legislative and security controls, for example, under the Australia Group's export control regime for biological and chemical materials.[5] Implementing legislation can also serve to publicise treaty obligations generally among the public, industry, other stakeholders and, not least, legislators themselves. Crucially, it should alert those government departments and agencies that are responsible for treaty implementation activities and law enforcement of their legal obligations and statutory duties.

The obligation to adopt national implementing legislation

Constitutional requirements

Through the act of becoming party to a treaty, either by ratification, accession or approval,[6] a state becomes bound to fulfil all its obligations under the agreement. Each state must ensure that its national laws are adequate and appropriate to enable it to carry out these obligations: it is a principle of international law that a state may not cite the existence or absence of national law to justify a failure to do so.[7] States therefore need to assess the effectiveness of their laws for this purpose and adopt any necessary measures before they become bound by the treaty.

Each state's constitution will prescribe the process for incorporating international law obligations into national law. While every state follows a different process, there has traditionally been a divergence of practice between common law and civil law states.[8]

States with a common law tradition, predominantly those drawing on the legal systems of the United Kingdom and the US, maintain that international and national legal systems are distinct: this is the 'dualist' approach. For these states, treaty obligations must be transformed into national law enforceable within their domestic legal jurisdiction when the treaty enters into force for them, otherwise they may be at odds with their own constitutional requirements and in non-compliance with their treaty obligations.

The situation is more complicated for states of the civil law tradition, for which international law and national law form a single, or 'monist', legal order. Treaties identified by these states as 'self-executing' may be automatically incorporated into national law when the treaty enters into force for the state, with no further national measures necessary to give them legal effect. Other types of treaties will require national legislation to give them full effect within the state.[9] A state's constitution will provide guidance on how the distinction between self-executing and other treaties is to be determined. However, where a treaty contains an obligation to adopt national measures and/or specifically to enact penal sanctions to implement the treaty, a state may not simply assert that the treaty is self-executing and refuse to adopt national legislation. In spite of this, many civil law states maintain this argument and refuse to adopt comprehensive national implementation legislation envisaged by such treaties. Many of these states adopt only piecemeal national measures which only give effect to certain parts of the treaty.[10]

The fulfilment of particular treaty obligations cannot be facilitated by the mere transformation of the international law text into national law. For example, treaties do not specify criminal offences or define the extent of punishments—such as prison terms or monetary fines—as these prescriptions remain the sovereign right of states within their jurisdiction to determine. Yet these provisions are essential for deterring, prosecuting and punishing violations by individuals and organisations of a state's treaty undertakings.

Certain other treaty obligations may similarly not be capable of being performed without authorising legislation. These include the obligation to collate and report information on measures and activities undertaken to ensure compliance with a treaty, or to make declarations of holdings of weapons or military equipment and/or numbers of military personnel. Such declarations may have to be made to other states parties or to an international monitoring, verification or compliance body. Legislation may especially be needed where government departments or agencies cannot share such information between themselves without specific legal authorisation, or where a national authority is established to co-ordinate implementation activities. National law may also be required to facilitate treaty requirements relating to monitoring and verification activities, such as aerial over-flights, on-site inspections and materials sampling, whether conducted by other states parties,

individually or collectively, or by an international verification organisation. For example, on-site inspections may, unless there is legislation in place, contravene civil rights law or constitutional or legal restrictions on access to private property. Where domestic law bans searches of private property without a search warrant, as in the US, an international inspection team conducting an inspection or fact-finding mission under the authority of an arms control treaty must be afforded appropriate access rights. There is also a risk that states which implement treaties solely on a 'self-executing' basis, that is, without any additional national laws, may apply the treaty differently from those states parties which have harmonised their implementation of the treaty by including common provisions in their national laws. This may result in inconsistency in treaty implementation between states parties.

Treaty requirements

The importance of national implementing legislation for all states—common law and civil law countries alike—is recognised by provisions in many recent arms control and disarmament agreements. These require states parties to adopt national legislation, along with any other national measures deemed necessary, to implement and enforce the treaty. Specifically, these provisions may also require states to establish offences and punishments for activities which violate the treaty. More recent arms control treaties now commonly stipulate the scope and content of national laws, for instance, by requiring that all areas under the state's jurisdiction or control are made subject to treaty-implementing legislation,[11] that offences and punishments are laid down in legislation,[12] and that a national implementing authority be established.[13] Those treaties which establish an international verification organisation to oversee treaty implementation and compliance often charge this body with monitoring the adoption of required national legislation and providing or facilitating legislative drafting and other technical assistance to states parties that request it.

Political obligations

As the threat to international peace and security posed by non-state actors, such as terrorist groups, has gained greater prominence, there is an increasing expectation in the international community, as well as political pressure, especially from the

US, for states to comply with their treaty obligations by passing legislation and/or strengthening existing legislation. As most agreements regulating the trade in and possession of small arms and light weapons are only politically—rather than legally—binding, and they lack international verification organisations, national implementation is often the only obvious compliance mechanism available and is therefore seen as particularly important. Moreover, as efforts to strengthen multilateral verification of arms control and disarmament treaty regimes relating to weapons of mass destruction (WMD), such as the BWC, have faltered, there has been increased attention to effective national implementation, through legislation and other measures. While national legislation is clearly important in relation to WMD, it cannot compensate for effective multilateral monitoring and verification.

Fulfilling the requirement

States may choose to amend existing laws, such as penal codes, or adopt new legal instruments to implement their newly-acquired treaty obligations. If they follow the latter route, they may choose to adopt a single, 'stand-alone' piece of legislation to implement all of their obligations under a particular treaty. This is particularly common for small states with no history of involvement with the prohibited weapon, as little activity will be required to implement or enforce the treaty. Some states may choose to adopt 'omnibus' legislation, enabling them to combine multiple treaty obligations in a single piece of legislation.[14] Most states will need many legislative measures to enforce a complex treaty that requires extensive activities to be monitored or performed. This legislation is also likely to grant government agencies authority to adopt successive relevant regulations ('secondary legislation'). For example, acts controlling the export and import of goods may provide for the regular updating of lists of prohibited goods or restricted goods which may only be imported or exported under licence, to be issued quickly as secondary legislation.

Many states have procedures for consultation between government departments, agencies and others involved in implementing a treaty, in order to be able to review existing legislation relevant to treaty implementation effectively. This has the advantage of facilitating the development of a common policy on treaty implementation, co-ordinating the drafting of implementing laws and appropriately allocating responsibilities for treaty implementation activities.

Some states also engage in public consultation in the development of implementation legislation for arms control and disarmament treaties, recognising the public's interest in states' compliance with such treaties. For example, a civil society coalition in South Africa, Mines Action Southern Africa (MASA), was requested by that state's Enabling Legislation Drafting Committee to organise six workshops to hear public comment on the draft bill to implement the Ottawa Convention.[15] Many common law states also have a process whereby a Select Committee receives written and oral submissions from individuals, interest groups and organisations on the draft law, and makes recommendations about amendments to the state legislature.

Challenges to the adoption of legislation

Despite the fact that national implementing laws are essential for states to fulfil all their obligations under international law, many states have either not adopted them—even where a treaty specifically requires them—or have not effectively covered all their obligations in their legislation. Reviews of the status and effectiveness of national implementation legislation conducted by compliance monitoring processes set out in treaties or by international organisations or non-governmental organisations (NGOs) show remarkably similar results across treaty regimes.

Specific reasons have been identified for this failure to adopt legislation. First, some states have allowed their implementation activities to lapse immediately after joining a treaty and need to be reminded of their responsibilities. For many more states, the officials responsible for developing implementation policies and legislation may not be familiar with the treaty issues or necessary procedures to ensure compliance with the range of complex obligations.

Second, many states simply lack the capacity to adopt national legislation to fulfil all their international obligations. This is particularly the case for small or developing states with small bureaucracies and limited resources. The implementation of treaties prohibiting weapons which these states have never developed or possessed is often of lower priority than the implementation of treaties which directly affect their national—primarily economic—interests, such as those on trade[16] and the environment.[17]

There are also generic problems which may impede the adoption of national implementation legislation in every state. For example, the process of adopting

legislation usually necessitates the co-operation of many government departments and agencies in formulating policy and reviewing draft legislation before it is considered for adoption. This requires significant time, effort, resources and political will, any or all of which may be deficient. Also, parliamentary procedures for considering draft legislation, integrating amendments and adopting final legislation can be time-consuming and may compete with other urgent priorities. Using consultants to draft legislation can be problematic, too, as they may not fully appreciate relevant indigenous issues. Their use may also detract from attempts to build legislative drafting capacity among local staff.[18]

Worst of all, many states refute the claim that legislation is necessary to effect national implementation of arms control treaty obligations under their constitutional processes. They argue that the automatic incorporation of the treaty texts into national law is sufficient to enable them to fulfil their duties and claim their rights under these treaties.

Monitoring the status and effectiveness of national legislation

Given the importance of national measures in facilitating a state party's performance of its treaty obligations, it is crucial that information about the adoption of such measures be made available for compliance to be assessed. Disclosing this information to other states parties, through a treaty secretariat where one has been established, as well as to the public, can build confidence in effective implementation of an agreement. But for arms control treaties that do not have a standing verification organisation or effective verification mechanisms of some description,[19] it is vital that this information be made available unilaterally.

Those treaties which require states to adopt national implementation measures and/or, specifically, national legislation, also usually require states parties to provide information to each other regularly as to their compliance with these obligations. A treaty verification organisation, where one exists, is usually tasked with collating this information and even compiling comparative summaries or assessments, distributing these to states parties and/or an executive organ designated by the treaty to assess compliance.

An assessment of compliance with obligations to adopt national legislation in three major treaties, each with a different form of monitoring mechanism, follows.

It illustrates the complex relationship between the rate of adoption and quality of national legislation and the role of treaty oversight mechanisms and civil society organisations.

The 1972 Biological Weapons Convention

Article 4 of the BWC obliges states parties to adopt any necessary measures, in accordance with their constitutional processes, to implement the treaty obligations prohibiting biological weapons. States parties reached agreement at the treaty's Second Review Conference in 1986 on the importance of national legislation, along with any other appropriate national measure, to effectively prevent and suppress prohibited activity.[20] This understanding has been endorsed by successive BWC Review Conferences, along with a request for states to provide information on and the texts of legislation and other regulatory measures enacted, to the UN Department for Disarmament Affairs (UNDDA). In the absence of a treaty verification organisation, BWC states parties have also tasked the UNDDA with some secretariat functions, including the collation and distribution of a report on states parties' compliance with the treaty, prepared for each Review Conference,[21] as well as the annual confidence-building measure (CBM) reports detailing implementation activities under eight categories,[22] including legislation and other national measures.[23]

Opportunities for assessing the rate of adoption, let alone the effectiveness of legislative texts adopted, have been limited since the treaty entered into force in 1975. The information that states provide in their CBM reports is only transmitted between states parties themselves and is not made publicly available. States parties only recently initiated a review of national implementation measures, among other compliance issues, as part of the new process that emerged from agreement at the resumed session of the Fifth Review Conference in November 2002. Discussions on the adoption of national measures generally, and penal legislation specifically, were held in August 2003. While this process did not assess the effectiveness of measures adopted, it significantly increased transparency on the issue and enabled states to share their experiences.[24] Disappointingly, the November 2003 Meeting of States Parties failed to deliver recommendations on how to improve the rate of adoption of national measures or the quality of measures adopted.[25]

This review process has also spurred attempts to make BWC-related national legislation publicly available. The UN has actively requested states to provide informa-

tion on national measures relating to penal sanctions and oversight of pathogens for a CD-ROM database, which is made available only to BWC states parties.[26] The International Committee of the Red Cross (ICRC) disseminates BWC implementing legislation that it has collected on its website.[27] VERTIC has also assessed the status of national legislation in states parties, collected texts of legislation adopted, and prepared a comparative analysis of legislative provisions, all of which are available on its website.[28]

States parties have been more responsive to these initiatives than they are to the calls made prior to each Review Conference for such information to be submitted.[29] Current data indicate that 59 percent of states parties have some national legislation which may implement the treaty, while no information is available for 36 percent of states parties, implying that nearly 30 years after the treaty's entry into force a worryingly large number of states parties simply do not have BWC-related legislation in place to enforce the treaty.

The 1993 Chemical Weapons Convention

Unlike the BWC, the CWC explicitly requires states parties to adopt penal sanctions along with any other necessary measures to implement their treaty obligations.[30] Article 7 also requires states to extend the ban on treaty-prohibited activity, by both natural and legal persons, extraterritorially.[31] Other obligations requiring implementation through national legislation have been identified in guidance promulgated by the Director-General of the Organisation for the Prohibition of Chemical Weapons (OPCW), the international verification organisation established under the CWC,[32] and the OPCW's Office of the Legal Advisor.[33] While the treaty provides for states to determine what measures are necessary according to their constitutional requirements, the complexity of these obligations strongly supports the interpretation—promulgated by the OPCW and others—that the CWC is not a self-executing treaty. The treaty also requires states to co-operate with each other by providing appropriate legal assistance to facilitate the implementation of national measures.[34] The OPCW is currently developing a network of national legal experts for this purpose,[35] indicating that many states are still not in compliance with Article 7 six years after entry into force.

While Article 7 also obliges states parties to inform the OPCW of the legislative and administrative implementation measures they have taken, only 82 states parties

(54 percent) had complied with this requirement by 7 May 2003,[36] including in response to two comprehensive surveys of national measures by the organisation. States parties reaffirmed their commitment to overcome the delays in adopting legislation and to ensure that measures adopted reflected the comprehensiveness of their obligations.[37]

The existence of an international CWC verification organisation, with a standing Executive Council and annual meetings of states parties, has ensured that for that treaty, at least, any implementation assistance or expertise needed is readily identified and made available to states that request it. The OPCW has also provided information on legislative requirements and served as a repository for information on these measures, although it does not make legislative texts available publicly.

Despite the advantages that the CWC has, the rate of adoption of national implementation measures is still no higher than it is for treaties that do not have an international verification organisation or oversight body. Contributory factors may include the complexity of the legislation required and the relatively short period of time since the treaty entered into force. The ready availability of expert legal, technical and other assistance makes the traditional arguments used by states for failing to adopt such measures spurious in this case.

The 1997 Ottawa Convention

States parties are required by Article 9 of this convention to adopt penal legislation to enforce the treaty's prohibitions and facilitate the performance of an array of humanitarian mine action activities. They must also report annually on the status of their legislation, among other implementation activities, in accordance with the transparency and reporting system laid down in Article 7. States parties have agreed to make these reports publicly available to facilitate their review of implementation and assist with necessary resource mobilisation.[38]

The unique combination of treaty advocacy, resource mobilisation and treaty implementation by civil society,[39] international organisations[40] and states parties makes this the most successfully implemented and comprehensively-monitored disarmament agreement in history. The popular interest and acclaim for this treaty has also made states parties more eager to demonstrate their adherence to its humanitarian norms. The constant advocacy and ground-breaking compliance monitoring activities conducted by civil society organisations, via the Landmine

Monitor initiative of the International Campaign to Ban Landmines (ICBL), as well as the ICRC and others, has pressured states parties to fulfil their treaty obligations expeditiously in order to reduce the possibility of disparaging public reports on their non-compliance.

However, despite this wealth of attention and the relative simplicity of the treaty, the rate of adoption of national implementing legislation remains lower than that for other treaty implementation activities[41] and indeed, for other treaties. Four and a half years after the Ottawa Convention's entry into force, only 35 of 136 states parties (26 percent) have adopted specific legislation or made amendments to existing legislation, particularly penal codes.[42]

Overcoming obstacles to adopting legislation

There are several ways in which the adoption of national implementation legislation for multilateral arms control and disarmament agreements might be improved. States should, for instance, be regularly reminded of their obligations at regular meetings held under the auspices of each treaty, as well as at the annual sessions of the First Committee of the UN General Assembly which deals with all aspects of disarmament. While not all states can maintain permanent missions to the UN in New York, Geneva and Vienna, where the majority of these meetings take place, most documentation from such meetings is made available publicly on the internet. Civil society can play an important role by advocating the adoption of effective legislation, monitoring states' compliance with this requirement and publicising deficiencies. States may draw on the knowledge and expertise of specialised NGOs, which are often better informed than many governments, in fulfilling their obligations, including by holding consultations over government policy or draft legislation.[43] Closer co-operation among states parties and increased interaction between governments and civil society on treaty implementation can also assist in identifying sources of assistance and in the allocation of donor support.

Sources of assistance for drafting implementing legislation

Numerous avenues of assistance are available to states that require technical, financial, drafting or other assistance in adopting appropriate legislation to enforce treaty obligations. These include other states parties, treaty secretariats, intergovernmental organisations, and relevant international organisations and NGOs. Other states parties,

especially donor or partner governments, are often willing to provide assistance in drafting legislation on request. Démarches by donor governments promoting accession to treaties and compliance with them—including the adoption of national legislation and transparency reporting—are often successful in achieving action.

Treaties with an international verification organisation or a standing treaty secretariat will have legal personnel to advise and assist states parties with national implementation requirements, including through the preparation of manuals on national implementation. Examples are the CWC,[44] the 1996 Comprehensive Nuclear Test Ban Treaty's Provisional Technical Secretariat,[45] the International Atomic Energy Agency (IAEA)[46] and the various assistance bodies associated with the Ottawa Convention.[47] As described above, the UN's departments and specialised agencies may be requested to facilitate or provide legislative drafting assistance as appropriate.

Intergovernmental organisations outside the arms control and disarmament field also have an interest in aspects of arms control treaties and can play a role in assisting their member states to nationally implement legislation within their sphere of expertise. For example, the complexity of BWC implementation is such that, in the absence of a treaty secretariat, many intergovernmental organisations could likely assist their member states which are party to the BWC to draft treaty-related legislation. These include the Food and Agriculture Organization (FAO), the Office International des Epizooties (World Organisation for Animal Health), the World Customs Organisation and the World Health Organization (WHO). Alliance and regional organisations are regularly approached by member states for legislative drafting assistance on, among other issues, arms control agreements. These organisations include the African Union, the Caribbean Community, the Commonwealth Secretariat, the European Union and the Inter-American Committee Against Terrorism.

Other international organisations may also be able to provide specialist assistance. For example, the ICRC's Legal Advisory Service comprises a global network of legal advisers providing specialist, confidential assistance to states drafting national legislation to implement international humanitarian law, including the Ottawa Convention, the BWC and 1925 Geneva Protocol.[48]

NGOs and civil society are also a resource for legislators adopting implementation legislation. Many individuals and organisations have relevant expertise in the issues

arising from national implementation of arms control and disarmament treaties and can make useful contributions to the processes of legislative review and drafting.

Conclusion

The adoption of comprehensive and effective national legislation is crucial for facilitating states' adherence to all of their obligations under disarmament and arms control agreements. These measures are also further evidence of a state's commitment to abide by an agreement and take all action necessary to prevent and suppress prohibited activity from occurring on its territory.

Analysis of the rate of adoption and effectiveness of national implementing legislation for some key arms agreements to date indicates the large number of states in non-compliance with their legal obligations. This is true of most states in Africa, Asia and Latin America. It illustrates the importance of having a standing body to promote the requirement to adopt legislation, issue guidance on which treaty provisions require legislation, collate and disseminate the texts of legislation and provide assistance. These bodies can act as a clearing-house for information on treaty implementation, as the Ottawa Convention's Implementation Support Unit does;[49] as a source of technical assistance in the adoption of necessary legislation, such as the OPCW's Office of the Legal Advisor for the CWC and the ICRC for national implementation of international humanitarian law; and as a repository of information on national implementation measures like the UNDDA for the BWC.

The existence of legislation repositories and technical assistance cannot, however, entirely overcome a lack of awareness of treaty obligations and certainly cannot redress the lack of capacity to fully implement legislation once it is passed. States should ideally address these needs during treaty negotiations, especially by establishing vigorous multilateral mechanisms to ensure that appropriate international attention and resources are devoted to national implementation.

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Endnotes

[1] Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction. The treaty was opened for signature on 10 April 1972 and entered into force on 26 March 1975.

[2] Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction. The treaty was opened for signature on 13 January 1993 and entered into force on 29 April 1997.

[3] Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-personnel Mines and on their Destruction. The treaty was opened for signature on 3 December 1997 and entered into force on 1 March 1999.

[4] Some treaties specifically require such extension, for example, Article 4 of the BWC.

[5] See www.australiagroup.net.

[6] Ratification demonstrates the state's intention to be bound by a treaty after it has signed it, while accession and approval are one-step processes for acceding to a treaty. In the interim period between signature and ratification, a signatory state is obliged not to carry out activity contrary to the purpose and object of the treaty; Article 18, 1969 Vienna Convention on the Law of Treaties.

[7] Article 27, 1969 Vienna Convention on the Law of Treaties.

[8] For an excellent discussion of the relationship between international law and national law see Anthony Aust, *Modern Treaty Law and Practice*, Cambridge University Press, Cambridge, 2000.

[9] Such as those treaties requiring the performance of specific activities in the state which would otherwise be illegal. For example, the Ottawa Convention provides for fact-finding missions to be granted specific rights of access in states parties' territory which might contravene national laws restricting access to private property.

[10] For example, while one official of a BWC state party maintains that their state does not require national implementing legislation under its constitution, the state has in fact adopted at least three measures to implement aspects of the treaty.

[11] For example, Article 4 of the BWC; Article 9 of the Ottawa Convention; and Article 7 of the CWC.

[12] For example, Article 9 of the Ottawa Convention.

[13] For example, Article 7(4) of the CWC.

[14] For example, the New Zealand Nuclear Free Zone, Disarmament and Arms Control Act 1987 [New Zealand] implements four nuclear treaties as well as the BWC.

[15] MASA is the South African affiliate of the International Campaign to Ban Landmines. The Anti-Personnel Mines Prohibition Act 2003 [South Africa] incorporated many suggestions from the public consultation process. See International Campaign to Ban Landmines, *Landmine Monitor Report 2003,* Human Rights Watch, Washington, DC, 2003, p. 430.

[16] Much assistance has been made available to help small states to enact legislation to combat terrorism and its financing, as required by UN Security Council Resolution 1373 of 28 September 2001. States have been threatened with trade sanctions from major trading partners if they did not adopt such legislation.

[17] For example, the 1992 Convention on Biological Diversity, which assists in the protection of natural resources, has comprehensive mechanisms available, co-ordinated through its secretariat, for providing a range of implementation assistance to states parties. Effective implementation of the 1982 UN Convention on the Law of the Sea enables small island states to derive economic benefit by granting licences to foreign fishers within their exclusive economic zone, if they have claimed one.

[18] However, the use of specialist, pro-bono legal advisors—such as the Legal Advisory Service of the International Committee of the Red Cross (ICRC)—is to be encouraged for states which might otherwise not adopt implementing legislation.

[19] Such as the BWC and 2002 Strategic Offensive Reductions Treaty (SORT).
[20] BWC Second Review Conference Final Declaration, BWC/CONF.II/13/II, 26 September 1986. See www.opbw.org.
[21] UNDDA compiles and publishes states parties' compliance reports as public Review Conference documents.
[22] The UNDDA prepares a background document on states parties' participation in CBM reporting which indicates which states have reported new or amended information under each form. These are the only public reports of the CBM reporting process, yet they do not indicate any substantive information provided by states parties. In fact, many states' reports on compliance to Review Conferences mirror their CBM reports, whether this is done for consistency, in the interests of transparency or perhaps out of complacency.
[23] Form E 'Declaration of legislation, regulations and other measures'.
[24] See chapter by Jez Littlewood in this volume.
[25] See Final Report, Meeting of States Parties to the Biological Weapons Convention, BWC/MSP/2003/4, 14 November 2003.
[26] It is entitled 'BWC Information Repository'.
[27] Database of National Implementation of International Humanitarian Law; see www.icrc.org.
[28] See VERTIC, *Time to Lay Down the Law: National Legislation to Enforce the BWC,* The Verification Research, Training and Information Centre, London, August 2003, available at www.vertic.org; and the 'Biological Weapons Convention: Collection of national legislation' dataset at www.vertic.org.
[29] Twenty-three per cent of states parties responded to VERTIC's request for information. In addition, VERTIC collected information from open sources, to make information on the status of legislation available for a total of 63 percent of states parties.
[30] Article 7(1)(a) of the CWC.
[31] Article 7(1)(c) of the CWC.
[32] Organisation for the Prohibition of Chemical Weapons, 'Note by the Director-General. Compliance with Article VII: legislation, cooperation and legal assistance', Conference of the States Parties document, C-III/DG.1/Rev.1, 17 November 1998.
[33] Organisation for the Prohibition of Chemical Weapons, Office of the Deputy Director-General, 'General obligations under the Chemical Weapons Convention and related tasks', S/246/2001, 15 March 2001.
[34] Article 7(2), CWC. This obligation is understood to apply to 'states in a position to' provide legislative assistance, with states parties seemingly having to be repeatedly encouraged to consider rendering it. See Conference of the States Parties decision C-V/DEC.20, 19 May 2000, available at www.opcw.org.
[35] Organisation for the Prohibition of Chemical Weapons, Office of the Legal Adviser and International Cooperation and Assistance Division, 'Note by the Technical Secretariat. Legal technical assistance: network of legal experts', S/363/2003, 28 May 2003.
[36] Organisation for the Prohibition of Chemical Weapons, Office of the Legal Adviser and International Cooperation and Assistance Division, 'Note by the Technical Secretariat. Legal technical assistance: network of legal experts', S/363/2003, 28 May 2003.
[37] 'Committee of the Whole: Report to the First Special Session of the Conference of the States Parties to review the operation of the Chemical Weapons Convention. Annex 1. Draft Political Declaration', RC-1/COW.1, 9 May 2003.
[38] This was agreed at the First Meeting of States Parties, held on 3–7 May 1999, in Maputo, Mozambique. These reports are collated and published by the UNDDA at http://disarmament.un.org/MineBan.nsf.
[39] Particularly by the International Campaign to Ban Landmines (ICBL), which was instrumental in the treaty's inception, negotiation and adoption. The ICBL's Landmine Monitor initiative monitors the implementation of the norm against landmines globally. See www.icbl.org and www.icbl.org/lm, respectively.
[40] In particular, the UN (especially the UN Mine Action Service) and the Geneva International Centre for Humanitarian Demining, which houses the Ottawa Convention Implementation Support Unit.

[41] For example, 86 percent of Ottawa Convention states parties have provided their initial Article 7 transparency report to the UNDDA, an unprecedented reporting rate for a disarmament agreement.
[42] Intervention of the International Committee of the Red Cross, Agenda Item #13, Article 9 discussion, Thursday, 18th September 2003, Fifth Meeting of States Parties to the Ottawa Convention, Bangkok, Thailand. See www.gichd.ch. At least 13 other states parties consider existing legislation sufficient to give effect to the treaty.
[43] For example, the public consultation process on the Anti-Personnel Mines Prohibition Bill in South Africa. See note 15.
[44] The Organisation for the Prohibition of Chemical Weapons, based in The Hague, Netherlands. See www.opcw.org.
[45] The Preparatory Commission for the Comprehensive Nuclear Test Ban Treaty Organization. See www.ctbto.org.
[46] See www.iaea.org/worldatom.
[47] The Implementation Support Unit of the Geneva International Centre for Humanitarian Demining. See www.gichd.ch. The establishment of the Implementation Support Unit was endorsed by Ottawa Convention states parties at the 3rd Meeting of States Parties, held on 18–21 September 2001 in Managua, Nicaragua. The unit is funded voluntarily by donor states parties and is housed in the Geneva International Centre for Humanitarian Demining in Geneva, Switzerland. The unit supports the work of an Intersessional Standing Committee meeting process, Coordinating Committee and President of the Meeting of States Parties. See 'Implementation support for the Convention on the Prohibition of Anti-Personnel Mines', APLC/MSP.3/2001/L.6, 21 September 2001, at www.gichd.ch; and Angela Woodward, 'Verifying the Ottawa Convention' in Trevor Findlay and Oliver Meier (eds), *Verification Yearbook 2001,* The Verification Research, Training and Information Centre (VERTIC), London, 2001, pp. 104–105.
[48] The 1925 Geneva Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare.
[49] See note 47.

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'Demonstrable progress' on climate change: prospects and possibilities

Molly Anderson

It is well known that developing a verification regime is as much a political exercise as it is a technical one. This has been evident in the negotiations on 'demonstrable progress' under the 1997 Kyoto Protocol to the 1992 United Nations Framework Convention on Climate Change (UNFCCC).[1] The concept emerged in response to broken promises, particularly the failure of the UNFCCC itself to achieve its goal of 'returning global greenhouse gas emissions to 1990 levels' by 2000.[2] Immediately after the convention was adopted, it became clear that emissions in most developed countries were far from stabilising; in fact, they were rising rapidly.[3] As a result, the Intergovernmental Panel on Climate Change (IPCC) called for even tougher action to reduce emissions levels. Thus began negotiation of the Kyoto Protocol.[4] The eventual deal committed developed countries to an overall emissions reduction level of 5.2 percent below 1990 levels by 2008–12 for a 'basket' of six greenhouse gases (GHGs).[5] This total was divided into individual, unequal targets for each Annex 1 (developed)[6] country in accordance with the principle of 'common but differentiated responsibilities and respective capabilities',[7] which is enshrined in the convention.

This principle is fundamental to the climate change negotiations. First, it acknowledges the historic role that industrialised countries have played in creating the climate change problem and it places the greatest burden on them to rectify it. Second, it takes into account the financial gap between rich and poor nations and recognises that global efforts to reduce GHG emissions should not be at the expense of development in the Third World. Taken together, there is an expectation—certainly among poorer countries—that the rich, industrialised world should take the lead in the global battle to mitigate and adapt to the effects of climate change. While, in theory, developed countries accept this role, so far, they have collectively

failed to live up to their declarations. Not meeting their emissions reduction commitments under the UNFCCC is one thing, but it is also questionable whether they are fulfilling their other obligations to provide financial support and technology transfers to developing states to help them adjust to climate change.[8]

When negotiations on the Kyoto Protocol started at the First Conference of the Parties (COP1) to the UNFCCC in Berlin, Germany, in March 1995, participants were talking about a five-year compliance (or commitment) period, beginning in 2008, 13 years in the future. Due to the periodicity of reporting,[9] a final assessment of compliance would only be available in 2015, 20 years hence. Given the atmosphere of mistrust that had emerged, developing countries were concerned that this was another attempt by developed nations to shirk their responsibilities and to delay taking action. This prompted them to push for an interim measure of progress to gauge whether developed countries were on course to meet their emissions reduction obligations. This concept was finally adopted in Article 3 of the accord, which states that 'each party included in Annex I (developed) shall by 2005 have made demonstrable progress in achieving its commitments under this Protocol'.[10] What is notable is the strength of this commitment. The use of the word 'shall' gives the article teeth, although, as will be seen below, lack of an implementation mechanism is likely to prove problematic.

The role of demonstrable progress

The *Verification Yearbook 2002*[11] provides a complete description of the protocol's verification provisions, setting this chapter in context. Demonstrable progress serves a number of important roles within this verification regime—as well as reassuring developing countries that industrialised nations are finally committed to taking action in the medium term. First, as a means of assessing progress in 2005, it will serve as an 'early warning system' for states not acting quickly or radically enough to meet their emissions reduction commitments in 2008–12. It will allow time for each country to introduce additional domestic measures and to take advantage of the protocol's so-called flexible mechanisms: international emissions trading (IET); joint implementation (JI); and the clean development mechanism (CDM).

International emissions trading will allow parties to buy carbon allowances to offset their own emissions from those countries that have exceeded their commit-

ments by making further reductions. Under the JI mechanism, states can earn extra allowances by implementing emissions reduction projects in other Annex I states. Alternatively, the CDM permits nations to claim allowances for projects that they have established in developing countries. The combined use of the flexible mechanisms must be 'supplemental to domestic action',[12] limiting the extent to which parties can use them to meet any shortfall in relation to their own emissions reduction obligations under the protocol.

Second, demonstrable progress will help to build trust between Annex I parties, reassuring them, even prior to the start of the commitment period, that there are no 'free riders' and that the burdens of the protocol are being shared equitably. This takes on particular significance in view of the economic implications of implementation. Even though it is unlikely to amount to a significant proportion of a country's gross domestic product (GDP),[13] the implementation of measures to achieve domestic emissions reductions will not be without cost. Each state needs to feel confident that it is not putting itself at a disadvantage in the global market by meeting its obligations while others are not.

Finally, the process will benefit all parties by providing a forum in which exchange information and to establish 'best practice'. Each country will need to examine its position and develop an integrated set of policies and approaches to satisfy its treaty commitments. By sharing methodologies and lessons, more advanced countries can impart the benefits of their experience to less advanced ones, thereby raising the general standard of implementation. Demonstrable progress will also give parties an opportunity to test their national systems and legislation, which will be mandatory once the first commitment period begins in 2008. The protocol is unique among multilateral environmental agreements and contains many innovative and untested elements, particularly in relation to its verification regime. A period of 'learning by doing' will be important for ironing out unforeseen problems and for engendering a co-operative approach to resolving differences in interpretation—before implementation questions are dealt with under formal compliance procedures.

The current status of demonstrable progress

The adoption of the Kyoto Protocol in 1997 in fact marked only the start of more protracted negotiations on the details of implementation. The protocol provided

only a framework, which needed to be 'fleshed out' before key countries would consider ratifying it. Agreement was finally reached at COP7, held in Marrakech, Morocco, from 29 October–10 November 2001. The Marrakech Accords are regarded as a comprehensive rulebook for implementation of the protocol. Agreement was only achieved, however, after the US withdrew from the talks in October 2000, claiming that it could not ratify a treaty that excluded the mounting emissions of the developing world. This was a major blow to the international climate change regime, given that, in 1998, the US emitted 5.8 billion tonnes of carbon dioxide equivalent into the atmosphere, almost 40 percent of the emissions of the industrialised world.[14] Worse still, the US emits 21.1 tonnes of carbon dioxide equivalent per head of population, compared to the European average of 10.3 tonnes and 1.1 tonnes in India.[15] In contrast to the European Union (EU), US emissions are still rising sharply. Clearly, without the US being a party to the protocol, only half of the climate change problem is being addressed. But, as many leaders have pointed out, it is currently the 'only game in town'.[16] There are hopes that the US can be persuaded to return to the negotiations in a future commitment period.

Following agreement on the Marrakech Accords, a series of key ratifications occurred, including that of the EU in August 2002. To enter into force, though, the protocol needs to be ratified by 55 parties to the UNFCCC, including those Annex I countries that, collectively, were responsible for producing at least 55 percent of total Annex I country emissions in 1990. As of mid-November 2003, 119 parties had submitted their instruments of ratification, including 32 Annex I states that, together, accounted for 44.2 percent of the emissions of industrialised nations in 1990. The world is now waiting on Russia—which was responsible for 17.5 percent of the emissions of Annex I countries in 1990—to finalise its domestic processes for ratification. Russia alone could trigger entry into force of the protocol. President Vladimir Putin announced in April 2002 that Russia was preparing to ratify the treaty, but there have since been conflicting statements from other ministers and officials. Latest reports suggest that Russia has completed its domestic processes for ratification,[17] although this could be yet another smokescreen. After eight long years of negotiation, the delay to ratification is extremely frustrating.

And it is bad news, too, for demonstrable progress. With uncertainly still clouding the matter of implementation, it is difficult, politically, to remind parties of their

promise to achieve demonstrable progress in less than two years. First, it is not a binding obligation until the accord enters into force. Second, it is likely to make an already jittery country like Russia have second thoughts about its ability to meet its obligations and hence to delay further its ratification. Yet, in order to have the time to gather and collate the information necessary to demonstrate progress—assuming that there has been some—countries need to start now. Since the Kyoto text was adopted, the Umbrella Group[18] has largely undermined the original concept of demonstrable progress, decoupling it entirely from the assessment of compliance. Developing countries have endeavoured to make it a more rigorous exercise, censuring those states that have not made satisfactory progress towards meeting their targets. However, they lacked the negotiating power to challenge the Umbrella Group, whose members were able to use their future ratifications as leverage.

For this reason, Article 7 of the Marrakech Accords only 'urges each party to submit a report by 1 January 2006 for the purpose of reviewing demonstrable progress'.[19] The non-mandatory nature of this submission is likely to render it not very meaningful. Despite being enshrined in the treaty, demonstrable progress has, over time, become so watered-down as to be in serious jeopardy of not meeting its original objectives and of becoming a mere paper exercise. This spells danger for the climate change regime, particularly at a moment when its future is in the balance.

The remainder of this chapter looks at the guidance offered to parties preparing their reports on demonstrable progress and the process for evaluating these submissions. And it discusses the roles that different stakeholders can play to resurrect this important provision and to make it a meaningful exercise that could underpin the future success of the climate change regime.

The report on demonstrable progress

The Article 7 decision of the Marrakech Accords determines that the following information should be in each country's report on demonstrable progress.

- (a) Policies and measures (PAMs) that have been implemented and the legal or institutional steps that have been taken to meet emissions reduction targets.
- (b) Trends in, and projections of, GHG emissions.
- (c) Details on how those PAMs that have been implemented will contribute to meeting emissions reduction commitments.

- (d) Activities and programmes undertaken to promote technology transfers to, and capacity building in, developing countries.

However, the accords offer no guidance to help parties prepare such reports. With this in mind, COP7 requested that the Subsidiary Body for Scientific and Technological Advice (SBSTA) consider how the information should be 'presented and evaluated'. Having a common structure for the reports will facilitate comparative analysis.

The guidance was eventually agreed at COP8, which took place in New Delhi, India, from 23 October–1 November 2002. It will be formally adopted at the First Meeting of the Parties (MOP), which will be held in conjunction with the first COP after the protocol enters into force.[20] It requires that parties prepare their report on demonstrable progress 'as a single document including four chapters',[21] containing the information listed above. The information should be consistent with the party's fourth national communication, which is due, according to the UNFCCC, between November 2004 and November 2006, in accordance with a COP decision.[22] Given that the signatories to the convention and its protocol are not identical—most notably, the US is a party to the UNFCCC but refuses to sign the protocol—and that, under the protocol, parties have assumed additional obligations, it makes sense that these reports are prepared and submitted separately. Yet, since both reports require much of the same information, it seems sensible that, in preparing them, parties follow the format and guidelines for the preparation of national communications.[23] Where this guidance is insufficient for reporting on protocol issues, parties are directed to use the guidance developed under Article 7 of the protocol.[24] This will be necessary when reporting on:

- legal and institutional activities related to the protocol;
- the enhancement of sinks activities;
- actions relating to the flexible mechanisms; and
- financial resources and technology transfers.

The UNFCCC reporting guidelines were last revised as a whole[25] at COP5, held in Bonn, Germany, in October 1999, and are divided into two distinct parts. The first part relates to the preparation of annual inventories, including a set of tables—

the common reporting format. The second part concerns all other obligations under the convention. It is the latter that contains information relevant to the preparation of most of the reports on demonstrable progress.

Policies and measures

Under item (a) above, parties are required to report on the policies that they have introduced and the measures that they have taken to limit or reduce their GHG emissions. They are expected to include the same information in their national communications. This makes it likely that they will compile both reports along the lines set out in the UNFCCC guidelines.

In accordance with these guidelines, parties are not required to list every PAM, since they are likely to be numerous. Instead, they 'should give priority to [reporting on] policies and measures, or combinations of policies and measures, which have the most significant impact in affecting GHG emissions and removals and may also indicate those which are innovative and/or effectively replicable by other Parties'.[26] This clause balances the need for the report to provide evidence of real or projected emissions reductions, and its role in exchanging information between parties and laying the foundation for best practice.

Furthermore, the guidelines state that the reduction of GHGs need not necessarily be the 'primary objective' of the selected PAMs, and that the report can include initiatives that 'are planned, adopted and/or implemented by governments at the national, state, provincial, regional and local level'.[27] Parties are asked to include descriptions of their selected Policies and Measures and to summarise them in separate tables for each sector, employing the common format,[28] with columns on the following:

- affected greenhouse gas or gases;
- kind of instrument (economic, fiscal, voluntary/negotiated agreement, regulatory, information, education, research or other);
- status of implementation (planned, adopted or operational);
- the implementing entity;
- impact of the policy, or collection of policies, including a quantitative estimate of emissions reductions by year;
- cost of implementation;

- non-GHG mitigation benefits (on health or emissions reductions of other pollutants, for example); and
- interaction of the policy with others at the national level.

There are difficulties associated with assessing the potential effects of PAMs or with evaluating their effect during and after implementation. The success or failure of a policy is inherently subjective and can depend on a wide range of factors. Attempts to model the impact of a policy must rely on a number of assumptions, including anticipating the behaviour of populations, the interaction of the policy with other instruments, and trends in domestic and world markets. For this reason, predictions are peppered with uncertainty. Further complications arise if parties employ different models and underlying assumptions to make predictions for their basket of PAMs. Since COP4, held in Buenos Aires, Argentina, in November 1998, parties have discussed 'good practices' in regard to PAMs. At COP7, such discussion resulted in the adoption of a decision that mandated the SBSTA to establish a work programme designed to improve the transparency, effectiveness and comparability of PAMs. It also requested that further options for co-operation be identified in order to enhance the individual and combined effectiveness of PAMs.[29] This work should support parties as they prepare their reports on demonstrable progress.

In addition to the description of PAMs, parties are asked to supply information in their report on demonstrable progress on legal or institutional steps that have been taken to implement the protocol. This should include domestic mechanisms for adopting an integrated climate change strategy. Part of this will be the mandatory establishment, under Article 5.1 of the protocol, of a 'national system for the estimation of anthropogenic emissions by sources and removals by sinks of all greenhouse gases'.[30] Where a country plans to take advantage of the flexible mechanisms, it will also need to establish a national registry for tracking and accounting for its assigned amount.[31] This data clearly will be in addition to that provided in the national communication. Parties will have to refer, therefore, to the Article 7 reporting guidelines.

National system

A national system comprises all of the 'institutional, legal and procedural arrangements' for preparing an inventory. The reporting guidance is designed to demonstrate

that parties have followed the framework for the establishment of national systems developed under Article 5.1.[32] By 2005, parties should be making significant progress towards setting up a national system, which should include appointing a single responsible entity and ensuring that it has sufficient capacity to meet its obligations under the protocol. The system will be subject to an in-depth evaluation during a party's pre-commitment review in 2007, making the report on demonstrable progress a good opportunity to take stock and to remedy any unfulfilled aspects. This will also be a chance to test the functionality of the system, as emissions data will form the basis of much of the information in the report.

The Article 7 guidelines require that each party describe its national system, outlining the processes that guarantee the reporting of 'consistent, transparent, comparable, accurate and complete'[33] information. It should include the following elements:

- the name and contact details of the national entity;
- the roles and responsibilities of other agencies involved in the preparation of the inventory—as well as the institutional, legal and procedural arrangements to formalise them;
- a description of the processes for collecting activity data and emissions factors, identifying key emission sources, and recalculating previously submitted inventory estimates where new data or methodologies have become available;
- a description of the procedures for ensuring the quality of the inventory and the mechanisms for reviewing these over time; and
- a description of the approval and sign-off procedures for the inventory before submission to the UNFCCC Secretariat.

Since the report on demonstrable progress is due two years before the national system has to be finalised, it seems sensible that parties report on the status of these elements under the same categories. They should also make clear what efforts are being made to implement unfulfilled elements of, and improvements to, their system.

National registries

As with national systems, parties will need to describe the progress that they have made in establishing a national registry. This will act like a bank, with accounts for holding, retiring and cancelling tradeable emissions allowances, or 'units',[34] under the flexible mechanisms. The Marrakech Accords stipulate that the registry

should take the form of a 'standardised electronic database'. Work continues under the auspices of the SBSTA to develop the technical standards necessary to ensure the 'accurate, transparent and efficient exchange of data' between them.

Due to late-night brinkmanship at COP7 over the rules for the flexible mechanisms and accounting for assigned amounts, there was no time to finalise the Article 7 reporting guidelines for national registries. Instead, these were forwarded to COP8 for elaboration. The resulting guidance sets out the information that parties should report annually in their registries. Again, with the report on demonstrable progress due prior to the deadline for establishing a registry, parties should provide a status report on their efforts to satisfy registry requirements. Obviously, it will not be possible at that stage to provide details of unit serial numbers or lists of transactions, as will be required later. At a minimum, though, parties should be able to name a responsible entity, outline an implementation plan and provide details of how they expect to meet the technical standards essential for the system's effective operation.

Emission trends and projections

In order to demonstrate (c) above, parties are required to establish a baseline trend for domestic GHG emissions and to calculate projections based on various domestic policy scenarios. In particular, this exercise is designed to evaluate the effect of the PAMS outlined in (a), as well as to explore how additional measures could generate alternative future emissions paths. Information of this nature is also required in national communications. Under the protocol, however, there are other ways in which a party can meet its emissions reduction target, including through the flexible mechanisms and the enhancement of natural sinks. Nevertheless, the UNFCCC reporting guidelines provide extensive instructions on how this data should be presented. What they do not do, though, is provide instruction on the use or development of projection methods.

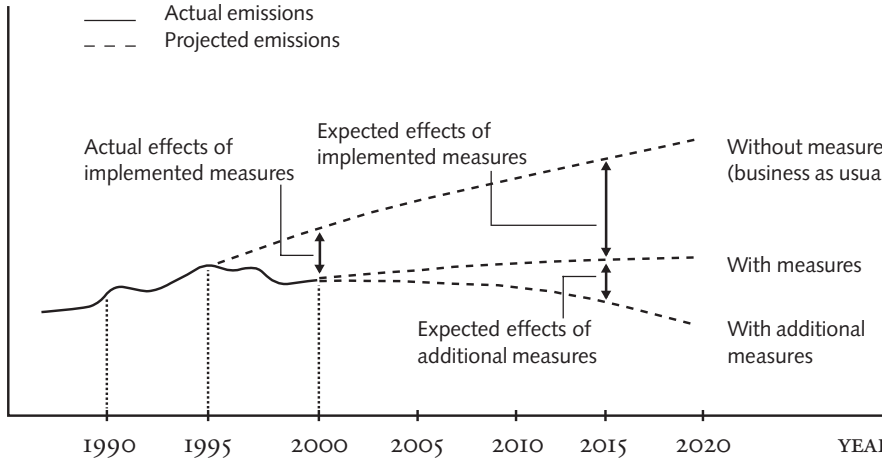
UNFCCC guidance requires that parties, as a minimum, make a projection of their 'with measures' emissions until 2020, as compared with their actual emissions recorded in national inventories since 1990. Parties are also encouraged to make projections of emissions 'without measures' (business as usual) and 'with additional measures'.[35] This process should be undertaken for each gas and provided in an aggregated format for each sector. The results are to be presented in graphical form (see figure 1). On the basis of the projections, the party should offer predictions

of emissions levels for each sector and for each gas in 2005, 2010, 2015 and 2020. Finally, parties should include total estimates of 'emissions avoided or sequestered' for each five-year period between 1990 and 2020—either by taking the difference between the 'with measures' and 'without measures' projections or by combining the results and predicted results of each PAM.

Given how dependent projections are on the methodology used to calculate them, significant emphasis is placed in the guidance on explaining the methods and the assumptions underlying the projections and the uncertainties associated with the approach that is employed. This is essential to making sure that reporting is transparent and that enough information has been provided to permit substantive and comparative judgements to be made on the methods used and the assumptions made.

By aggregating the information gathered and collated for sections (a) and (b) of the report on demonstrable progress, parties will be in a position to examine the impact of their climate change programmes. Under (c), parties are required to carry out an assessment of the contribution that domestic policies and measures will make in meeting their obligations under the protocol. By implication, they should provide an explanation of how any deficit will be made up through alternative means.

Figure 1 **Graphical representation of a party's actual and projected emissions for one sector or gas**



Financial resources and technology transfers

Under Articles 10 and 11 of the Kyoto Protocol, Annex I parties are required to help poorer nations adapt to and mitigate climate change through the provision of financial resources and technology transfers. They are obligated to report on them in their reports on demonstrable progress. However, they are already required to promote financial and technology transfers to developing countries under Article 4 of the UNFCCC and to report on these efforts in their national communications. One way of meeting the requirements of these articles is by contributing to the Global Environment Facility—the official financial mechanism for the UNFCCC and other United Nations (UN) environmental agreements—which was set up by the UN in 1991. Under the protocol, though, three new funds have been established. The Least Developed Countries Fund has been set up to help identify priority action that is required in the poorest UN member states. The Special Climate Change Fund will assist a wider group of developing countries with implementing adaptation and mitigation measures. Finally, the Kyoto Protocol Adaptation Fund, financed through a levy on the CDM, is designed to support specific adaptation projects and programmes in developing countries that are also parties to the protocol.

UNFCCC guidance on reporting on these financing efforts can easily be extended to cover additional funds and mechanisms under the protocol. Parties are asked to complete a table showing the resources that they have provided to various funds and institutions each year to promote climate change activities and programmes in developing countries. The three Kyoto funds should be added to this. The guidelines state that parties should only include in the table 'new and additional' financial resources and should clarify how this status has been determined in order to avoid double counting. Further tables are provided for reporting information on resources imparted through bilateral, regional and other multilateral channels. This may be particularly relevant to EU members, for example.

A similar approach is pursued in relation to reporting on technology transfers. A pro forma is provided in the UNFCCC national communications reporting guidelines for countries to supply information on projects or programmes that facilitate or finance the transfer of environmentally sound technologies. This includes a description of the activity, an evaluation of its success rate, and an estimation of its impact on GHG emissions.

Evaluation of reports

Parties agreed at COP8 that reports on demonstrable progress would be 'evaluated along with the national communication submitted after entry into force of the Kyoto Protocol'. For most Annex I parties this will be their fourth national communication. An expert review team (ERT) will be assigned to appraise each party's submission, including via an in-country visit. The ERT's assessment of the report on demonstrable progress will be included in its review report. In addition, the UNFCCC Secretariat has been asked to prepare a synthesis document containing information from all parties' submissions. The Subsidiary Body on Implementation (SBI) will consider this document in making recommendations to the COP/MOP.

While this process could provide a meaningful assessment of parties' efforts to meet their obligations under the treaty, it is unlikely to do so. Unless there is a renaissance in relation to political support for demonstrable progress, only developing countries and environmental non-governmental organisations (NGOs) will press for it to be awarded a high profile in 2006. Concerns about censure, the failure of key countries to tackle rising emissions levels, and lack of capacity in states with economies in transition[36] provide some explanation for this. It is unlikely that any country will be willing to criticise another in a public forum when its own report is also being scrutinised. This is already the case with national communications under the UNFCCC. Consequently, should proponents of demonstrable progress accept that they have lost the battle? Perhaps not quite yet, although the situation is not very promising.

The role of parties

By not pushing for each country to be individually held to account, and by promoting the 'softer' objectives of information exchange and confidence building, it may be possible to re-engage parties more effectively. Parties should be able to use the process as a way of taking stock of their institutional, legislative and programmatic measures for implementing effective climate change policies. The reporting exercise can help to push climate change up the national and international political agenda and to stimulate the provision of new resources, nationally and internationally.

The chance to 'test' systems and policies and to practice using the reporting guidelines should not be underestimated. While many countries already report in accordance with the convention's requirements, there are many that have yet

to submit national communications or annual reports. This is particularly true of states with economies in transition. Even in situations where annual reports have been filed, they are often incomplete, lack transparency, or are not in the common reporting format (adopted at COP5).[37] This is often due to countries not having the methodological, institutional and financial capacities to meet their obligations. In Portugal, for example, only two members of staff are dedicated to the preparation of an inventory covering seven sectors, ranging from the supply of energy to agricultural processes.

Given this lack of capacity, work should be conducted to simplify the reporting process as far as possible and to make available the tools for assessing the impact of PAMs and for making emissions projections. The fact that parties need to seek appropriate guidance from at least two separate sources, neither of which has been specifically created for the purpose of reporting on demonstrable progress, leaves them uncertain. A consistent, transparent and comparable set of submissions would make evaluation easier. Some of the necessary methodological work could be carried out under the SBSTA programme on 'good practices' in regard to policies and measures, while the Secretariat or an independent organisation would be best placed to produce a guide for parties on the preparation of reports on demonstrable progress. This document could consolidate the guidance that parties are required to follow, taking them through the process step-by-step, emphasising openness and good reporting practice.

The role of the Secretariat

The UNFCCC Secretariat is tasked with providing substantive support to parties in meeting their reporting obligations under the convention and the protocol. It is also responsible for co-ordinating and supporting the work of the ERTs. It has experienced and knowledgeable members of staff who are able to advise parties on the preparation of their reports and promote the exchange of information and the development of best practice. There is, however, a feeling in some corners of the Secretariat that demonstrable progress is a 'hot potato' due to the subjective nature of much of the data that is likely to be in the reports and because of the political concerns of parties about their reports being used to judge them. Yet, it is important that the Secretariat not let demonstrable progress be swept under the carpet or shy away from the practical and political problems that will be associated with it.

Given that demonstrable progress is mandatory, the Secretariat should more actively encourage early action by parties. The resources available to parties engaged in other reporting tasks under the protocol should also be accessible to those preparing reports on demonstrable progress. One idea is to find a country that is willing to fund workshops to assist parties in submitting their reports. More advanced nations could share the benefits of their experiences with those encountering problems.

In any event, as noted above, the COP has mandated the Secretariat to compile a synthesis report of parties' submissions in 2006. While it will not name names, it can still provide valuable information on collective progress towards meeting Kyoto targets. First, it can provide a communal assessment of global emissions between 1990 and 2005 and attempt to issue a forecast of emissions levels at the end of the first commitment period in 2012. Second, it can analyse the effectiveness of the PAMs being undertaken by parties and evaluate whether the methodologies employed to calculate emissions projections are valid. Some judgement should also be made on whether additional measures are required to meet Kyoto targets. This type of analysis will provide credible information on which the SBI can make recommendations to the COP.

The role of NGOs

A high standard of reporting by parties will also facilitate the involvement of other groups in the evaluation process. NGOs have traditionally played a significant role in monitoring the implementation of environmental treaties by states parties.[38] In the absence of a rigorous process to review and verify submissions on demonstrable progress, NGOs should look to fill the gap and to conduct their own independent analysis. This could form the basis of lobbying campaigns to exert pressure on non-compliant countries and could be used to influence the evolution of the climate change regime. It is not coincidental that negotiations on targets for a second commitment period are due to begin in 2005. Parties anticipated that their reports on demonstrable progress would inform the adoption of new targets for the period between 2012 and 2017.

Political implications of demonstrable progress

The implications of demonstrable progress extend beyond a simple judgement on whether Annex I parties will meet their Kyoto targets. The future of the protocol

is likely to depend on whether they can show that they are providing a lead in combating climate change. Initial discussions at COP8 indicated significant differences of opinion between developed and developing countries on the shape of future commitments.[39] The industrialised nations believe that the richer developing states should join them in adopting some form[40] of target to avoid run-away increases in emissions due to the rapid growth of their economies. They also expect a rising number of developing countries to take on other commitments, such as regular reporting. Developing states, represented by the Group of 77 (G77) and China, are strongly resisting these pressures, arguing that Annex I nations have yet to demonstrate real emissions reductions in proportion to their historical responsibility for climate change. This is likely to result in a major impasse in the negotiations before too long.

Demonstrable progress would be one way of highlighting, in a verifiable manner, the actions of Annex I parties and setting them on an emissions path that would reassure G77 members. However, it will be hard to satisfy the group as a whole, given substantial differences in regard to the national interests of its members. Clearly, the larger economies of China and India should take on burdens much earlier than the Pacific island states. But this makes it even more important to build trust between developed and developing countries. Without this, the poorest nations will continue to negotiate as part of the G77, rather than forming alliances with other negotiating bodies that might better serve their interests. Instead of seeking to achieve their goal of bringing key non-Annex I parties into the regime through diplomacy alone, Annex I countries should take note of the adage that 'actions speak louder than words'. Meeting their targets and fulfilling their financial obligations is the surest way of bringing other nations onboard. That is what demonstrable progress is all about.

Undoubtedly, the problem of the US is uppermost in the minds of parties as they negotiate the future of the climate change regime. If the US remains outside the protocol there will be no binding limits on its emissions, a lacuna that substantially undermines the effectiveness of the instrument. While it is admirable that other countries have opted to proceed without the US, it is, nevertheless, important that efforts continue to integrate it into the process as soon as practicable. Demonstrable progress could help to achieve this objective in two ways. First, the

administration of US President George W. Bush is likely to draw confidence from the results of the reporting exercise, seeing that other countries have been able to implement PAMs without imposing economic disadvantages on their commercial sectors. Furthermore, the submission and evaluation of parties' reports could demonstrate that the protocol's mechanisms are functioning and are able to prevent rogue nations from 'free riding'.

Second, an interim assessment of progress will allow for a comparison to be made with the climate change activities being carried out at the state level in the US. Despite the attitude of the Bush administration, many states are implementing tough policies to reduce emissions. One of the more progressive states is California: given its extensive coastline, climate change is accorded a high priority. The state government has undertaken a wide range of measures, from setting efficiency standards for motor vehicles[41] to implementing a registry for reporting industrial emissions inventories.[42] Enabling comparisons to be made between countries inside the Kyoto framework and those operating outside of it could establish new lines of communication and thus break down the preconceptions of each constituency. Over the longer term, it is to be hoped that all countries can work within the same international regime.

Conclusion

Demonstrable progress has the potential to fulfil a number of roles in the Kyoto process. Yet, the political context in which parties are preparing their reports means that it will be difficult for it to deliver. This will not only amount to a missed opportunity, but it also threatens to undermine seriously what is already a vulnerable treaty. With Russia's ratification still not guaranteed, there is growing concern that the protocol may not enter into force at all. This would be a waste of seven years of complex negotiations. The possibility that designing another legal instrument might take at least as long should motivate everyone involved to bring the protocol into effect as soon as possible. Special emphasis should be placed on the effective operation of the reporting and verification system, which will be the backbone of the treaty, helping to rebuild diminishing confidence between parties and ensuring that the treaty satisfies its aims. This chapter has argued that demonstrable progress is an important element of this verification process.

The bottom line is that climate change is happening and urgent, global solutions are required. Two years before reports are due to be submitted, it is time for all stakeholders involved in the Kyoto process to revisit and reinvigorate the concept of demonstrable progress.

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Endnotes

[1] The text of the UNFCCC is available at http://unfccc.int/resource/docs/convkp/conveng.pdf.

[2] UNFCCC, Article 4.

[3] For links to emissions data between 1990 and 2000, see www.climatenetwork.org.

[4] The text of the Kyoto Protocol can be found at http://unfccc.int/resource/docs/convkp/kpeng.pdf.

[5] The Kyoto Protocol regulates the emission of six greenhouse gases: carbon dioxide (CO_2); methane (CH_4); nitrous oxide (N_2O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulphur hexafluoride (SF_6). The 'basket' approach sets one emissions reduction target for all six gases. The last five gases in the list can be converted into carbon dioxide equivalents using global warming potentials (GWPs), which reflect the capacity of each gas to increase the temperature of the atmosphere. Emissions are measured in metric tonnes of carbon dioxide equivalent (tCO_2-e).

[6] Annex I parties are the 35 industrialised countries (plus the European Community) that are signatories to the UNFCCC: Austria, Belgium, Bulgaria, Canada, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, Netherlands, New Zealand, Norway, Poland, Romania, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine, United Kingdom of Great Britain and Northern Ireland, and the United States. However, a total of 38 countries have accepted emissions reduction targets as inscribed in Annex B to the Kyoto Protocol. Annex I countries Belarus and Turkey did not accept the targets, but Croatia, Liechtenstein, Monaco, Slovakia and Slovenia were added to Annex B, bringing the total to 38.

[7] UNFCCC, Article 3, paragraph 1.

[8] For background material on the financial mechanisms under the UNFCCC and a second review of parties' implementation of their obligations, see http://unfccc.int/issues/financemech.html.

[9] Information in the annual inventories will be for the current year minus two.

[10] Kyoto Protocol, Article 3, paragraph 2.

[11] Molly Anderson, 'Verification under the Kyoto Protocol', in Trevor Findlay and Oliver Meier (eds), *Verification Yearbook 2002,* The Verification Research, Training and Information Centre (VERTIC), London, December 2002, pp. 147–169.

[12] FCCC/CP/2001/13/Add.3, p. 2.

[13] The IPCC predicts that implementation costs for the Kyoto Protocol will be in the range 0.1–1.1% of GDP using the flexible mechanisms. See www.ipcc.ch/pub/un/syreng/spm.pdf, p. 25.

[14] Hal Hurton et al, 'Comprehensive emissions per capita for industrialised countries', September 2001, The Australia Institute, www.tai.org.au.

[15] See United Nations Development Programme (UNDP), *Human Development Report 2003,* chapter 19, www.undp.org/hdr2003.

[16] Quote by Jan Pronk, then Environment Minister of the Netherlands and Chairman of COP6, 19 July 2001. See http://news.bbc.co.uk/1/hi/sci/tech/1446313.stm.

[17] Vanessa Houlder and Andrew Jack, 'Hopes grow that Russians will ratify Kyoto pact', *Financial Times,* 10 September 2003, www.financialtimes.co.uk.

[18] The Umbrella Group is a loose alliance of non-EU members of the Organisation for Economic Co-operation and Development (OECD) that negotiates collectively on some issues. Members of the Umbrella Group are Australia, Canada, Japan, New Zealand, Norway, Russian Federation, Ukraine and the US.

[19] Decision 22/CP.7, FCCC/CP/2001/13/Add.3, p. 14.

[20] It is expected that the first MOP will be held in parallel with COP10 in 2004, after Russia submits its instrument of ratification.

[21] Decision -/CP.8, COP8. For an advance, unedited version see http://unfccc.int/cop8/latest/22_sbstal6add1.pdf.

[22] Parties are required by the COP to submit regular national communications at intervals of three to five years. Parties were due to submit their third national communication by 30 November 2001. They are

likely to adopt a decision that Annex I parties submit their fourth national communication by 1 January 2006, to coincide with the submission of reports on demonstrable progress.

[23] The full title of the guidance is 'UNFCCC guidelines on reporting and review', FCCC/CP/1999/7.

[24] This guidance, finalised in sections at COP7 and COP8, will be consolidated and adopted by the first MOP. See decision 22/CP.7, FCCC/CP/2001/13/Add.3, pp. 14–29, and the advance, unedited version of -/CP.8 at http://unfccc.int/cop8/latest/19_sbstal15add1.pdf.

[25] Part I of the guidelines, relating to the submission of annual inventories, was updated more recently at COP8. This was in order to incorporate changes made necessary by the reporting and review requirements agreed under the Kyoto Protocol.

[26] FCCC/CP/1999/7, p. 83, paragraph 14.

[27] FCCC/CP/1999/7, p. 83, paragraph 15.

[28] FCCC/CP/1999/7, p. 86, table 1.

[29] For a summary on progress in 'good practices' regarding PAMs, see http://unfccc.int/issues/goodpract.html.

[30] Kyoto Protocol, Article 5.1.

[31] A party's assigned amount (AA) is the volume of carbon dioxide equivalent that it is allowed to emit over the first commitment period (2008–12). This is calculated by combining its emissions during the base year (normally 1990) with its negotiated emissions reduction target (expressed as a percentage) and multiplied by five (the number of years in the commitment period).

[32] Decision 20/CP.7, FCCC/CP/2001/13/Add.3, p. 2.

[33] FCCC/CP/2001/13/Add.3, p. 21, paragraph 3(b).

[34] Parties will be able to trade four types of units. Assigned amount units (AAUs) are derived from the emissions allowance allocated to each party prior to the commitment period. Emission reduction units (ERUs) and certified emission reduction units (CERs) are awarded in respect of projects under the JI and the CDM respectively. Removal units (RMUs) are issued to parties undertaking sinks activities under Articles 3.3 and 3.4 of the Kyoto Protocol. All units are equal to one tonne of carbon dioxide equivalent.

[35] The guidelines define 'with measures' as those PAMs that have been implemented or adopted at the time of reporting. An 'additional measures' projection should also include planned PAMs. A 'without measures' projection should exclude all measures that are planned, adopted or have become operational after the year chosen as the starting point (1990 for most countries). In this way, it provides a 'baseline' or 'reference' projection to compare against actual changes.

[36] Nations in the former Soviet bloc that suffered economic downturns following the collapse of communism are referred to as countries with economies in transition. Under the Kyoto Protocol, these states are likely to have an allowance surplus in the first commitment period due to their GHG emissions having declined substantially since the base year because of the reduction in industrial and other activity.

[37] FCCC/SBSTA/2001/5 and FCCC/SBSTA/2001/5/Add.1

[38] Oliver Meier and Clare Tenner, 'Non-governmental monitoring of international agreements' in Trevor Findlay and Oliver Meier (eds), *Verification Yearbook 2001,* VERTIC, London, December 2001, pp. 207–222.

[39] For an advance, unedited version of the Delhi Declaration see http://unfccc.int/cop8/latest/1_cpl6rev1.pdf.

[40] Kevin Baumert et al (eds), 'Building on the Kyoto Protocol: options for protecting the climate', World Resources Institute, Washington, DC, October 2002.

[41] See 'Governor Davis signs historic global warming bill', press release issued by the Governor of the State of California, 22 July 2002, available at www.governor.ca.gov/state/govsite/gov_homepage.jsp.

[42] US industry can voluntarily submit emissions inventories, according to standards and guidelines. This provides companies with an incentive to document their GHG emissions, to learn reduction strategies, and to protect early actions prior to introduction of an emissions trading scheme. See 'Governor Davis applauds California climate action registry for nation's first greenhouse gas reporting standards', press release, 26 June 2002, available at www. governor.ca.gov/state/govsite/gov_homepage.jsp.

II

Monitoring and verification of geological and ocean carbon dioxide disposal

Jason Anderson

Through all of the noise of natural variation, the evidence of anthropogenic influence on climate is becoming clear. Vast challenges remain in refining the science, but the questions are increasingly shifting from 'if' to 'when, and how much'. Meanwhile, even as the problem comes into sharper focus, we are faced with political stagnation and ever-rising greenhouse gas emissions. Seeking a way through the stand-off between the entrenched powers of the present day and impending ecological disaster, some have proposed 'engineering' solutions to climate change. Among them is capturing carbon dioxide from combustion and disposing of it in subsurface geological formations and the oceans.[1] While the solution seems attractive to many people (including those in the fossil fuel industry), the long-term environmental benefits have yet to be proved.

Whether they can be proved through monitoring and verification is indeed one of the sticking points of the whole concept.

The context for capture and disposal

The primary culprit in anthropogenic climate change is carbon dioxide (CO_2) emitted from the combustion of fossil fuels such as coal, oil and natural gas. Between 1751 and 2000, total world carbon emissions from fossil fuel combustion were approximately 277 gigatonnes of carbon (GTC).[2] Currently some 6.5 GTC are emitted annually to the atmosphere, of which about 3.3 GTC are retained in the atmosphere.[3] As a result, the concentration of CO_2 in the atmosphere has risen from around 280 parts per million by volume (PPMV) prior to the industrial age to approximately 368 PPMV in the year 2000.[4] It is estimated that a rise to 450 PPMV could mean a global temperature rise of 2°C.[5] Even this level of warming would

produce serious impacts,[6] but it may well be at the lower end of the range of achievable levels given current trends.

Given that approximately 4,000 GTC of accessible fossil fuel reserves still remains in the ground—the vast bulk of it as coal rather than oil or gas—there is more than enough carbon available to cause serious damage to the global climate. The reluctance of major emitters such as the United States to engage seriously in limiting emissions, the desire of developing countries to spur economic growth by developing emitting industries,[7] and overall rising standards of luxury are all reasons for concern about the prospects for reining in emissions.

The realisation that avoiding climate change would not be easy struck home in the early 1990s. The United Nations Framework Convention on Climate Change (UNFCCC), agreed in 1992, exhorted parties to limit their emissions but resulted in little action.[8] The result was the negotiation of the 1997 Kyoto Protocol—a framework for a binding agreement with clearly defined targets to reduce emissions in five-year increments.[9] The first five-year increment, or 'commitment period', would be from 2008 to 2012. Greenhouse gas (GHG) emissions from industrialised countries would be reduced by 5 percent below 1990 levels.[10]

As parties began considering their options in order to meet this goal, it became clear that what many envisioned as the 'obvious' answers—wasting less energy, switching from fossil fuels to renewable energy, promoting public transport—were going to meet challenges from traditional polluting industries wishing to retain their dominant position. The initial reaction was largely to denounce global warming as an unsubstantiated environmentalist fad. Facing mounting scientific evidence to the contrary, however, these industries began to look for mitigation options—preferably such as would keep them in business. Among the most promising concepts has been geological and ocean carbon dioxide disposal. Geological and ocean disposal means basically taking the CO_2 from power plants and putting it in the ground or deep in the sea. While this idea is conceptually attractive to industry because it will allow it to continue using fossil fuels, it brings with it a host of challenges and problems—technical, financial and environmental.

At present, the cost of separating CO_2, either from flue gases or prior to combustion, is prohibitively high for anything but specialised applications such as natural gas purification. The immediate challenge to a carbon-constrained world is therefore

to motivate industry to research capture options intensively and bring costs down—a challenge that is being met with some success. Among the options for geological disposal sites—aquifers, oil and gas fields, and coal beds—there is usually one fairly close to most power plants. It is estimated, for example, that some 65 percent of power plants in the US are located close to a saline aquifer.[11] Power plants are also commonly sited in coastal areas, making the oceans a tempting disposal option.

Still, the existence of potential disposal sites and the cost of achieving disposal are only part of the picture when the future role of the concept is considered. Its ultimate contribution to the mitigation of emissions will depend on a much more detailed understanding of the appropriateness of disposal sites in two regards: (a) local environmental impacts and safety, and (b) the long-term effectiveness of disposal. Assessment of both of these will depend in large measure on effective monitoring and verification.

Monitoring and verification of disposal sites will probably be technically complex and demanding: while the fossil fuel industry has extensive experience in subsurface geology and engineering, for example, it still faces the challenge of dealing with a new substance with different physical and chemical characteristics from hydrocarbons—CO_2—and a new paradigm—injecting for the long term rather than extracting in the short term. As a commercial operation, CO_2 injection will also have to be affordable, and may well come up against an unwillingness to expend the resources to monitor and verify accurately, and a reluctance to act on findings of leakage, soil acidification, fish kills or similar unwanted side effects.

Capture and disposal: a brief overview

Capture and disposal options range in sophistication from collecting CO_2 from a smoke stack and putting it in a hole in the ground to using advanced chemical and combustion techniques that represent a significant change in the way power plants work.

Capture

The most basic CO_2 capture technique is post-combustion capture from flue gases. These typically contain only 5–20 percent CO_2, so capturing significant quantities is difficult and energy-intensive. The most developed technique is to filter flue gases through alkanolamines, which absorb CO_2 selectively. When subjected to

the right changes in temperature and pressure, the CO_2 is released and collected for disposal. Alternatively, the flue gases can be brought into contact with substances like zeolites that adsorb CO_2 on their surface. Finally, gases can flow past membranes that selectively allow CO_2 to pass through. Usually several stages are needed to reach desired levels of purity.

An ancillary technique is to enhance the level of oxygen in combustion to yield a purer stream of CO_2 in the flue gases, which makes the CO_2 much easier to separate. While this has the disadvantage of requiring a source of oxygen, in itself a challenge, it can yield CO_2 concentrations of up to 90 percent.

Perhaps the most conceptually elegant solution is to avoid CO_2 being produced by combustion in the first place. This can be achieved by subjecting the hydrocarbon fuel—coal, oil or gas—to a process which breaks it down chemically and separates it into two streams: hydrogen, which may be used to power an engine or a fuel cell, and CO_2, which is collected and disposed of.

Disposal

Some two-thirds or more of the cost of capture and disposal can be ascribed to capture, and there are serious concerns about the energy used in the process that may challenge its widespread adoption. But, although capture faces real technical and financial barriers, the solutions lie in the controlled realm of engineering. Disposal, on the other hand, releases CO_2 into the natural environment, where it is exposed to the vagaries of natural processes that are difficult to predict. The long-term effectiveness and short-term risks are a matter of complex conjecture.

One potential method of disposal is a process known as enhanced oil recovery (EOR), of which the operators of oil fields have considerable experience. For 30 years, particularly in North America, CO_2 has been injected into oil-bearing formations to increase pressure behind the oil and force it towards wells, also making it less viscous and thereby improving flow. The impact can be dramatic, increasing yields by between 5 percent and 50 percent above initially recovered amounts. The CO_2 used in this process is mainly mined from underground sources but, because EOR has economic value, the cost of capturing anthropogenic CO_2 for use in EOR would be offset somewhat, making it one of the first likely options for widespread disposal.

From a monitoring and verification standpoint, EOR has several distinct advantages. First, it occurs in formations for which the geology is well documented thanks

to petroleum industry activity; in these areas wellbores are available to mount monitoring equipment; and machinery and manpower, including personnel experienced in environmental health and safety precautions, are at hand. There are also two main disadvantages. First, by its nature, EOR will recover a certain amount of CO_2 as it pumps up the oil that has been pushed towards the wells and this has to be dealt with properly to avoid release; it is only once the EOR operation stops and the wells are sealed that long-term storage begins. Second, while the proximity of petroleum industry operations can be an advantage, in places with a long history of drilling it is possible that wells with degraded seals will allow escape routes for disposed CO_2. Texas alone has some 1,500,000 oil and gas wells.[12]

A second technique that offers economic returns is enhanced coal-bed methane extraction (ECBM). Coal seams contain methane, which can be drilled for and pumped out in much the same way as oil or gas. CO_2 injected into the seam will replace the methane that adheres chemically to the surface of the coal, simultaneously increasing production while locking the CO_2 into the coal bed. For each methane molecule release, two molecules of CO_2 adhere to the surface. ECBM theoretically represents a chance for secure storage with economic returns.

In practice, however, there are limitations to the ability to inject CO_2 into coal without clogging pores around the well, while increased pressure may cause fracturing. Sometimes coal beds are intentionally fractured to facilitate the collection of methane, but this may create escape pathways for CO_2. Given that some relevant coal beds are relatively shallow and not sealed by thick layers of rock, there may be less certainty about the long-term containment of CO_2 if it fails to adhere successfully to the coal.[13]

A third possibility is storage in saline (brine, salty water) aquifers. These offer the greatest potential of any type of geological storage site in terms of volume. Injected to depths of over 800 metres, CO_2 enters a liquid-like 'supercritical' state,[14] allowing condensed storage. Naturally more buoyant than salt water, it must be kept down by thick layers of impermeable caprock above the storage formation. Over time it may dissolve and sink in the water, or partially react with rock and mineralise. Crude estimates show that globally saline aquifers could accommodate 50–200 times the amount of fossil fuel emissions predicted in the coming 50 years. How much of this volume would be well sealed or accessible and how much of the potential aquifers would be economic to use is still under study, however.

Compared to EOR as a disposal method, aquifer storage offers some advantages. Potential storage volumes are larger, they are not limited to hydrocarbon-bearing areas, and they are less frequently penetrated by wells, which may become sources of leakage. The main disadvantage is that they have never been commercially exploited and geological information about specific sites is therefore far more limited than the information for oil and gas fields.

Fourth, in principle the oceans offer a tempting sink for captured CO_2. After all, they already contain 40,000 GTC, and there is a natural air–ocean exchange of 90 GTC a year, of which 2 GTC is retained in the oceans.[15] Because CO_2 emitted from power plants enters the atmosphere and most of it eventually enters the ocean anyway, proponents of ocean CO_2 disposal like to say that they would just be speeding up a natural process.

The primary concern with this approach is that concentrated CO_2 releases in the ocean will cause acidification and potential ecological damage. The challenge of monitoring and verifying emissions is another major impediment. The oceans are naturally in constant flux, and determining what happens to a given amount of injected CO_2 in the long run can only be estimated by modelling. While deeper injection should tend to delay release to the surface significantly, unanticipated shifts in upwelling (perhaps due to climate change itself) could nullify the advantage. Given this uncertainty, the acidification problem and the fact that international law proscribes it,[16] the environmental community has been particularly sceptical about this option and political pressure has so far forced the cancellation of proposed pilot projects.

Monitoring and verification of CO_2 disposal

Each kind of CO_2 disposal presents its own challenges from a monitoring and verification standpoint, but the principles for each are the same: (a) verifying the suitability of a location as a disposal site and predicting the behaviour of CO_2 at the site; (b) monitoring a site for seismic impacts, effects on fresh water, and leakage to soils or air that may have local health or ecological impacts, and meeting relevant regulatory requirements; (c) long-term monitoring of CO_2 releases to the atmosphere to verify effectiveness from a climate mitigation point of view; and, last but not least, (d) confirming that disposal activity takes place as claimed.

Monitoring CO_2 underground

Given the immense natural variation in underground geology, finding a site suitable for disposal requires intensive study. Highly detailed maps of fractures in geological formations are necessary to spot breaks in otherwise acceptable sites. Even very small fissures can offer a significant escape route over time. Bearing in mind that a site might be used for decades and then left alone for centuries, finding a suitable area is no mean feat. Any failure to perform detailed pre-injecting characterisation would be an invitation to future leakage.

Once CO_2 is in the ground, kilometres of rock separate observers from what is happening. Detection technologies are therefore needed to monitor whether and how the plume of injected CO_2 is spreading. A standard technique in the industry is to lower into wells detectors that log a variety of data, mostly about the condition of the well. By detecting the composition of fluids seeping from the rocks lining the well, the resulting data can give an idea if there is any seepage of CO_2. Because the well itself would be an important escape pathway, this is useful, but it is of limited value in describing the movement and size of the plume.

Geophysical monitoring techniques allow geologists to monitor a larger area. A long-standing petroleum industry exploration technology is seismic monitoring, where sound waves are directed at a formation and devices record the reflections. This can be done at the surface, down a well, or from one well to another (cross-well). Seismic monitoring takes advantage of the differences in the density and elastic stiffness of different materials. Comparing monitoring data to known values for CO_2 and those for surrounding water, gas, oil or rock makes it possible to form a picture of the location of CO_2.

The most important factor in seismic monitoring is resolution—the size of a feature that can be detected. Cross-well seismic monitoring will yield more information than monitoring from a single well, while using a third well to form a three-dimensional (3-D) image is even better. Even so, this still only yields a picture across a particular slice of a formation at a certain depth. A surface seismic image can cover a broader area over a large range of depths, but there will be kilometres of rock between the sensors and the disposal formation, complicating interpretation of the image. Research shows that in the order of 20,000 tonnes of CO_2 can be detected in a formation using surface seismic techniques but the risk of false readings

cannot be ruled out when dealing with volumes 20 times less.[17] Given that a power plant might inject 1 megatonne (MT) of CO_2 every year, the plume should be easy to spot, but smaller amounts of CO_2 migrating away from the plume, perhaps in undesirable directions, could be missed. A promising technique, less used in petroleum exploration, is time-lapse detection, where the difference between images taken over time helps spot movement of CO_2 in a formation. This can also be done in 3-D.[18]

CO_2 injected under the surface may increase the pressure of a formation to such a degree as to cause the land to buckle, however slightly. Meters exist that can measure this deviation extraordinarily accurately—to fractions of a millimetre. Coupled with the possibility of satellite or aeroplane-based monitoring, small land shift changes can give an indication of pressure changes underground over a wide area that may be due to CO_2 injection.

Monitoring impacts

Fresh well water is an important and, in many places, increasingly scarce resource. Maintaining both sufficient quantities and drinkable quality is a primary goal of the regulations that govern various activities affecting the underground, such as hazardous waste disposal. CO_2 will obviously not be allowed to be disposed of in potable water sources; they will be in much deeper saline aquifers. However, two mechanisms at work could affect water sources. Either injected CO_2 could displace saline water away from the injection site until it reaches a fault that connects it upwards to fresh water, or the CO_2 could itself find similar faults and migrate to fresh water. While the geophysical techniques can indicate plume movement, CO_2 or saline water migration can also be detected by directly taking fluid samples, including at wells themselves—and there is already a serious problem if anything is detected there.

Once CO_2 leaks into soil near the surface, it can start to have an impact on plants and animals. Normally the gas content of soil is up to 1 percent CO_2. At elevated levels, the CO_2 can kill trees by inhibiting the uptake of oxygen and nutrients by their roots. This process is already evident in areas with naturally elevated CO_2 levels, such as the carbogaseous regions of France, areas of northern Hungary and Mammoth Mountain, California, where CO_2 of volcanic origin is killing 40 hectares of pine forest.

As CO_2 reaches the air, direct measurement would be needed to protect both humans and animals from dangerous exposure and to estimate the magnitude of any leakage. Current technology is far more directed to the former, given that CO_2 is a workplace hazard in certain industries and standards exist regarding acceptable levels. Two types of hand-held chemical sensors are already in use, one using gas chromatography and one using Draeger tubes. These are more appropriate for spot checks to determine human exposure than for large-area, long-term monitoring. They are adequate to check for dangerously high levels, but not for subtle changes. Direct measurement of CO_2 in air is most commonly done through infrared (IR) sensors. Small infrared gas analysers (IRGA) are commonly used to ensure safety in workplaces such as breweries, for example, by being linked to ventilation systems. Field sensors to detect CO_2 flux from the ground are also employed in locations like Mammoth Mountain. This group of detectors is useful for measurements at a single point, but to cover a wide area either need to be mobile or in large numbers.

Other sensors employing shorter wavelengths allow distances of up to 1 kilometre to be covered. This has the advantage of covering a large area but the disadvantage that the readings are cumulative for the whole length of the path. If a reading is high, it may be due to a cumulative effect or to one hot spot along the way. Portable monitoring may then be necessary to detect the source more accurately.

Even broader coverage could be achieved by aircraft or satellites equipped to detect both CO_2 and disposal impacts such as deformation of the land surface. The US National Aeronautics and Space Administration (NASA) believes that satellites could theoretically detect increased CO_2 levels to a 100 square metre area. However, because variations in topography may have a significant impact on measurability, and measurements are of the whole air column, it is difficult to discern differences in concentrations of CO_2 at ground level, which is of most interest. Satellite monitoring could therefore be used as a warning system to prompt further investigation. A suitably capable satellite would naturally have to be in the right place to cover a particular site, which may limit its widespread applicability. To be more site-specific and to reduce the distance from the surface, aircraft may be a more effective alternative.

Compliance monitoring

While much research is currently focused on technologies that will enable us to understand the complex geological factors affecting CO_2 disposal, much of their

success as a mitigation measure will depend on verifying that disposal takes place as claimed. With recent corporate accounting scandals fresh in people's minds, it should come as no surprise that corporate carbon accounting may be equally susceptible to foul play. CO_2 capture and disposal will be expensive, complicated, and seen as an environmental burden that is tangential to a company's core business, and this may tempt companies to cut corners. However, carbon dioxide is the centrepiece of international agreements and a marketable commodity.[19] Parties to the UNFCCC and the Kyoto Protocol will want to know that accounting for mitigation activities is credible in their own and other countries. Similarly, businesses trying to reduce emissions or participating in an emissions trading system will want to know that their competitors are living up to their obligations as well.

In addition to straightforward monitoring to verify that CO_2 is captured and flowing through pipes to disposal sites as claimed, techniques are being developed to assign responsibility for the long-term fate of CO_2. To aid in distinguishing the source of the CO_2 it may be possible to inject tracers into the injected CO_2 or formation water at the injection site. Possibilities include noble gases mixed with the CO_2, and perfluorocarbons.[20] Another possibility is that isotopic measurements (of the C13/C12 [$^{13}C/^{12}C$] ratio) may 'tag' specific CO_2 sources; the ratio in CO_2 from a specific power plant would very likely be different from that found in the atmosphere, allowing it to be recorded and detected later should there be leakage from the disposal site. However, there are still questions about the impact sub-surface storage may have on the isotopic ratio: by the time it has leaked the CO_2 may have undergone a change. Oxygen isotopic ratios could also be exploited for the same purpose.

Isotope measurement is typically done via isotope ratio mass spectrometry (IRMS). This is accurate but expensive and requires laboratory preparation of the samples, making it inappropriate for cheap, large-scale or real-time measurement. One company, Aerodyne Inc., is developing 'tunable infrared laser differential adsorption spectroscopy' (TILDAS) techniques. These could allow real-time measurement in the field or from aircraft. Developments are currently overcoming the difficulty of retaining precision over long path lengths.

Ocean disposal monitoring

While geological disposal is supposed to contain CO_2 in a defined area, the opposite is true for ocean disposal, which generally operates according to the old catchphrase

'the solution to pollution is dilution'. The disadvantage is that CO_2 creates acids in water that may lower pH (alkalinity) to levels that are dangerous to marine life, in addition to having narcotic and asphyxiant effects on marine life just as it is does on terrestrial life. The dilution sought is of course only lateral: the hope is that CO_2 will not migrate vertically, and ultimately out to the atmosphere. In any case, dispersal in the ocean complicates monitoring. On-site monitoring is in practical terms limited to verifying quantities on their way to disposal. Once those verified quantities are dispersed into the ocean, movement is most likely only to be estimated using computer models.

A number of options for injecting CO_2 into the ocean have been proposed, but they generally involve pipes leading down to a depth of 1,000–3,000 metres or more. Flow meters on pipes leading to an injection point could accurately establish quantities, while video cameras could be placed at the injection point to verify flow, check for problematic blockages and estimate volumes. Sensors at the injection point could also check for CO_2 concentration and pH changes.

Unmanned undersea vehicles could be used to check both the integrity of the injection site and CO_2 concentrations and pH at intervals from it. Repeated sampling could give some data as input to models on movement of the plume and the impact it is having on the water, and by extension anything in the water.

Monitoring far from any specific injection site is not likely to yield data specific enough to say much about that site. It will reveal more about the cumulative impact of ocean disposal globally. Estimates place the potential pH drop from injecting all power-plant CO_2 into the ocean over the coming decades as of the order of .3 units.[21] This is a relatively unlikely scenario and a relatively small drop, but it says nothing about the much more important local changes in areas with concentrations of power plants, the coastlines near major population centres being an obvious example.

An alternative to the dilution method is the possibility of retaining a single large pool of liquid CO_2 in an underground 'lake'. While everything under it would be destroyed, at least the destruction would be confined. That kind of thinking has done little to win the concept friends; and a further problem is verifying that the liquid CO_2 does not expand or disperse. It could be possible to set fixed monitors or regularly visit the site with a remote submersible to verify the action of the CO_2.

This would give a view of overall behaviour, but estimates of the mass would still only be approximations: losses to dissolution, for example, would still have to be modelled.

Modelling effectiveness: accuracy and acceptability

There will always be a trade-off between cost (or effort) and accuracy: IR equipment capable of very precise CO_2 measurements can monitor a specific point. However, over decades of injection, a saline aquifer may fill with CO_2 that extends over hundreds of square kilometres.[22] Options for monitoring possible leakage to the air include many individual monitors, field staff with monitors taking samples, monitors with long path lengths but lower accuracy, and aircraft and satellite imaging with broader ranges and even lower accuracy. Detecting large leaks in order to protect the public may involve placing monitors only near likely leakage sites, such as wells, or using remote sensing, which can spot the rough variations. Spotting steady, low-level leakage and quantifying it would require closer detection. Ultimately, combinations of approaches would be needed.

Estimates have been made for the cost of 3-D time-lapse seismic measurements which would provide a relatively good picture of how a plume is evolving. Each image might cost in the range of US$1.5 million; if images are taken at five-year intervals during the 30-year injection time from a power plant, total costs would come to US$9 million—which, in the context of the 300 MT of CO_2 disposed of, amounts to only US$0.03 a tonne.[23] But the kind of commitment that would be necessary to monitor the site for the duration of the intended disposal period is still poorly understood. To be effective, storage must keep CO_2 from entering the atmosphere for hundreds or thousands of years. Who will take responsibility for making sure a disposal site will not leak 300 years from now? Who will monitor and guarantee it, and how? A US$1.5 million 3-D monitoring effort may be acceptable once every five years for 30 years, but what about for 300 years? Will people even be aware of the danger in 300 years? At the moment there are still no good answers to these questions, and it is largely because of this (and a feeling that the answers we do get may be incomplete) that many consider it premature and perhaps ultimately rash to consider disposal as a major tool in mitigating climate change.

To some degree estimation and modelling will have to be used to give an indication of how CO_2 is moving within a site, leaking to the atmosphere, or affecting the environment. But confidence in compliance with health and safety regulations, Kyoto targets, national legislation or emissions trading requires that all parties involved feel that emissions estimates are as uniform and precise as possible. Precision, that is, reproducible results for similar activities, is a prerequisite for fairness. However, it is possible to be precise without being accurate: while everyone may agree to use the same emissions factor and probability of emissions, these may not actually represent reality well.[24] The challenge is therefore twofold: reaching agreement on methodologies for accounting, and being sure that the accounting can be done accurately enough to represent the real risk to the atmosphere. For this reason, the process of setting standards cannot precede a scientific understanding of the likelihood of leakage. At the moment we are far from that understanding for any type of disposal.

Despite the gaps in understanding, research and development on CO_2 capture and disposal has gained pace over the past decade and includes efforts by industry, academia and governments in Europe, Australia, North America and Japan. Recognising the growing base of knowledge, the Intergovernmental Panel on Climate Change (IPCC) decided to initiate a special report on the subject, which will be finalised in 2005. It will be an important assessment of relevant technical advances and will probably influence ongoing discussions both nationally and internationally. Among the most important issues will be defining the monitoring and verification standards and practices that will pass muster under the UNFCCC and its Kyoto Protocol.

The IPCC will also address the issue in its review of the revised 1996 guidelines for national GHG emissions inventories, which should be completed in 2006.[25] Emissions from sources relevant to CO_2 capture and disposal, such as those from large power plants, are currently included in national GHG inventories in one of three ways.

The first is the reference approach, which basically takes the amount of fuel consumed in the economy and multiplies it by the appropriate emissions factors. This approach covers all sources. The second is the sectoral approach, which does the same thing but with data sector by sector; and the third is a bottom–up approach, which uses empirical data on either fuel consumption or actual measured CO_2

emissions from the stack of individual emission sources. CO_2 capture would skew the first two measurements because it changes the relationship between fuel used and emissions. But it would be far too simplistic to merely count plants that employ capture as non-emissive. Not all capture methods would have the same effectiveness: CO_2 could be reduced by close to 100 percent in some cases, but might be much less in others, depending on the technology. Accurate measurement would require plant-by-plant information, making the bottom–up approach a necessity. In the European Union countries, and possibly other parts of the world, legislative measures such as emissions trading will mean that plant-level monitoring is in any case required. Since with such systems the pollutant being monitored has a financial value, there may be a stronger incentive on all sides to ensure high levels of accuracy.

Capture alone would not necessarily require a new methodology for the good practice guidelines, given that the relevant data point—CO_2 emitted from the stack—is the same as today. In that sense capture is like any other mitigation technology (such fuel switching and improved engine efficiency) that reduces stack emissions. The more complex side of the equation is disposal and the long-term measurement of leakage. Because of its own unique complexities, a separate protocol for biological sequestration was completed in 2003;[26] a similar effort will be needed for geological and ocean disposal.

Any international guidelines will be general, but relevant national and local regulations can be complex and demanding. In North America, Europe and Japan, CO_2 monitoring regulations are currently being reviewed for their relevance to capture and disposal. Until now, CO_2 regulations have focused exclusively on the health and safety of workers in chemical manufacturing, breweries and other places where it can be a local hazard. Regulation routinely establishes safe limits for exposure to CO_2 and mandates checks or continuous monitoring in danger areas. More relevant to disposal are analogous storage and disposal efforts regarding other substances, such as natural gas, waste water and nuclear waste. These cases indicate not only that is it important to adopt relevant technical standards and management procedures but also that lessons should be learned from the political battles surrounding their safe and acceptable development. Looming behind the development of carbon capture and disposal is the spectre of the divisive battles

over nuclear waste disposal that are in large measure responsible for the stagnation of an entire industry.

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Endnotes

[1] There is an active debate about the proper terminology for this concept. The most common term is 'sequestration' , but this is easily confused with terrestrial sinks. The forthcoming Intergovernmental Panel on Climate Change (IPCC) special report will use the term 'storage', but this is clearly a misnomer as it implies action of a temporary and easily reversible nature. 'Disposal' is most accurate because it describes what is in fact happening.

[2] Gregg Marland, Thomas A. Boden and Robert J. Andres, 'Global, regional, and national CO_2 emissions', in Trends: A Compendium of Data on Global Change, Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, US Department of Energy, Oak Ridge, TN, 2003, available at the website of the Carbon Dioxide Information Analysis Center, http://cdiac.esd.ornl.gov/trends/emis/tre_glob.htm.

[3] Intergovernmental Panel on Climate Change, *Climate Change 2001: The Scientific Basis,* Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, 2001, p. 207 (chapter 3.5.1: Observations, trends and budgets).

[4] Intergovernmental Panel on Climate Change, *Climate Change 2001: The Scientific Basis* (chapter 3.4.1: Anthropogenic sources of CO_2), p. 204.

[5] Intergovernmental Panel on Climate Change, *Climate Change 2001: The Scientific Basis* (chapter 9.3.3: Projections of future climate change), p. 558.

[6] See Climate Action Network website at www.climnet.org/publications/adequacy.htm.

[7] While in absolute terms increasing developing country emissions are a concern, in general they are nowhere near the per capita emissions of developed countries, and thus, as long as the latter maintain their high emission levels, growth in developing country emissions is defensible.

[8] The text of the UNFCCC can be found at http://unfccc.int/resource/docs/convkp/conveng.pdf.

[9] The text of the protocol can be found at http://unfccc.int/resource/docs/convkp/conveng.pdf. See also Molly Anderson, 'Verification under the Kyoto Protocol', in Trevor Findlay and Oliver Meier (eds), *Verification Yearbook 2002,* The Verification Research, Training and Information Centre (VERTIC), London, December 2002, pp. 147–69.

[10] When the impact of credits due to the enhancement of terrestrial sinks is included, actual industrialised country emissions may not be reduced but rather stabilised at 1990 levels. Worse still, countries such as Australia and Russia effectively renegotiated their original Kyoto targets by forcing concessions that enable them to earn higher credits from existing domestic carbon sinks. The withdrawal from the protocol negotiations of the US, which contributes more than a third of GHG emissions in industrialised countries, means that its share of the initial 5 percent target will not be achieved either. Considering the current growth trends in US emissions, this could lead to industrialised countries' emissions being up by 5 percent rather than down in 2008–12.

[11] Howard Herzog, Elizabeth Drake and Eric Adams, *CO_2 Capture, Reuse, and Storage Technologies for Mitigating Global Climate Change,* White Paper Final Report (order no. DE-AF22-96PC01257), US Department of Energy, Washington, DC, January 1997, p. 28.

[12] Michael Celia and Stefan Bachu, 'Geological sequestration of CO_2: is leakage unavoidable and acceptable?', Proceedings of Greenhouse Gas Technologies Conference no. 6 (GHGT-6), Kyoto, October 2002, p. 1.

[13] The CO_2 would be put it in unmineable coal seams, although whether seams that are unmineable today will be so in the future is another question.

[14] Gases enter supercritical state when the temperature is too high for the vapours to form liquids, but the pressure compresses them to the density of the liquid state. They retain the viscosity of a gas. The supercritical point for CO_2 is 74 times atmospheric pressure at 31°C. Density is on the order of 600–800 kg/cubic metre.

[15] Intergovernmental Panel on Climate Change, *Climate Change 2001: The Scientific Basis,* pp. 197–98 (chapter 3.2.3: Ocean processes).

[16] The 1982 Law of the Sea Convention and the 1992 Convention for the Protection of the Marine Environment of the North-East Atlantic (the Oslo–Paris (OSPAR) Convention), covering the North Sea, use similar language in which only specific kinds of waste are allowed to be dumped. Carbon dioxide is not one of them.

[17] Larry Myer, Michael Hoversten and Erika Gasperikova, 'Sensitivity and cost of monitoring geologic sequestration using geophysics', Proceedings of Greenhouse Gas Technologies Conference no. 6 (GHGT-6), p. 5.

[18] Time-lapse seismic monitoring of Statoil's reinjection of CO_2 separated from natural gas into the Sleipner field of the North Sea has provided a wealth of information for researchers. See www.statoil.com.

[19] There has already been a forward trade of carbon credits bought by Ontario Power Generation, generated from an EOR project in conjunction with the Partnership for Climate Action. See www.pca-online.org.

[20] These are, ironically enough, very strong greenhouse gases, but quantities would be minute.

[21] Howard Herzog, Ken Caldeira and Eric Adams, 'Carbon sequestration via direct injection', in John H. Steele, Steve A. Thorpe and Karl K. Turekian (eds), Encyclopedia of Ocean Sciences, Vol. 1, Academic Press, London, September 2001, pp. 408–414.

[22] Sean T. Brennan, 'Specific disposal volumes: a useful tool for CO_2 storage capacity assessment', in Proceedings, Second Annual Conference on Carbon Disposal, Washington, DC, May 2003.

[23] Myer, Hoversten and Gasperikova, p. 6.

[24] For example, the Kyoto Protocol uses a global warming potential (GWP) of 21 for methane, but a subsequent study puts it at 23. So, while consistent application of 21 will yield fair and precise results across the board, they will be inherently inaccurate.

[25] The revised 1996 guidance on national greenhouse gas inventories is available at www.ipcc-nggip. iges. or.jp/public/gl/invs1.htm.

[26] The protocol is still in draft version. See www.ipcc-nggip.iges.or.jp/.

12

Monitoring the Montreal Protocol

Duncan Brack

The 1987 Montreal Protocol on Substances that Deplete the Ozone Layer is generally regarded as one of the most, if not the most, successful environmental conventions in existence. Not only is it dealing effectively with the problem that it was set up to solve—to phase-out a family of industrially useful, but environmentally damaging, chemicals—but it has provided the international community with a series of valuable lessons in the design and implementation of multilateral environmental agreements (MEAs).[1] The development of the protocol's data reporting and non-compliance systems (the main focus of this chapter) has been an important factor in its success.

Ozone depletion

Ozone is a molecule comprising three oxygen atoms. It is comparatively rare in the earth's atmosphere; 90 percent is found in the stratospheric 'ozone layer', ten to 50 kilometres above the planet's surface. The Montreal Protocol was a response to growing evidence of the accumulating damage to the ozone layer caused by the release into the atmosphere of chemical substances known as halocarbons, compounds containing chlorine (or bromine), fluorine, carbon and hydrogen. The most common ozone-depleting substances (ODS) were chlorofluorocarbons (CFCs). Stable and non-toxic, cheap to produce, easy to store and highly versatile, CFCs proved to be immensely valuable industrial chemicals, employed as coolants in refrigeration and air conditioning systems, as 'foam-blowing agents', and as solvents, sterilants and aerosol propellants. As scientific knowledge developed, other chemicals—halons, carbon tetrachloride, methyl chloroform, hydrochlorofluorocarbons (HCFCs), methyl bromide and bromochloromethane—also came

to be identified as ozone depleters. The characteristic that they all share is their propensity, when released, to diffuse up into the stratosphere, where they are broken apart by solar radiation, releasing chlorine or bromine atoms, which, in turn, destroy ozone molecules.

Throughout the 1970s and 1980s, scientists began to detect a steady thinning of the ozone layer: between 1997 and 2001, ozone losses averaged four percent (compared to 1980 levels) in northern mid-latitudes (between the tropics and the poles) in winter and spring, and six percent in southern mid-latitudes the year round. Atmospheric circulation tends to move ODS in the stratosphere away from the tropics and towards the poles. Ozone destroying reactions are particularly intense on the surface of the ice particles inside the polar stratospheric clouds. Hence, ozone depletion is at its worst over the Antarctic and Arctic: an average 40–55 percent reduction in the Antarctic spring (September and October), and up to 25 percent in the Arctic spring (March and April). The almost total disappearance of the ozone layer above Antarctica for a few weeks in spring—the 'ozone hole'—was first observed in 1985, and has occurred every year since.[2]

A depleted ozone layer allows more ultraviolet-B (UV-B) radiation to reach the earth's surface; levels are now on average between six and 14 percent higher than values recorded prior to the emergence of the ozone hole. Not surprisingly, UV-B irradiation increases dramatically nearer the poles, particularly in spring—now 22 percent higher in the Arctic and 130 percent higher in the Antarctic. As the areas of ozone depletion around the poles rotate to cover different parts of the globe, some inhabited areas have experienced much higher levels of UV-B irradiation. The southern tip of South America, for example, has seen the occasional doubling of UV-B levels.

Moderate exposure to UV-B poses no risks; indeed, in humans it is an essential part of the process that forms vitamin D in the skin. But higher levels have potentially harmful effects on human health, animals, plants, micro-organisms, materials like plastics, rubber and wood, and air quality. In humans, long-term exposure to UV-B is associated with the risk of eye damage (including severe reactions, such as snow blindness, cancer and cataracts), suppression of the immune system, and the development of skin cancer—the most serious form of which, melanoma, is now one of the most common cancers among white-skinned people. Animals

suffer similar health effects; marine life is particularly vulnerable to UV-B, a matter of some concern, since more than 30 percent of the world's animal protein for human consumption comes from the sea.

Due to rising scientific concern from the mid-1970s onwards, a number of governments began to impose restrictions on the use of CFCs, especially in aerosol propellants, where alternatives were already available—although the rapid spread of air-conditioning systems in the early 1980s saw CFC production accelerate. As a global problem, however, it was clear that ozone depletion needed a global solution. The Vienna Convention for the Protection of the Ozone Layer was eventually agreed on 22 March 1985 and entered into force on 22 September 1988. It contained pledges to co-operate in research and monitoring, to share information on CFC production and emissions, and to draw up control protocols if and when warranted. This was an important milestone: nations agreed in principle to tackle a global environmental problem before its effects were clear, or its existence scientifically proven—probably the first example of the acceptance of the 'precautionary principle' in a major international negotiation.

Talks on a control protocol began almost immediately, spurred by mounting scientific evidence of the ozone destruction hypothesis, and, on 16 September 1987, 46 countries signed the Montreal Protocol on Substances that Deplete the Ozone Layer. The protocol required that industrialised parties cut production and consumption of the five main CFCs by 50 percent from 1986 levels by 1999, with interim reductions. Production and consumption of the three main halons were frozen at 1986 levels from 1993. These control measures represented a compromise between the still uncertain science of ozone depletion and the priorities of important industrial sectors. Within six months, however, convincing evidence of the link between ozone depletion and CFCs was published and opposition to the principle of controls on ODS largely collapsed.

The Montreal Protocol

An important feature of the Montreal Protocol was its inherent adaptability to evolving scientific knowledge and technological developments. Even before it entered into force on 1 January 1989, plans were being made to strengthen its provisions. Over the past 14 years, the protocol has been modified no less than five times,

accelerating the phase-out schedules, adding new ozone depleting chemicals to its control provisions, and introducing other new features. In the industrialised world, consumption of CFCs was phased out completely by 1996, other than for a few essential uses; by 2005, consumption of all categories of ODS other than HCFCs (which have very low ozone depleting potentials), and methyl bromide for approved critical uses, will have ended in industrialised countries.

The protocol has proved to be a highly effective agreement, with a better record of achieving its aims than many of the 250 or so MEAs now in existence. By September 2003, a total of 184 countries had ratified it. No producers or significant consumers are left outside. Even though it allows developing nations, unlike industrialised states, a grace period in which to implement controls, world production of CFCs fell by 86 percent between 1986 and 1999.[3] The total combined abundance of ODS in the lower atmosphere peaked in 1992–94, and is now declining; in the stratosphere, concentrations lag by up to six years and are now thought to be at or near their peak. Current average ozone losses should, therefore, now be close to the maximum.[4] And although the rate of recovery of the ozone layer is affected by interactions with other pollutants, such as greenhouse gases, full recovery is expected by the middle of the century.

As well as its adaptability to changing scientific and technological developments, a number of other factors have contributed to the protocol's success.

- The recognition—now commonplace, but in 1987 an innovation—of 'common but differentiated responsibilities', recognising the special needs of developing countries through slower phase-out schedules.
- The 'adjustment' procedure for control schedules in the protocol, allowing countries to accelerate phase-out without the need for repeated treaty amendments, each requiring ratification (amendments have been used to add new substances to the protocol, and other new features).
- The participation, in regard to negotiation and implementation, of key sectors of society: governments, industry, scientists and non-governmental organisations (NGOs).
- The extent to which industry responded to the control schedules. Once initial resistance was overcome, companies rushed to compete in the markets for non-ozone depleting substances and technologies, developing alternatives (which

often proved cheaper and more effective than the originals) at a speed that no one initially anticipated.
- The incentives for compliance built into the protocol, in the form of 'sticks' (trade measures) and 'carrots' (financial and technical assistance).

It is the last point that is the focus of the remainder of this chapter.

Control schedules and data reporting

At the heart of the Montreal Protocol lies the control measures that it imposes on the production and consumption of ODS, defined in Article 2. These phase-out schedules, consisting of percentage reductions in consumption and production by specified years,[5] have been progressively tightened through agreements reached in London (1990), Copenhagen (1992), Vienna (1995), Montreal (1997) and Beijing (1999). Developing countries have longer phase-out periods (see below). The various categories of ODS are listed in four annexes to the protocol: Annex A (main CFCs, halons); Annex B (other CFCs, carbon tetrachloride, methyl chloroform); Annex C (HCFCs, hydrobromofluorocarbons, bromochloromethane); and Annex E (methyl bromide).

'Production' is defined as the total 'amount of controlled substances produced' minus any amounts used as chemical feedstock or process agents, or destroyed. 'Consumption' is defined as production plus imports minus exports. Most of the annexes listing ODS have a number of sub-groups, and it is total production and consumption aggregated by group, rather than each individual substance, that must be controlled. Each substance is also given an ozone depleting potential (ODP), measured against the reference point of CFC-12, which is allocated an ODP of 1.0; the production and consumption targets are calculated in ODP tonnes.

Trade in recycled and used ODS is not included in the calculation of production, in order to encourage recovery, reclamation and recycling. 'Essential uses' for which no alternatives have yet been identified are exempt from the controls; the main exemption is currently for CFCs for use as propellants in metered-dose inhalers for asthmatics. In addition, parties are permitted to exceed their control targets by a specified percentage to allow for exports to meet the 'basic domestic needs' of developing nations. This provision was included in the protocol to allay developing countries' fears of a lack of access to ODS after phase-out in the industrialised

world; in fact, the provision has become less important as several developing states have developed significant production capacities of their own. Phase-out schedules for these extra production allowances were agreed in Beijing, China, in 1999.

Article 7 describes parties' obligations to report data to the Ozone Secretariat in Nairobi, Kenya. Within three months of becoming a party, each country must provide data on production, imports and exports of ODS for the *base year* for each category of ODS: 1986 for Annex A, 1989 for Annexes B and C[6] and 1991 for Annex E. These provide the reference points against which production and consumption target reductions are calculated.[7] Parties then provide *annual data* on production, feedstock and process agent use, destruction, imports and exports, enabling calculations of 'production' and 'consumption', as defined in the protocol, to be made. The deadline for reporting annual data is 30 September of the following year.

Developing countries have one additional set of data to provide: the *baseline* data for each category of ODS. As mentioned above, developing countries have longer phase-out periods than developed states, and their starting 'reference points' are also set later. Defined in Article 5 of the protocol, these are the annual average of production or consumption: in 1995–97 for Annex A ODS; average 1998–2000 for Annex B; 2015 for HCFCs;[8] and average 1995–98 for Annex E. As this renders their *base year* data largely irrelevant, non-reporting of base year data is more or less overlooked in the compliance process, although the secretariat does encourage reporting of best estimates.

The secretariat provides forms for countries to fill in when reporting their data,[9] together with written guidance. The raw information is entered into a database, which carries out all of the necessary calculations, including working out the ODP tonnage involved and aggregating the groups of ODS. Data reports are produced, initially for the Implementation Committee (see below) and then for the Meeting of the Parties (MOP) and the general public.[10]

Timeliness of data reporting is a constant problem, although the Montreal Protocol fares much better than most MEAs in this respect. By 30 September 2002 (the deadline for reporting 2001 data), just over 50 percent—91 of then 180 parties—had actually reported; a further 29 had reported by the time that the data report for the 2002 MOP was published, 18 days later.[11] By June 2003, a total of 153 parties

(85 percent) had reported 2001 data. These are similar percentages to those of recent years.

In addition, several parties regularly report data earlier than they need to. By June 2003, for example, 56 of the protocol's 183 parties had reported 2002 data, three months before the deadline, and several more submitted data at or just before the July meeting of the protocol's Open-Ended Working Group (the preparatory meeting for the main MOP later in the year). However, 11 parties have never reported any data at all. MOPs regularly issue requests for parties to report data more quickly, and direct assistance is available to developing countries in this regard (see below).

Inevitably, the quality of the data received by the secretariat is also somewhat variable.[12] The data reporting forms introduced in 1997 dealt effectively with a number of earlier problems, including confusion over terms like 'feedstock', or whether to adjust the quantities reported by ODP value. But problems are still experienced, ranging from simple input errors to changes in the way in which countries collect data. As Sebastian Oberthür observed in his comprehensive survey of the data reporting system:[13]

> there is generally little information available on the methods used by parties in collecting data. For example, parties could rely on either information provided by producers, importers and exporters; information generated through a licensing system; customs data; or estimates … Such different methods might result in very divergent figures of varying accuracy'. Perhaps more importantly, 'no review mechanism is available to check the accuracy of the data submitted. Doubts exist about the reliability of a number of figures provided by governments.

There is no formal procedure for verifying the accuracy of submitted data. In practice, though, governments of countries receiving financial assistance with phase-out (see Section 5) will work together with the implementing agencies—the United Nations Environment Programme (UNEP), the United Nations Development Programme (UNDP), the United Nations Industrial Development Organization (UNIDO) and the World Bank—in collecting and reporting data, so there is some external monitoring. Scientific measurements of atmospheric concentrations also

provide an overall check on total volumes (although not, of course, on particular countries' data); the latest (2002) science assessment concluded that 'the observed abundance of CFCs, HCFCs, and methyl chloroform in the lower atmosphere continue to be consistent with reported production and estimated emissions'.[14] Oberthür concluded that 'the quality of data submitted by the parties to the Montreal Protocol has been improving over recent years … in general, the coverage of the Secretariat data with regard to the main producers and consumers of controlled substances is quite comprehensive'. Overall, 'despite the inadequacies regarding the parties' data submissions, the overall quality of the Secretariat data appears to be sufficient as a basis for political decision-making, at least with respect to the major ODS'.[15]

Monitoring compliance: the Implementation Committee

In 1987, negotiators decided, wisely, not to try and agree the details of the protocol's non-compliance procedure at the time, setting the trend for a number of later MEAs.[16] Article 8 of the original Montreal Protocol simply said that: 'The Parties, at their first meeting, shall consider and approve procedures and institutional mechanisms for determining non-compliance with the provisions of this Protocol and for treatment of Parties found to be in non-compliance'. It was not until 1992 that the full structure was agreed, but it has subsequently evolved into what most observers consider to be one of the most effective non-compliance mechanisms of any MEA.

The full procedure developed under Article 8, which was reviewed and modified slightly in 1998, is set out in 16 paragraphs of explanatory text, together with a short 'indicative list of measures that might be taken by a meeting of the parties in respect of non-compliance with the Protocol'.[17] It revolves around the protocol's Implementation Committee, which comprises two members from each of the UN's five geographical regions (countries, not individuals, are nominated). It normally meets twice a year and receives reports from the Ozone Secretariat on the data reported by the parties and their levels of compliance with their obligations.

The committee's procedures evolved rapidly in the mid-1990s to address problems associated with non-compliance in transition economies (see below). They are now changing again, as developing countries report data on their compliance, or non-compliance, with their first targets under the protocol: the 1999 freeze on CFC

consumption and production; and the 2002 freeze on halons and methyl bromide. The sheer number of developing country parties to the protocol (140 as of September 2003) has meant that the committee's work has expanded dramatically over the past two years, with meetings now being scheduled for three days each instead of one. Indeed, in many ways, along with the Executive Committee of the Multilateral Fund (see below), the Implementation Committee is one of the two most important institutions in the ozone regime today.

The secretariat itself is the main channel for reporting possible cases of non-compliance to the committee. In fact, the non-compliance procedure allows parties to report to the secretariat any party about which they have 'reservations regarding [its] implementation of its obligations under the Protocol'.[18] In practice, though, this provision has never been taken up, although the third option allowed under the procedure, self-reporting of non-compliance,[19] has occurred occasionally. While there is no formal way for any other organisation—like an NGO—to bring possible cases of non-compliance to the committee's attention, there is no reason why they should not informally raise any concerns they may have with committee members.

The main route for considering possible cases of non-compliance remains, however, the data report presented by the secretariat to each meeting of the Implementation Committee. This highlights those parties that have not reported data, in breach of their obligations under Article 7 of the protocol, together with those that have reported data showing production and/or consumption above the control schedules set out in Article 2 or Article 5. In many cases, there may be justifications for these deviations: agreed consumption for essential uses, for instance, or production for export to developing countries. Where the divergence cannot be explained, the first step is for the secretariat to write to the countries concerned asking them to clarify the discrepancies; in some cases, the data may simply include errors and can be revised.

If no satisfactory explanation is received, the party concerned is invited to appear before the committee to explain the reasons. The committee focuses on working with the party to discover why non-compliance has occurred and to suggest ways and means by which it can satisfy its obligations. In cases where the committee agrees that a state of non-compliance exists, the next step is to request that the party draw up an action plan for its return to compliance. This action plan centres

on a list of time-specific benchmarks, setting out annual production and/or consumption levels for the party until it returns to compliance. Other features include commitments to adopt key regulatory measures, such as establishing export and import licensing and quota systems and banning imports of equipment that uses ODS. Once the MOP agrees these action plans, the Implementation Committee monitors compliance with them, through reports from the countries concerned and from the relevant implementing agencies. It also considers what to do should the benchmarks not be met.

The committee itself only makes recommendations, all of which are referred to the MOP for adoption as decisions. Given the expansion of its work, these draft decisions are taking up an increasingly large proportion of the MOP agenda: at the 2002 MOP, for example, no less than 25 of 43 decisions originated from, or were related to, the Implementation Committee.[20] Underlying this relatively non-confrontational approach is the threat of the use of the 'sticks'. The 'indicative list of measures that might be taken by a meeting of the parties in respect of non-compliance with the Protocol' includes issuing formal cautions and the suspension of specific rights and privileges under the protocol, such as those dealing with finance and trade (see below); sometimes these are explicitly mentioned in the decision dealing with the party. Whether or not non-complying parties really feel threatened by these measures is, perhaps, questionable, but it is clear that they do not like being identified in MOP decisions, often saying so openly in the meeting. Conversely, officials from non-complying parties have sometimes found it useful for their country to be listed, helping them to argue with colleagues at home the need for greater urgency in dealing with the issue.

The first big challenge to confront the non-compliance regime was the problems associated with the transition economies in Central and Eastern Europe and the former Soviet Union. Between 1995 (the last year before the total phase-out of CFCs in industrialised countries) and 1999, a total of 24 decisions were taken on compliance by 12 countries, all of them transition economies; six of them had warned the 1995 MOP that they were unlikely to achieve compliance due to internal political and economic disruption. The decisions followed the formulations described above, centreing on commitments to meet time-specific phase-out benchmarks. The record in regard to all of these countries has been positive, with almost every

state identified gradually moving back into compliance,[21] with relatively few diplomatic feathers ruffled along the way (despite a walk-out by the Russian delegation at the 1995 MOP). In the case of Russia, the most serious non-complying party to the treaty (and the only producer of CFCs among the transition economy parties), a World Bank special initiative mobilised additional funding to ensure production sector phase-out, which was achieved in 2000.

The next, and probably more serious, challenge that is beginning to manifest itself concerns compliance by developing countries. All of the 12 decisions of the 2002 MOP that requested or presented action plans dealt with developing countries—it seems likely that several more will be dealt with similarly in 2003. New issues are also emerging, including the problems faced by low volume consuming states, which cannot cost-effectively import quantities small enough, in a single year, to fall below their phase-out thresholds (although, as the quantity is used over several years, actual use in any one year does fall below the threshold), and by countries that experienced abnormal conditions during their baseline data years (for example, Bosnia–Herzegovina, which was in the midst of a civil war) and thus have unusually low baselines against which to measure future consumption. A more serious problem has arisen in regard to a number of parties' requests for upwards revisions of baseline data. To a certain extent, this was to be expected, as data reporting systems tend to improve over time, and original data may often be of low quality. But there is a clear danger in simply accepting revisions, since this could provide an easy way out for parties experiencing difficulty in meeting their obligations. The committee has proceeded very cautiously in relation to these requests, and has not yet found a satisfactory way to deal with them.

The committee itself has worked relatively harmoniously, although, in general, the two members from the 'Western Europe and Others' group have tended to play a much more active role than other members—not surprising perhaps, as these countries tend to have the largest delegations and the greatest capacity to devote to the task. Nevertheless, there has been broad consensus on the evolution of the non-compliance system and, importantly, no draft decision originating from the committee has ever been rejected by the MOP or has had to be referred back to it for further refinement.

Encouraging compliance: trade measures

The key weapon in the protocol's non-compliance armoury is the threat of restrictions on trade in products controlled by the agreement.[22] These were built into the regime from the outset, as measures designed to be employed against non-parties, but they now also constitute an important potential tool for use against non-complying parties.

Article 4 of the protocol required that parties ban the import of Annex A ODS from non-parties from 1990 (one year after the protocol came into force); exports to non-parties were prohibited from 1993. Imports of goods containing CFCs (listed in Annex D and including, for example, refrigeration and air-conditioning equipment) were proscribed from 1993; a ban on imports of products made with, but not containing, ODS (such as electronic components) was contemplated under the protocol, but the parties decided, in 1993, that its introduction was impracticable due to difficulties concerning detection. As new substances have been added to the control schedules, the trade provisions have gradually been extended to cover them, too. The trade restrictions are not applicable, however, to a non-party that a MOP decides is otherwise in compliance with the control schedules.

The trade provisions had two aims. One was to maximise participation in the protocol, by denying non-signatories supplies of ODS, which always originated from a relatively small number of countries. The other goal, should participation not become universal, was to prevent industries from migrating to non-parties to escape the phase-out schedules and then exporting to states that are parties. (In fact, as industrial innovation proceeded far more quickly than expected, many of the substitutes proved significantly cheaper than the original ODS—but this was not foreseen in 1987.) In practice, the trade restrictions have not often been applied, largely because every major producer and consumer is now a party to the protocol. There is direct evidence from some countries that the trade provisions were important in persuading them to accede to the treaty; a good example is the Republic of Korea, which initially expanded its domestic CFC production, but realising the disadvantages of being shut out of Western markets, became a party.[23]

These trade measures can also be employed against non-complying parties, which can be suspended under the 'indicative list of measures' from 'specific rights and privileges under the Protocol … including those concerned with … trade'.[24] As

noted above, their use has been threatened, in a series of MOP decisions, usually in the following terms: 'These measures may include the possibility of actions available under Article 4, such as ensuring that the supply of CFCs … is ceased and that exporting parties [parties exporting to the non-complying party] are not contributing to a continuing situation of non-compliance'. So far, this provision has never had to be used, but, as with the former non-parties that decided to accede, its existence appears to be important in encouraging compliance. The measures can also be applied relatively flexibly; in the case of Russia, for instance, the only case to date of a major producing country that has been in non-compliance, a 1995 decision of the parties[25] specified that it could continue to export, despite its non-compliance, to former Soviet states, for which it was historically the main supplier.

Encouraging compliance: the Multilateral Fund

Arguably more important than the protocol's 'sticks' are its 'carrots', the financial and technical assistance available for aiding compliance. Article 10 of the protocol provides for a financial mechanism to meet the incremental costs facing developing countries[26] in phasing out ODS. The Multilateral Fund was thus established, as an interim mechanism in 1990, and in its final form in 1992. Industrialised parties contribute to it according to the standard UN assessment scale. Funding was set at US$240 million for 1991–93, US$510m for 1994–96, US$540m for 1997–99, US$476m for 2000–02, and US$573m for 2003–05. This amounts to about US$2 billion over 15 years.[27] Around 90 percent of the promised funding has been received, an excellent record for an international agreement (the main non-contributors, unsurprisingly, being the transition economies).

The fund has its own secretariat (based in Montreal, Canada) and is directed by an Executive Committee, comprising representatives of seven developing and seven developed countries selected by the annual MOP. The fund operates through four implementing agencies, each with a slightly different role.

- UNEP's Division of Technology, Industry and Economics assumes clearing-house functions, carries out institutional strengthening activities and helps to prepare country programmes, especially for low volume consuming states. In 2002, it initiated its Compliance Assistance Programme geared towards achieving total

phase-out, and decentralised most of its resources to the regional level, facilitating direct support to developing countries.

- UNDP organises demonstration and investment projects, provides technical assistance and conducts feasibility studies.
- UNIDO prepares and appraises investment project proposals and implements phase-out schedules at the plant level.
- The World Bank, which disburses almost half of the total funding, concentrates on large-scale phase-out and investment projects at the plant and country levels.

Each developing state, assisted by one or more of these agencies, prepares a country programme, showing its present and projected use of ODS and identifying opportunities for reduction. The 'incremental costs' that countries can claim include the costs of conversion to alternative technologies and substances, patents, designs and royalties, training and research and development. Recycling controlled substances and modifying or replacing equipment can also be eligible. The Executive Committee has discretionary powers to include costs other than those listed. An early, and important, step was its decision to allow finance for 'institutional strengthening', creating the institutional capacity, in terms of personnel, to carry out the phase-out process. This process, which is UNEP's main function as an implementing agency, usually involves providing funding to, and training for, a National Ozone Unit within the relevant ministry, and running regional networks and training events. A later important development was the decision to help fund the phase-out of ODS production (as well as consumption), covering, to date, Argentina, China, the Democratic People's Republic of Korea, India and Mexico.

The Executive Committee approves both the country programmes and subsequent proposals for investment projects and institutional strengthening. By the end of 2002, a total of US$1.06bn had been spent to support the phase-out of about 130,000 ODP tonnes of consumption and more than 50,000 ODP tonnes of production.

In addition to Article 10 of the protocol, Article 10A calls on all parties to transfer 'the best available, environmentally safe substitutes and related technologies' to developing countries. Effectively this function has been taken over by the Multilateral Fund, and appropriate measures built into its decisions on investment projects.

Clearly, the activities of the fund and the decisions of its Executive Committee are of key importance to the work of the Implementation Committee. In recognition

of this, the latter decided, in 1994, to invite the chair and vice-chair of the Executive Committee to attend its meetings, and this is now normal practice; the president of the Implementation Committee has also, on occasion, been invited to participate in Executive Committee meetings. More broadly, countries in receipt of Multilateral Fund assistance are required to report data to it as part of the conditions for receiving support; although the format and deadlines are different from the protocol's procedures under Article 7, this can provide a helpful check on data reported (or not reported) to the Ozone Secretariat.

More importantly, the four implementing agencies work closely with those nations in receipt of Multilateral Fund assistance; they possess a high degree of knowledge about the local situation and often help non-compliant parties prepare their compliance action plans. They are also frequently involved in helping to collect the data reported by countries to the Multilateral Fund, thereby providing something of an external monitoring system (in common with data reported under Article 7 of the protocol, there is no formal verification procedure). The agencies' degree of participation in Implementation Committee meetings has grown in recent years, particularly during discussions of compliance by individual parties that are invited to attend[28]—with considerable benefit for the Implementation Committee's deliberations.

With the collapse of the Soviet bloc in the late 1980s and early 1990s, it became obvious that the countries that emerged would need assistance with meeting their protocol obligations, given the difficulties caused by the massive restructuring of their economies—yet very few of them were eligible for support from the Multilateral Fund.[29] The gap was met by the Global Environment Facility (GEF), which was created in 1991 to provide finance for environmentally sustainable development. The GEF has played a major role in assisting compliance among the transition economies, allocating some US$155m between 1991 and 1999. On occasion, GEF assistance to Russia, then in non-compliance, was delayed until it had reported the data it was required to—a means of dealing with persistent non-compliance that may be of future application in the context of the Multilateral Fund.

The GEF operates in a similar way to the Multilateral Fund, largely borrowing its procedures, and using three of the same four implementing agencies (UNDP, UNEP and the World Bank). The GEF Secretariat has also participated in Implementation

Committee meetings, although it has tended to be absent in recent years, as most of its projects in transition economies were completed successfully. The approach of methyl bromide phase-out in 2005, however, together with a few continuing problems of non-compliance, prompted re-engagement; the GEF Secretariat was present at the July 2003 meeting of the Implementation Committee, and the GEF business plan for 2004–06 includes US$12m for methyl bromide phase-out projects.

Conclusion

The Montreal Protocol's compliance system is rightly regarded as a model worthy of emulation. Suggestions have been made at various times by parties to the 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) for an implementation or compliance committee analogous to the protocol's Implementation Committee.[30] The 1993 Lucerne Conference of European Environment Ministers called for the development of non-confrontational compliance procedures (à la Montreal) for all MEAs.[31] Conversely, in other fora, for example in the negotiations over the 1992 United Nations Framework Convention on Climate Change and the 1997 Kyoto Protocol, the regime has been regarded as too effective to be copied, mainly given its potential recourse to trade measures as an enforcement mechanism.[32]

The Montreal Protocol has a unique combination of strengths: an effective set of procedures and institutions, centred around the Implementation Committee, a well-funded financial mechanism to assist with compliance, and a credible threat of sanctions—chiefly trade measures—for use in cases of persistent non-compliance. It has a successful record in dealing with non-compliance among transition economies, and, although it faces a major challenge in regard to developing countries, there seems every reason to believe that it can cope with them just as successfully. Among the not always encouraging stories of international environmental co-operation, it stands as a shining light.

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Endnotes

[1] See Clare Tenner, 'Multilateral environmental agreements: trends in verification', *Verification Yearbook 2000,* The Verification Research, Training and Information Centre (VERTIC), London, 2000, pp. 133–149.

[2] All figures are taken from the 'Synthesis of the 2002 reports of the scientific, environmental effects and technology and economic assessment panels of the Montreal Protocol', United Nations Environment Programme (UNEP), UNEP/OzL.Pro/WG.1/23/3, 25 February 2003.

[3] Sebastian Oberthür, *Production and Consumption of Ozone-Depleting Substances 1986–1999: The Data Reporting System of the Montreal Protocol,* Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Eschborn, 2001, p. 42.

[4] Observations released in July 2003 by the National Aeronautics and Space Administration (NASA) suggest that the rate of ozone destruction is now beginning to fall—if confirmed, a significant development. See www.nasa.gov/home/hqnews/2003/jul/HQ_03253_Ozone_Recovery.html.

[5] The final schedule for reducing CFC production and consumption in industrialised countries, for example, was a freeze at 1986 levels by 1989, a 75 percent reduction by 1994, and total phase-out by 1996 (with specified exemptions).

[6] In fact, there is no requirement for reporting base year data for bromochloromethane, the one substance listed in Annex C Group III—given that the only control requirement is 100 percent phase-out by 2002, base year data would be irrelevant. The same argument could apply to the hydrobromofluorocarbons (HBFCs) in Annex C Group II, where the one control requirement is 100 percent phase-out by 1996. For some reason, though, the protocol still requires reporting of base year data for 1989.

[7] Except for HCFCs, common first generation replacements for CFCs, where the baseline figure against which consumption reductions are calculated is set at the 1989 HCFC consumption level plus 2.8% of the 1989 CFC consumption level. The production baseline is slightly more complicated, but based on similar principles.

[8] The other ODS in Annex C are treated in the same way as in developed countries (see endnote 4).

[9] Available at www.unep.org/ozone/data-reporting-tools.shtml.

[10] The latest version—*Production and Consumption of Ozone-Depleting Substances under the Montreal Protocol, 1986–2000,* Ozone Secretariat, Nairobi, UNEP, April 2002—is available at www.unep.org/ozone/15-year-data-report.pdf.

[11] See UNEP/OzL.Pro/14/3, p. 5.

[12] For a comprehensive review, see Sebastian Oberthür, chapter 2, pp. 11–32.

[13] Sebastian Oberthür, p. 19.

[14] 'Synthesis of the 2002 reports of the scientific, environmental effects and technology and economic assessment panels of the Montreal Protocol', paragraph 14. For a discussion of the other ODS for which measurements are more difficult, or where discrepancies appear to exist (mainly in regard to carbon tetrachloride), see the full Scientific Assessment Panel report, available at www.unep.org/ozone/sap2002.shtml.

[15] Sebastian Oberthür, p. 19.

[16] For details of negotiations on this issue, see Patrick Széll, 'The Montreal Protocol: a new legal model for compliance control', in Philippe G. Le Prestre, John D. Reid and E. Thomas Morehouse, Jr. (eds), *Protecting the Ozone Layer: Lessons, Models and Prospects,* Kluwer Academic Publishers, Boston/Dordrecht/London, 1998; Richard Benedick, *Ozone Diplomacy: New Directions in Safeguarding the Planet,* Harvard University Press, Cambridge, 1998) (2nd ed); and Stephen O. Andersen and K. Madhava Sarma, *Protecting the Ozone Layer: The United Nations History,* Earthscan, London, 2002.

[17] See *Handbook for the International Treaties for the Protection of the Ozone Layer,* UNEP, Nairobi, 2003 (6th ed), Section 2.7, 'Non-compliance procedure', pp. 295–297.

[18] *Handbook for the International Treaties for the Protection of the Ozone Layer,* paragraph 1.

[19] *Handbook for the International Treaties for the Protection of the Ozone Layer,* paragraph 4.

[20] The decisions dealt with the following issues: membership and functioning of the committee (2); agreed changes in baseline data (1); general requests for data to be reported (2); specific requests (to listed parties) for data to be reported (2); requests for explanations of deviating data (2, listing six parties), requests to parties in non-compliance for plans of action (10); agreed plans of action for countries in non-compliance (3); notes of parties currently or previously in non-compliance but returned to, or expected to return to, compliance (2); others (1).

[21] Kazakhstan and Tajikistan, which acceded the protocol relatively late, were identified in 2001 as being in non-compliance.

[22] For a full description of the evolution and operation of the trade measures, see Duncan Brack, *International Trade and the Montreal Protocol,* Earthscan/Royal Institute of International Affairs, London, 1996.

[23] See Duncan Brack, pp. 54–58, for other examples.

[24] 'Indicative list of measures that might be taken by a MOP in respect of non-compliance with the Protocol', section C, *Handbook for the International Treaties for the Protection of the Ozone Layer,* p. 297.

[25] Decision VII/18, 'Compliance with the Montreal Protocol by the Russian Federation', adopted by the 7th MOP in December 1995.

[26] Strictly speaking, parties that are both developing countries and consume below a certain threshold level of CFCs and halons—'Article 5 parties'—are eligible for assistance. A few of the richer developing countries, such as the Republic of Korea, were initially excluded from the category, and a few transition economies have subsequently been added.

[27] Each of the sums after the first included some money collected but not allocated from the previous period: US$76m, for example, of the US$573m for 2003–05.

[28] Although the section of the Implementation Committee meeting that finalises recommendations for the MOP is held in private.

[29] Most of them were not classified as developing countries—although some have since been reclassified—and, also, they consumed above the threshold set in Article 5 of the protocol.

[30] See Rosalind Reeve, *Policing International Trade in Endangered Species: The CITES Treaty and Compliance,* Earthscan/Royal Institute of International Affairs, London, 2002, pp. 268–272.

[31] Peter Sand, 'The Montreal Regime: Sticks and Carrots', in Philippe G. Le Prestre, John D. Reid and E. Thomas Morehouse, Jr. (eds), p. 107.

[32] See Patrick Széll, p. 94.

III other issues

13

US nonproliferation assistance: verification and transparency

Michael Jasinski

The collapse of the Soviet Union in 1989 exacerbated fears that the vast Soviet arsenals of weapons of mass destruction (WMD) and associated materials and know-how might no longer be adequately safeguarded. This gave rise to a number of US government assistance programmes, known under the collective rubric of Cooperative Threat Reduction (CTR), intended to ensure the safety and security of WMD assets in former Soviet republics. The Soviet Nuclear Threat Reduction Act of 1991 set out the following goals: 'A) to facilitate on a priority basis the transportation, storage, safeguarding, and destruction of nuclear and other weapons in the Soviet Union, its republics, and any successor states; and B) to assist in the prevention of weapons proliferation'.[1] Since their inception these programmes, implemented by the departments of Defense, Energy, State and Commerce, have been allocated approximately US$4 billion. In spite of some difficulties, significant progress has been made toward accomplishing their goals.

The Department of Defense (DOD) CTR programmes focus on helping the newly independent states of the former Soviet Union to meet their disarmament obligations under the 1991 Strategic Arms Reduction Treaty (START I), as well as improving the security of WMD storage and transport facilities. The Department of Energy (DOE), by comparison, is tasked with safeguarding nuclear materials in Russia and other former Soviet republics, stemming the 'brain drain' of nuclear scientists, and the disposition of excess nuclear materials. The nonproliferation assistance programmes of the departments of State and Commerce concentrate on providing export control assistance as well as training and equipment for customs and border guard organisations. Other key programmes funded by the State Department (in cooperation with other Western governments) include the International Science

and Technology Center (ISTC) in Russia and the Science and Technology Center in Ukraine (STCU), which were established to redirect WMD expertise in the newly independent states to other uses. The State Department's Nonproliferation and Disarmament Fund also participates in various DOE and DOD projects. These efforts, while of great significance, are not directly concerned with reducing or safeguarding WMD stockpiles or delivery vehicles, and are thus outside this chapter's scope.

Verification methods and challenges

From its beginning, the CTR programme (also known, particularly in Russia, as the Nunn–Lugar Program after its two main authors)[2] has placed great emphasis on the verifiability of the activities it funds and ensuring the transparency of operations funded by CTR monies. There have been relatively few verification-related problems affecting the progress of CTR projects. By the estimate of former Senator Sam Nunn, one of the co-authors of the CTR programme and one of its staunchest supporters, in 2002 up to 90 percent of CTR projects were being successfully implemented.[3]

The verification activities that are performed within the framework of various CTR projects take a number of forms. In cases when projects involve performance criteria that are easily quantifiable (for example, the elimination of ballistic missiles and other weapon systems), verification is carried out in a relatively straightforward manner by physically confirming that the criteria have been met. In other cases such direct verification is impossible either because security considerations (for example, nuclear warhead security) preclude Western access to sites or because the nature of the activity does not lend itself to such straightforward methods. Moreover, in many instances the assistance takes the form of improving the capabilities of the Russian entities charged with nuclear safety and security. In such situations verification is performed by ensuring the accountability and proper use of equipment and/or services provided to Russian entities. Since in many situations Western access to Russian nuclear stockpiles is limited or impossible, such verification is an indirect method of ensuring the security, if not necessarily the transparency, of the Russian nuclear complex.

Western efforts to increase the security and transparency of Russia's nuclear stockpiles have encountered a number of difficulties. One of the biggest threats to these programmes is possible diversion of assistance. Because Russia's economic and

political institutions are still developing, the risk of diversion of assistance is high, and on-site auditing provisions are therefore a vital part of the overall CTR effort to make the Russian nuclear stockpiles both more secure and transparent. The opaqueness of the Russian financial system makes it difficult to ensure that nonproliferation assistance is applied correctly. A Russian parliamentary audit, conducted by the Audit Chamber, revealed that US$270 million of foreign aid that was intended for nuclear disarmament was not accounted for.[4] Some Russian lawmakers reportedly suspect the military of diverting assistance to weapon programmes, although no reliable information is available.[5]

Another problem is secrecy. The Russian authorities have often been reticent about providing access to nuclear facilities. In part this is due to the understandably sensitive nature of these sites. However, other factors include lingering Cold War-era suspicions and resentments, which find their expression in the fears of some Russian officials that CTR-provided equipment may be used to gather intelligence information. Russian journalist Aleksandr Golts believes that, apart from concern about revealing military secrets, the Russian military resist intrusive nonproliferation assistance verification methods because they do not want outsiders to see how far the Russian armed forces have decayed. Golts also believes that the Russian military want to divert assistance to other uses, including financing the war in Chechnya.[6]

Considerations of prestige and status may also be factors. Many Russian officials wish to avoid a donor–recipient relationship and see this as incompatible with Russia's great-power status. The Russian government has been stung by American allegations that Russia is a 'WMD supermarket', its WMD stocks and technologies insufficiently safeguarded and posing a significant proliferation threat.[7] Even though Russia on occasion has acknowledged threats to its security, including from Chechen separatists, it has consistently and steadfastly denied that its nuclear weapons are in danger of being stolen.[8] Russian opposition may also be due to the fact that much of the CTR assistance is spent on American, rather than Russian, goods and services, although in this respect the situation has improved in recent years. Resentment is also caused by the implied suspicion of theft, exemplified by Pavel Felgengauer's comment in 2002 that, while the US administration is afraid that Russian government agencies and contractors will misappropriate CTR assistance, only US programme officials have ever been the object of a criminal investigation.[9]

Russian opponents of the assistance programmes appear to have had some success in slowing them down. According to some observers, the transparency problem has actually become worse in recent years.[10] The Russian security service, the Federal Security Service (Federal'naya Sluzhba Bezopasnosti, FSB), has become more active in combating the dissemination of information about Russia's WMD programmes. The imprisonment of the Russian researcher Igor Sutyagin, who is alleged to have disclosed classified information concerning Russian tactical nuclear weapons, is only the most prominent example of the more aggressive stance recently adopted by the FSB.[11] Although the Russian authorities have explained their increased emphasis on secrecy as being part of efforts to protect Russia against terrorism, this has had the net effect of reducing the public flow of information.

The overall attitude toward increasing nuclear transparency was exemplified by the tepid Russian response to the '10 + 10 Initiative' of the Group of Eight industrialised countries (G8),[12] launched at its summit meeting in Kananaskis, Canada, in June 2002. The G8 countries pledged up to US$20 billion of new funding towards nonproliferation assistance projects, with particular emphasis on chemical weapons, the dismantling of nuclear submarines and fissile material disposition.[13] Russian observers noted that Russian officials were far from overjoyed by the prospect of this aid. In some cases this was due to their scepticism that the promised funds would ever materialise. At least in part, however, the lack of enthusiasm was due precisely to the fact that the opaqueness of the nuclear stockpiles would be more difficult to maintain if the aid programme was implemented.[14]

Department of Energy programmes

The DOE has made considerable efforts to ensure improved transparency and security of Russian fissile materials. The ultimate goal of those efforts is to establish a high degree of transparency in regard to the Russian nuclear weapons and materials stockpiles, starting with deployed nuclear warheads, through the non-deployed warhead stockpile and weapon disassembly plants, and ending with excess component storage, conversion and blending activities, and the storage of excess high enriched uranium (HEU) and plutonium. The 2000 DOE Warhead and Fissile Material Transparency Program Strategic Plan does not include any provisions for monitoring the storage of strategic reserve components or weapon assembly plants.[15]

Key activities include the Materials Protection, Control and Accounting (MPC&A) Program, which improves the security of fissile materials in the newly independent states by providing security upgrades to selected nuclear facilities, promoting the consolidation of nuclear materials in central sites, and improving nuclear materials accounting procedures. The DOE also manages all Russian fissile material disposition projects, which are designed to convert weapons-grade material into nuclear fuel. In addition, DOE programmes include MPC&A upgrades to Russian facilities housing fresh and spent naval nuclear reactor fuel, as well as some facilities with naval nuclear weapons. DOE programmes also focus on ensuring the security of Russian nuclear materials, disposing of excess fissile materials, and preventing the brain drain of Russian nuclear scientists. The DOE Nuclear Cities Initiative (NCI) and the Initiative to Prevent Proliferation (IPP) seek to provide alternative employment opportunities for the employees of the Russian nuclear industrial complex, reducing the risk that individual scientists might transfer their weapon design know-how to countries of concern.

Efforts to increase the transparency of Russian nuclear stockpiles are being pursued through several different programmes in various stages of development. Deployed strategic nuclear warheads are already partially covered by the START I verification provisions, and the safeguarding of non-deployed nuclear warheads is the concern of the DOD. It was hoped that START III would eventually extend verification provisions to non-deployed warheads, disassembly activities and the storage of excess components. However, START III is now defunct, and the 2002 US-Russian Strategic Offensive Reductions Treaty (SORT) that superseded it is unlikely to incorporate such extensive verification provisions in the foreseeable future.[16] Nevertheless, the DOE has been pursuing the Russian Lab-to-Lab Warhead Dismantlement Transparency Program, whose purpose is to sustain an unclassified technical dialogue with Russian experts on warhead dismantlement transparency and foster support for transparency within the Russian nuclear weapons establishment. The goals of the programme include identifying the Russian nuclear weapons dismantlement programme, demonstrating transparency measures to confirm nuclear weapons dismantlement, and providing a 'chain of custody' of extracted nuclear material.[17] Only limited progress has been made in this programme. So far Russian experts have identified the main steps in the Russian warhead dismantlement process,

specified a number of technological approaches to verifying warhead dismantlement, and performed demonstrations of unclassified technologies. Further progress has been hindered by concerns about secrecy and access to sensitive facilities.[18]

By contrast, the conversion and downblending of weapons-grade materials from disassembled warheads is the most advanced portion of this effort. It also enjoys the most comprehensive transparency measures. It dates back to the US-Russian 1993 HEU Purchase Agreement, by which Russia is to sell to the US, over a period of 20 years, 500 metric tonnes of HEU extracted from dismantled nuclear warheads for conversion into reactor fuel. All the HEU-to-LEU (low enriched uranium) downblending operations are conducted at Russian nuclear facilities, while the conversion to reactor fuel is performed in the US. The United States Enrichment Corporation (USEC) transfers payments to the Russian company Tekhsnabexport.

The HEU Purchase Agreement includes what at present is the only formal large fissile material transparency regime. The Protocol on HEU Transparency Arrangements of March 1994 laid out procedures for ensuring transparency of operations at both the American and the Russian facilities involved in the project. The protocol permits reciprocal visits at a number of facilities in each country—six sites in the US where the LEU is transformed into nuclear fuel and four Russian facilities where HEU is downblended into LEU.[19] Monitoring at Russian facilities began in 1996. American monitors are entitled to observe the downblending process, put American tags on HEU and LEU containers, and review Russian nuclear material accounting documents.[20] In October 1996, in return for advance payment of US$100 million, the Russian Ministry of Atomic Energy (Minatom) also agreed to enhanced transparency measures which include the use of US equipment for the verification of the presence of weapons-grade HEU and for continuous monitoring of the blending process.[21] The DOE has set up a permanent office in Novouralsk with four monitors who have continuous access to the Ural Electrochemical Combine.[22]

A report by the US General Accounting Office (GAO), issued on 22 September 2002, stated that most of the transparency provisions of the agreement have been put in place. Problems identified by the report included lack of access to weapons dismantlement facilities and delay in putting some of the verification measures into place. Continuous monitoring equipment was installed in only one facility

(the Ural Electrochemical Combine), and the issue of installing the equipment at two other facilities was unresolved. However, the GAO report found that the existing verification measures provided sufficient confidence that HEU is being downblended, even though these measures were deemed insufficient to guarantee that all LEU shipped to the US was the product of downblended HEU extracted from nuclear weapons. Furthermore, no progress has been made on additional transparency and the access measures proposed by the US administration in 1998 beyond the expression of interest by one Russian facility.[23]

Similar efforts are also being undertaken to account for, secure and eliminate surplus plutonium. In 1995, the US and Russia each declared 50 metric tonnes of weapons-grade plutonium from dismantled nuclear warheads as surplus. On 2 September 1998 US President Bill Clinton and Russian President Boris Yeltsin signed the Joint Statement of Principles for Management and Disposition of Plutonium Designated as No Longer Required for Defense Purposes.[24] Continued negotiations led to the 2000 Plutonium Disposition Agreement, signed by US Vice-President Al Gore and Russian Prime Minister Mikhail Kasyanov, which obliges both the US and Russia to eliminate 34 metric tonnes of the surplus plutonium each by using it as reactor fuel or blending it with radioactive waste. The Plutonium Disposition Agreement was the result of many years of negotiations.

A major role in the plutonium disposition verification effort will be played by the Trilateral Initiative, a joint effort launched in 1996 by the US, Russia and the International Atomic Energy Agency (IAEA). The Trilateral Initiative is an international monitoring regime whose purpose is to verify the permanent and irreversible removal of weapon materials from US and Russian nuclear weapon programmes and their subsequent storage.[25]

The Plutonium Management and Disposition Agreement signed by Russia and the US in September 2000 also contains provisions for the IAEA to be involved in verification activities, using techniques developed as part of the Trilateral Initiative. At the 2002 IAEA General Conference the Trilateral Initiative Working Group declared completed its task of investigating the legal, financial and technical aspects of creating a verification regime for classified and unclassified nuclear materials that would provide a high degree of confidence without revealing sensitive data. However, a number of crucial issues remained unresolved.[26]

In addition, the US is conducting an effort to reduce the amount of plutonium produced by the Russian reactors. Named Elimination of Weapons-Grade Plutonium Production, this programme is now managed by the DOE, although it was the responsibility of the DOD until December 2001.[27]

Excess weapons-grade materials will be stored under the Mayak Fissile Material Storage Facility (FMSF) transparency arrangements. The Mayak FMSF was conceived in 1992 as a storage facility for up to 50 tonnes of excess plutonium and 200 tonnes of uranium from dismantled nuclear warheads. Half of the funding for the project was to be provided by the US (through the DOD CTR programme) and half by Russia. However, Russia failed to provide its portion of the costs, and the US share of the project funding increased. Since the material to be stored at the Mayak FMSF must be of weapons origin, the DOE is developing technologies to confirm its origin by measuring a number of characteristics of the material, including the mass of fissile material components and the isotopic ratios and chemical composition of the material, while ensuring that no critical information is revealed. The US and Russia are also considering, under the Processing and Packaging Implementation Agreement (PPIA), how to support the processing and packaging of materials to be stored at the FMSF. The PPIA would entitle the US to conduct measurements to determine the weapons origin of the material prior to its reshaping and packaging, and to establish a chain of custody for the material. This aspect of the effort to ensure the transparency and security of Russian fissile materials is funded by the DOD, the main agency, through the CTR programme.[28]

Another crucial DOE programme is the MPC&A programme, which up until 1995 was implemented by the DOD. Its purpose is to safeguard the approximately 603 tonnes of weapons-grade material (not counting material in nuclear warheads) that Russia was estimated to possess at the time the Soviet Union broke up. MPC&A improvements include upgrading physical protection systems at sites where fissile materials are stored, incorporating control systems that would indicate theft or tampering, and modernising accounting systems to help keep track of fissile materials.[29] By the end of 2002 fewer than half of the 252 buildings at 40 sites where weapons-usable materials are stored had received such upgrades, but the process is continuing. The MPC&A effort also includes security upgrades to Russian naval nuclear warhead storage facilities through the installation of fences, strengthened

doors, security and monitoring systems, and radio communication systems. By 2002, the DOE was working on all but one of the 42 sites where an estimated 4,000 nuclear warheads are stored,[30] and had succeeded in implementing immediate upgrades to 91 percent of the sites and comprehensive upgrades to 17 percent.[31]

In late 1995 the DOD transferred the responsibility for the MPC&A projects to the DOE. The DOE has also developed its own procedures for verifying equipment accountability and usage. They include delivery and receipt verification, on-site visits by technical teams, videos, photographs and other documentation.[32]

Department of Defense programmes

CTR projects that deal directly with nuclear weapons and delivery systems include the Strategic Offensive Arms Elimination (SOAE) projects, the construction of the FMSF which was discussed in greater detail above, and the Weapons Protection, Control and Accounting (WPC&A) project. In addition, the DOD is involved in defence conversion efforts, improving contacts between the US and Russian militaries, and the elimination of chemical weapons.

Since many of the activities are performed by Russian subcontractors, or cannot be verified directly, on-site verification of scheduled eliminations is supplemented by a comprehensive programme of on-site auditing and accounting for the goods and services provided. The 1992 CTR Umbrella Agreement negotiated with Russia and other recipients of CTR assistance in the Commonwealth of Independent States (CIS) includes provisions that require adherence to US laws and regulations, including the Federal Acquisitions and Regulations Act (FAR), which requires that all federally-funded activities be subject to verification. FAR adherence is a mandatory requirement for all enterprises, whether they are in the US or CIS countries, seeking CTR contracts.[33] Under the umbrella agreements, the DOD has established the right to examine the use of any equipment or goods supplied. The terms of the umbrella agreements vary from country to country.

The main verification tool used by the DOD is audits and examinations (A&Es) whose purpose is to ensure that the assistance is fully accounted for and is being used in accordance with the intended purpose. The DOD is obligated by the annual National Defense Authorization Act, authorising CTR funding, to provide an annual accounting to Congress of the results of its verification activities. Each year DOD

personnel conduct numerous on-site A&Es to ensure proper use and accountability of equipment and resources by entities in Russia and other recipient countries. A&Es are conducted at a rate of approximately one a month, with about half of A&E activities taking place in the Russian Federation, the largest recipient of CTR assistance. In addition to A&Es, on-site verification is performed by programme managers and by CTR logistics contractors who carry out maintenance. Furthermore, Western firms which were awarded CTR contracts maintain a continuous on-site presence. The close contacts between US and Russian firms has yielded benefits in terms of eliminating the risk of proliferation (for example, following reports of ballistic missile gyroscopes finding their way to Iraq, the accountability of such devices throughout the missile elimination cycle was strengthened) and has also resulted in Russian firms adopting more transparent Western-style business practices.[34]

Since the Defense Threat Reduction Agency (DTRA) does not have sufficient resources to perform annual audits of all CTR-provided equipment and services, it uses a number of selection criteria to identify CTR programmes that will be audited in a given year. These criteria include the value of assistance provided, the date of the most recent audit, the results of previous audits, and instructions from the Assistant Secretary of Defense for Strategy and Threat Evaluation. A GAO report released in December 2002 criticised the A&E methodology used by the DOD, although it did acknowledge that the DOD met the accountability requirements.[35]

SOAE projects lend themselves especially well to quantitative verification, since performance is measured in terms of number of ballistic missiles eliminated, numbers of missile silos and quantities of rocket fuel. By mid-2003 American inspectors had verified the deactivation of over 6,000 nuclear warheads (out of the total requirement of 13,000), the destruction of over 900 sea- and land-based strategic ballistic missiles (out of the total requirement of over 100 strategic bombers and over 2,400 strategic ballistic missiles), and other CTR successes. The process of elimination will continue at least up to 2012.[36]

The project that has experienced the greatest verification problems is the effort to improve the safety and security of Russian nuclear warhead storage facilities. Remarkably the DOD appears to have encountered considerably greater difficulties than the DOE did in its effort to secure naval nuclear warheads. Because of the sensitive nature of the warhead storage facilities, the Nuclear Warhead Storage

Security programme has been an exception to the established verification procedures. In 1997 the DoD and the Russian Ministry of Defence (MoD) concluded the so-called Special Arrangement in accordance with which assistance is subject to limited audits through alternative means, in the form of data on locations of equipment provided, photographs taken by MoD representatives, other documentation on equipment provided, MoD letters confirming that equipment is being put to the use intended, and examination of sample equipment.

In order to track CTR-supplied equipment on a site-by-site basis, the DoD and MoD have established a database which helps the DoD auditing process and helps them both in planning security improvements to the sites while reducing interference with the MoD nuclear warhead storage facility operations. During A&Es of security equipment provided as part of the 'Quick Fix' upgrade (for facilities deemed to be in the most urgent need of security improvements), audit teams were able to physically inspect equipment that had not yet been installed, but had to rely on photographs and other evidence provided by the MoD for security equipment that was installed. A&Es are conducted on a limited percentage of randomly selected items of equipment, based on a statistically significant sample. In some cases the equipment is brought for inspection to a training facility at Sergiev Posad, near Moscow, which enjoys a less stringent security environment and is therefore more accessible to US inspectors. The limited access has also led the DoD to rely on anecdotal data (provided by a variety of sources, both governmental and non-governmental) to assess programme effectiveness.[37]

The Special Arrangement does not extend to equipment provided as part of Nuclear Weapon Transportation System (NWTS) assistance. Such equipment is brought by the MoD for inspection to non-sensitive central locations where it is inspected by American personnel. As with other types of equipment, a statistically significant sample of equipment is provided. For example, an A&E of the security kits for railway wagons used to transport nuclear warheads selected 15 out of 100 converted railway wagons and 2 out of 15 guard force wagons for an audit, which included a visual inspection, a review of their logs maintained by the MoD, and a test of operational capabilities at the rail depot in Tver.

Nevertheless, the Special Arrangement proved inadequate to address the transparency problem fully. While the initial Quick Fix storage facility security upgrades

were installed at the Russian MOD's expense, the remainder will have to be installed by contractors paid by the CTR programme. Although the US has furnished the 12th Main Directorate of the MOD with security equipment for its nuclear warhead storage facilities, the equipment cannot be installed unless US funding is provided to pay the contractors. However, under the FAR requirements, the DOD cannot release the necessary funding unless the Russian government allows US representatives access to the facilities to verify that the security upgrade work has been completed, and the Russian government has unfortunately not given its permission. Although various compromise approaches to verification have been discussed (for example, verification through third parties using photographs), the US assistance programmes do not have the authority to ignore the FAR compliance requirement. As a result of the delays, only 20 percent of warhead storage facilities have received upgrades. SORT only added to the problem by promising to increase the number of non-deployed warheads, which will put greater strain on the storage facilities.[38]

While the efforts to achieve access to warhead storage facilities have so far been unsuccessful, other aspects of WPC&A have not suffered such problems. The 12th Main Directorate received assistance for its personnel reliability programme, warhead inventory systems, and guard force training in the form of polygraph machines, drug detection kits, small arms training simulators and computers. Audits have verified that the equipment is being put to proper use.

The future of verification

While US nonproliferation assistance has increased both the level of security of the Russian nuclear stockpile and, to a lesser extent, its transparency as well, some problems remain. Further progress in this area will depend in part on developments in the Russian political system and in part on the character of the relationship between the US (and Western countries in general) and Russia.

According to former Senator Nunn, the reason for Russian resistance to greater transparency lies in the lower echelons of the Russian government. Lugar believes that, although the US and Russian presidents understand the proliferation threat and what must be done to combat it, their understanding has not trickled down to the bureaucracy.[39] However, some Russian observers believe that the problem is caused not only by the US and Russian bureaucracies but is linked to the broader

relationship between the US and Russia. For example, Sergey Rogov, director of the US–Canada Institute, has said in reference to the difficulties experienced in gaining access to Russian nuclear warhead storage facilities that the situation was unlikely to change in the near future unless Russian inspectors were permitted similar access to US warhead storage facilities.[40] Here Rogov touched on the fact that the performance of the CTR programme has been linked not only to compliance with verification and transparency requirements but also to compliance in other areas of arms control. Such linkages have been made by both Russia and US. Whereas the US has made assistance conditional on Russia meeting a number of requirements that are not directly related to implementation of the CTR programme, Russia apparently has placed obstacles in the way of the US CTR verification effort in order to extract concessions from the US in arms control negotiations. As a result, the fate of the CTR programme has become intimately linked with the fortunes of the broader US-Russian arms control effort.

Moreover, the efforts to increase the transparency of Russian nuclear stockpiles have coincided with the reduced US emphasis on verification in strategic arms control and the decrease in interest in arms control treaties in general. Russian officials have frequently linked nonproliferation issues to major initiatives of President George W. Bush's administration, including its withdrawal from the 1972 Anti-Ballistic Missile (ABM) Treaty in 2001, the signing of SORT and the administration's 2001 Nuclear Posture Review. For example, the Russian Foreign Ministry's statement welcoming American willingness to continue cooperation with Russia on nonproliferation also asserted that the problem of proliferation had became more acute as a result of US withdrawal from the ABM Treaty.[41]

Russia was also irritated by a number of provisions in the Nuclear Posture Review, including the raising of the possibility that the US would develop a new generation of nuclear weapons and resume underground nuclear tests as part of the development programme. Such a move would be a grave setback to the 1996 Comprehensive Nuclear Test Ban Treaty (CTBT), which Russia has consistently supported.[42] The Nuclear Posture Review placed considerable emphasis on pre-emption while paying little attention to preventive measures, including nonproliferation assistance to other countries, Russia among them. The administration was determined to spend far more on ballistic missile defences and on the readiness to resume nuclear

tests than on nonproliferation. Nor did the US favour the inclusion of extensive verification measures in SORT. Whereas the Russian government preferred a fully-fledged arms control treaty akin to START I or II, the US opted for a text that preserved maximum flexibility for itself.[43] In spite of Russian concerns about verification, transparency and irreversibility, the Bush administration asserted that such provisions were unnecessary in the light of the new strategic relationship between the US and Russia.

Although the Bush administration appears to be interested in bolstering the transparency of the two countries' tactical nuclear weapon (TNW) holdings, its efforts have been interpreted by Russia as part of the US pursuit of unilateral advantage. Before the May 2002 summit meeting between presidents George W. Bush and Vladimir Putin, during which SORT was signed, officials announced that the US administration intended to raise the issue of Russian TNW transparency during the summit. Although the US was not interested in holding formal negotiations on the issue, it did want Russia to provide a detailed list of its TNW holdings and an explanation of what it intended to do with them in the future.[44] Testifying on 25 July 2002 before the Senate Armed Services Committee, Defense Secretary Donald Rumsfeld said that he wanted Russia to share more information about its TNW.[45] According to Rumsfeld, US intelligence did not have reliable figures on the Russian TNW arsenal and desired a better understanding. Rumsfeld had earlier stated that he was not interested in TNW reductions, only greater transparency.[46] However, the Russian government reacted negatively, stating that it was not bound by any treaty to provide such information—most likely a reference to the continued Russian desire for a verification regime for SORT.[47] Senator Joseph Biden has also supported greater TNW transparency but in conjunction with other measures: he advocates SORT verification and irreversibility provisions, and increased CTR assistance to eliminate the reduced warheads.[48]

These US moves and initiatives have not been effective in removing residual Russian suspicions concerning US intentions in Russia. However, some American officials have recognised the importance of transparency and verification to the continued success of nonproliferation assistance programmes and have advocated incorporating verification measures into SORT as a means of inducing Russia to improve its cooperation on other issues, including the CTR programme. During hearings following

the signing of SORT, Senator Biden pointed out the inconsistency of trusting Russia to abide by the SORT provisions without verification procedures while at the same time implying that Russia was not living up to other treaty obligations through the decertification process.[49] Likewise, former Senator Nunn recognised the problem of non-reciprocity and said that he would like to see a more reciprocal verification relationship.[50] Nunn and retired General Eugene Habiger (a former commander of the US strategic forces) have called on the administration to develop a coherent strategy for countering the threat of proliferation through reciprocal monitoring of US and Russian nuclear, biological and chemical (NBC) arsenals. Their plan also included provisions for ensuring transparency and irreversibility of weapons cuts under SORT and promoting verifiable de-alerting of strategic nuclear arsenals.[51]

Conclusion

The experience of the CTR programme strongly suggests that verification of nonproliferation assistance programmes in Russia and other former Soviet republics is both possible and necessary. US nonproliferation assistance programmes have scored considerable successes in increasing both the security and transparency of the Russian nuclear complex. The emerging new strategic relationship between Russia and the West has not removed the need for greater WMD transparency. The improvement in Russia's relations with the West produced by President Putin's desire to portray his country as an ally in the 'war on terror' may actually reduce the West's willingness to press Russia on transparency and verification. Following the 11 September 2001 terrorist attacks on the US and the subsequent renewed concern about WMD proliferation from Russia, it is a distinct possibility that the temptation to sacrifice transparency in favour of expediency will win. To pursue such policies, however, would be a mistake. Sacrificing transparency under the guise of combating bureaucratisation would open the door to the possibility of major diversion and misuse of foreign assistance. Subsequent revelations of such abuse could deal a major blow to the CTR programme's reputation from which it might not recover.

Instead, it is necessary to press for greater transparency while at the same time addressing Russia's concerns. The CTR programme is, after all, an important component of the broader US-Russian strategic relationship, and it may not be possible to address its problems without also addressing other aspects of the broader relation-

ship. Although it may be tempting to think that the remaining verification problems can be addressed by applying political will, doing so might overestimate the extent of Putin's authority and/or his willingness to spend political capital on such an issue. Robust verification and transparency measures for SORT—a worthwhile endeavour in its own right—would be doubly useful if they also helped assuage Russian concerns about long-term US strategic plans and resulted in an improved WMD transparency environment.

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[4] Paul Webster, 'Weapons for sale?', *Maclean's,* 16 December 2002, p. 35, available on the Lexis-Nexis Academic Universe website, www.lexis-nexis.com.

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[12] The G8 countries are Canada, France, Germany, Italy, Japan, Russia, UK and the US.

[13] 'Statement by G8 leaders: The G8 Global Partnership against the Spread of Weapons and Materials of Mass Destruction', 27 June 2002.

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[17] 'Chain of custody' refers here to transparency in handling of nuclear materials, from extraction from warheads through to conversion into reactor fuel or placement in long-term storage.

[18] US Department of Energy, 'Warhead and Fissile Material Transparency Program Strategic Plan'.

[19] The US facilities subject to monitoring are Siemens Power Corporation, Portsmouth Gaseous Diffusion Plant, ABB/Combustion Engineering, Inc., Westinghouse Nuclear, Framatome Cogema Fuels, and GE Nuclear Energy. Russian facilities subject to monitoring are the Siberian Chemical Combine, the Ural Electrochemical Combine, the Krasnoyarsk Electrochemical Plant, and the Mayak Production Association. Russian facilities involved in warhead dismantlement are not covered.

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14

Monitoring UN sanctions in Africa: the role of panels of experts

Alex Vines

The early 1990s saw a dramatic increase in the number of sanctions imposed on countries by the United Nations Security Council. Until then sanctions had only been imposed on two countries: Rhodesia in 1966 and South Africa in 1977. During the 1990s and up to 2003 the Council imposed sanctions on: Iraq in 1990; the former Yugoslavia in 1991, 1992 and 1998; Libya in 1992; Liberia in 1992 and 2001; Somalia in 1992; Haiti in 1993; parts of Angola in 1993, 1997 and 1998; Rwanda in 1994; Sudan in 1996, Sierra Leone in 1997; Afghanistan in 1999; Ethiopia and Eritrea in 2000; and parts of the Democratic Republic of the Congo (DRC) from July 2003.[1]

Instruments vested in the Council as part of the peace and security mechanisms envisioned in Chapter VII of the UN Charter provide the basis for the imposition of sanctions by the Council. Such sanctions have been the cause of significant debate and controversy, not least because of the humanitarian crisis in Iraq during the 1990s, which was related to, if not directly caused by, the imposition of UN sanctions. Sanctions have been a particular tool used in response to crises in Africa in recent years. UN Secretary-General Kofi Annan noted in his 1998 report that 'sanctions, as preventive or punitive measures, have the potential to encourage political dialogue, while the application of rigorous economic and political sanctions can diminish the capacity of the protagonists to sustain a prolonged fight'.[2]

The most widespread type of sanction used in Africa is the arms embargo, such as those imposed on Angola, Ethiopia/Eritrea, Liberia, Rwanda, Sierra Leone and Somalia, and in 2003 on parts of the DRC. There have also been embargoes on the export of diamonds imposed on Angola, Sierra Leone and Liberia, travel bans on Angola, Sierra Leone and Liberia, and a ban on the sale of petroleum products to

the Angolan rebel movement UNITA (União Nacional para a Independência Total de Angola, National Union for the Total Independence of Angola). The UN imposed a timber embargo on Liberia in July 2003 and financial sanctions on UNITA in 1998.[3]

Only since the late 1990s have UN sanctions appeared to have had some influence on those they have been targeted against in Africa. This is due mainly to greater efforts in monitoring compliance with them. The revitalisation of sanctions committees at the UN has helped. These committees are made up of members of the Security Council and meet regularly to review compliance with sanctions. They report to the Council through their chair (one of the member states on the Council). Over the past two years independent investigative teams of experts have increasingly been appointed to provide additional reports to the sanctions committees in respect of sanctions on Angola, Liberia and Somalia. The committees are fed with information provided by their members or by interested parties via the UN Secretariat. Where there are UN peacekeeping operations present, there can also be some monitoring and feedback from them, as in Sierra Leone and the DRC.

However, the new enthusiasm with which sanctions have been imposed has not always been backed up by the political will to implement, verify and enforce them. For example, there was virtually no enforcement of the Rwanda arms embargo imposed by Resolution 918 in May 1994. Recognising this, the Council, in September 1995, adopted Resolution 1013, establishing, for the first time, a UN International Commission of Inquiry (UNICOI) to investigate and report on violations of the arms embargo to the Rwanda Sanctions Committee. The commission was designed to be independent and many of its members were chosen for their investigative skills. UNICOI assembled detailed documentation on the extensive arms-trafficking networks and financing schemes that sustained and strengthened the Hutu extremists in Rwanda and fuelled the war as it spread into eastern Zaire. It issued five reports between January 1996 and November 1998 and established a benchmark for more aggressive, independent monitoring of violations of UN sanctions.[4]

This chapter considers the monitoring of compliance with UN sanctions in Africa since the 1990s by examining the cases of Angola, Sierra Leone and Liberia. It assesses the effectiveness of sanctions monitoring and draws lessons for improving future monitoring endeavours.

Angola

Sanctions were a visible failure in Angola up to 1999. There were three packages of sanctions imposed on the UNITA rebels by Security Council Resolutions 864 (September 1993), 1127 (August 1997) and 1173 (June 1998).[5] Table 1 lists the resolutions and summarises their provisions.

Table 1 **Angola: Security Council sanctions resolutions**

Resolution 864, 15 September 1993
Imposes arms embargo on UNITA; petroleum embargo except through ports of entry designated by Angolan government; and creates sanctions committee

Resolution 890, 15 December 1993
Threatens stronger sanctions, on Secretary-General's recommendation, but gives no timetable for action

Resolution 1075, 11 October 1996
Threatens additional sanctions against UNITA for its failure to comply with 1994 Lusaka Protocol

Resolution 1127, 28 August 1997
Bans travel of senior UNITA officials and flights to and from UNITA-held territory; imposes diplomatic sanctions, including closing UNITA offices abroad; stronger sanctions to be enacted in October 1997

Resolution 1173, 12 June 1998
Freezes UNITA's financial assets; bans all financial transactions with UNITA; imposes embargo on diamond exports not certified by Angolan government; bans travel to UNITA areas

Resolution 1237, 7 May 1999
Establishes panel of experts with 6-month mandate to investigate violations of sanctions and make recommendations

Resolution 1295, 18 April 2000
Establishes monitoring mechanism with 6-month mandate to investigate relevant leads initiated by panel of experts

Resolution 1336, 23 January 2001
Extends mandate of monitoring mechanism for 3 months

Resolution 1348, 19 April 2001
Extends mandate of monitoring mechanism for additional 6 months

Resolution 1374, 19 October 2001
Extends monitoring mechanism for 6 months and reduces number of experts from 5 to 4

Resolution 1404, 18 April 2002
Extends monitoring mechanism for further 6 months

Resolution 1412, 17 May 2002
Suspends travel ban on UNITA for 90 days

Resolution 1432, 15 August 2002
Suspends travel ban on UNITA for further 90 days

Resolution 1439, 18 October 2002
Lifts travel ban, effective 14 November, and extends monitoring mechanism for 2 months and reduces number of experts to 2

Resolution 1448, 9 December 2002
Abolishes sanctions committee and lifts sanctions

When it imposed its 1993 arms and oil embargo, the Security Council established a sanctions committee to examine reports that countries were asked to submit regarding their fulfilment of their obligations under the embargo. In practice, the committee remained passive and only at its fourth meeting, on 12 November 1993, did it decide to take the very timid step of making a 'special appeal' to the countries neighbouring Angola. Precious little ensued, and the Council continued to refrain from acting against governments suspected of violating the embargo. In 1998 the Angola Sanctions Committee began to become more visible, mounting trips to southern and western Africa in an attempt to investigate the situation.

The pace changed in January 1999, when a new chair of the sanctions committee was appointed—Ambassador Robert Fowler, permanent UN representative of Canada, one of the 10 non-permanent members of the Security Council in 1999. Fowler took over just after Angola had returned to all-out war. Two UN aircraft had been shot down in Angola on 26 December 1998 and 2 January 1999, resulting in the deaths of 15 passengers and eight crew. Many at the time suspected that UNITA was responsible, as its leader, Jonas Savimbi, had announced that the UN would be a legitimate target following its imposition of further sanctions on the rebels.

Fowler and his aide, fellow Canadian diplomat David Angell, helped transform the Angola Sanctions Committee over the next year. They consulted widely with business, non-governmental organisations (NGOs), and government and law enforcement agencies, and immediately commissioned a report on the progress of the sanctions regime. Given the ineffectiveness of the committee in the past, this was a positive start. On 7 May 1999 the Security Council authorised establishment of two panels of experts with a six-month mandate to investigate violations of sanctions imposed on UNITA. These panels were soon merged into one 10-member panel recruited mainly from government and law enforcement circles. Two of the experts had worked for UNICOI. A former Swedish ambassador to Angola, Anders Mollander, chaired this combined panel.

Fowler dominated the panel's work during the next six months. In June and July 1999 he issued reports that contained 19 recommendations for improving the implementation of sanctions and maintained an iron grip on the panel's progress.[6] The panel's March 2000 report had strong editorial input from Fowler, and is

still remembered today as the 'Fowler Report'. It had a dramatic impact, as it ignored diplomatic niceties and named and shamed specific individuals, including serving presidents, such as those of Togo and Burkina Faso.[7] The report provoked heated debate in the Security Council, where a number of African and European nations challenged its methodology.

The report did have undeniable flaws. Unlike the UNICOI reports it relied heavily on videotaped testimonies of senior defectors. There was also some political editing: reference to Zambia was excluded, as the authors feared that this could provide a pretext for Angola to invade it. This gave the report an anti-francophone flavour—an issue that was used to try to undermine the report and the panel of experts.

The publication of the Fowler Report was a watershed for monitoring of UN sanctions. Never before had a UN panel attracted such press attention (nor has it happened since). Fowler showed that independent panels of experts could be used in an innovative way to make it possible for the Security Council to apply pressure on sanctions violators. Sanctions committees and the Council are normally bogged down by diplomatic procedure, protocol and consensus-seeking, but independent panels are not tied to these norms and can provide information that members of the Council may disassociate themselves from.

The political storm over the Fowler Report resulted in the creation of a new body, the Monitoring Mechanism on Angola Sanctions, in 18 April 2000. It was set up to investigate leads on reported violations and develop means of improving the effectiveness of sanctions. Ambassador Fowler had hoped that at least one member of the original panel would be appointed to the monitoring mechanism, but failed to obtain consensus for this from a Security Council that was still shell-shocked by the original panel's report. A completely new five-person team was finally appointed, headed by former Chilean diplomat Juan Larrain. The label 'monitoring mechanism' was chosen to distinguish it from the previous panel of experts.

From panel of experts to monitoring mechanism

From April 2000 to December 2002 the monitoring mechanism ran almost continuously.[8] Following the death of Jonas Savimbi in April 2002 and the peace protocol that quickly ensued, the mechanism entered a rapid winding-down phase that resulted in the lifting of all sanctions in December 2002.

Unlike the Fowler panel, the Monitoring Mechanism on Angola Sanctions emphasised the importance of education and quiet diplomacy to maintain dialogue on sanctions compliance. Ireland took over as chair of the Angola Sanctions Committee from Canada in January 2001 and this also contributed to a change in approach. However, the choice of experts also contributed greatly to the different style and content of the reports that the mechanism produced. The monitoring mechanism's reports were increasingly noted for their dryness and historical content, with the result that they received scant media attention, in contrast to the reports of other panels operating at this time. The monitoring mechanism developed a reputation for preferring quiet diplomacy. This gradually resulted in a noticeable swing, among some Security Council members, back in favour of ad hoc panels of experts that focused on investigation and were not based in the Secretariat.

The setting up of the monitoring mechanism should also be understood in its political context. The backlash in reaction to Fowler's style was a contributing factor, but so was the growing strategic value of Angola for key countries on the Security Council and in the UN Secretariat itself. The humiliation of the UN in Angola by UNITA's rejection of two peace accords and UNITA's suspected shooting down of the two UN aircraft created a strong desire to see UNITA brought to its knees. Angola's growing importance as an oil producer for France, the United Kingdom and the United States and for the Russian Federation as a major market for weapons also ensured that the Angolan government enjoyed strong support from four of the five permanent members for sanctions against the rebels.

In this context there was little incentive for innovative investigation. Sanctions had become a solidarity tool and by mid-2001 were being used to offset the Angolan government's displeasure at the UN Secretariat's efforts to seek a negotiated settlement to the conflict. One diplomat who sat on the Angola Sanctions Committee in this period admitted that: 'The Mechanism is our gift to Angola. Luanda loves it, and it's helped improve our bilateral relations. The mechanism fulfils our political requirements exactly'.[9] The Panel of Experts on Angola and the monitoring mechanism never reported on corrupt Angolan officials helping UNITA to violate sanctions. This contributed to UN sanctions being seen by Angolan civil society as partisan.

The monitoring mechanism did try to enhance its investigative capacity in 2001 by commissioning the political risk consultancy Kroll Associates to assist it. The

results were disappointing and demonstrated to the UN Secretariat that subcontracting to the private sector might not be appropriate for this type of work.

There were successes as well. The monitoring mechanism's efforts to shut down UNITA's overseas bank accounts and international offices were given a boost after 11 September 2001. Portugal agreed to freeze accounts and, although the amounts were small, the symbolism was important. Shortly after the death of Savimbi, one of his aides, Alcides Sakala, admitted that the impact of sanctions was 'mostly psychological on us. In the last two years we found communicating more difficult with our outside supporters because of them and some of our old friends became more cautious'.[10] UN sanctions increased UNITA's sense of isolation, and this was helped by consensus in the Security Council. The Angolan government was the keenest advocate of the sanctions, using them to its advantage. Paradoxically, although the monitoring of sanctions was weak, by 2001 the sanctions themselves were among the best observed in Africa. A key factor must have been the political will in the Security Council, backed by an aggressive advocate—the Angolan government in this case.

The drawing-down phase began in October 2001. Following the death of Savimbi in April 2002 the pace quickened, and on 9 December 2002 the Security Council abolished the sanctions committee and lifted the sanctions. To the surprise of the UN, the Angolan government wanted the sanctions ended quickly so that the Lusaka Peace Process could be declared complete before Angola took its seat as a non-permanent member of the Council in January 2003. In its final 18 months the monitoring mechanism found that the Angolan government became less co-operative—a result of its strengthened position on the battlefield and its suspicion of UN efforts to seek a negotiated settlement with UNITA.

Sierra Leone and Liberia

Sanctions on Sierra Leone and Liberia have fared differently. They have both had proactive monitoring through panels of experts but, as the case of Liberia will show, this has only had a limited impact on compliance.

Sanctions were first imposed on Sierra Leone in response to the May 1997 overthrow of the government of President Ahmad Tejan Kabbah by disaffected members of the armed forces, with subsequent backing from the Revolutionary United Front

(RUF) rebels. Security Council Resolution 1132 of October 1997 imposed an arms embargo, an oil embargo and a travel ban on members of the Armed Forces Revolutionary Council (AFRC) and their associates. In March 1998 the oil embargo was lifted following the ousting of the junta, and in June 1998 sanctions were lifted from the Kabbah government, which had been reinstated. However, an arms and travel ban were reimposed on the RUF and former members of the junta. In July 2000, following attacks by the RUF rebels and the capture of UN peacekeepers, Resolution 1306 increased the pressure on the rebels. As part of this decision, the Security Council set up a panel of experts to report on violations of the sanctions, and especially the links between the diamond trade and arms trafficking. This five-member panel submitted its report in December 2000 and confirmed that diamonds had played a central role in sustaining the RUF. The report's recommendations included the imposition of wider sanctions on Liberia.[11]

Sanctions on Liberia were not new. An arms embargo had been placed on the country in 1992 following a request from the Economic Community of West African States (ECOWAS) after it intervened militarily in the Liberian civil war to prevent Charles Taylor and his National Patriotic Front of Liberia (NPFL) rebels from taking power. Liberia was once again an example of the lack of implementation of sanctions.

Table 2 **Sierra Leone: Security Council sanctions resolutions**

Resolution 1132, 8 October 1997
Imposes oil embargo, arms embargo and travel sanctions on AFRC junta members and their families. Makes lifting of sanctions conditional on junta relinquishing power. Creates sanctions committee

Resolution 1156, 16 March 1998
Lifts oil embargo

Resolution 1171, 6 June 1998
Confirms removal of sanctions on government; reimposes arms embargo and travel ban on RUF and members of former junta

Resolution 1306, 5 July 2000
Sets up 5-member panel of experts; imposes embargo on all diamond exports not under government control

Resolution 1385, 19 December 2001
Extends by 11 months prohibition on all imports of Sierra Leonean rough diamonds except those controlled by government under Certificate of Origin Scheme

Resolution 1446, 4 December 2002
Extends by 6 months prohibition on all imports of Sierra Leonean rough diamonds except those controlled by government under Certificate of Origin Scheme

Table 3 **Liberia: Security Council sanctions resolutions**

Resolution 788, 19 November 1992
Imposes limited arms embargo (exempts forces of ECOWAS Monitoring Group, ECOMOG)

Resolution 985, 13 April 1995
Creates sanctions committee

Resolution 1343, 7 March 2001
Demands cessation of Liberia's support for RUF in Sierra Leone. Reimposes arms embargo and creates new sanctions committee; imposes freeze on assets, travel ban and embargo on exports of diamonds after 2-month grace period. Establishes panel of experts for 6 months, 1 month following adoption of resolution

Resolution 1395, 27 February 2002
Re-establishes panel of experts for 5 weeks

Resolution 1408, 6 May 2002
Reaffirms Resolution 1343 for another year but also calls on all states to stop support of armed groups in the region and re-establishes panel for 3 months

Resolution 1458, 28 January 2003
Re-establishes panel of experts for 3 months

Resolution 1478, 6 May 2003
Extends sanctions for 1 year and expands travel ban to Liberians United for Reconciliation and Democracy (LURD) and other rebel groups. Sanctions on timber exports introduced on 7 July for 10 months; Secretary-General is requested to submit report on socio-economic impact of such prohibitions, and sanctions committee is asked to establish list of aviation and maritime companies whose aircraft and vessels have been used in violation of UN sanctions. Panel of experts re-established for 5 months

It even took two years for a sanctions committee to be established, and the sanctions had no impact at all on Liberia. Farcically, they were maintained even after Taylor was elected president in 1997.

It was in March 2001 that this changed. In response to the report of the Panel of Experts on Sierra Leone, the Security Council decided to approve new sanctions on Liberia, to start in May 2001. Resolution 1343 reauthorised the arms embargo but also imposed a travel ban on key officials, their spouses and business associates of Charles Taylor, and mandated the freezing of all financial assets of the RUF and its expulsion from Liberia. An embargo was also imposed on all exports of diamonds, and in July 2003 an embargo on the export of timber was added.

The Panel of Experts on Liberia was also created to monitor compliance with the Liberian sanctions. Drawing its members originally from the Sierra Leone panel of five, it has since been mandated five times for periods ranging from five weeks to six months.

Resolution 1343 marked the first time the Security Council had imposed sanctions on one country for its refusal to comply with sanctions on another. The Liberia sanctions were at their core designed to shore up the peace process in Sierra Leone. This they did. The diamond embargo in particular resulted in an almost complete halt to the traffic in illicit diamonds from Sierra Leone to Liberia and encouraged the redirection of the indigenous product to Freetown, the Sierra Leonean capital. The Liberian diamond trade also changed, with some Liberian rough diamonds passing to Sierra Leone to be sold there.[12]

Events in Sierra Leone in late 2000 and 2001 also show that the threat and imposition of sanctions on Liberia probably contributed to the RUF's decision to sign an unconditional ceasefire in November 2000 and its reaffirmation of the agreement in May 2001. However, sanctions on their own did not achieve this. The deployment of hundreds of troops by the UK in May 2000 to support the UN, along with sustained, hard-hitting Guinean military operations against the RUF and Liberian territory, also played a role. Sanctions on Liberia within this context helped to loosen Monrovia's grip on the RUF, and this in turn assisted the RUF's efforts to transform itself into a political party that was able to contest the parliamentary and presidential elections in Sierra Leone in December 2002.

By early 2003, following the successful elections in Sierra Leone, the original justification for sanctions on Liberia was weakened. In late 2002 and mid-2003 the panel of experts submitted reports demonstrating that its mandate was increasingly outdated and that if the sanctions were to continue they needed to be put on a new basis.[13] Their effectiveness had also deteriorated over time. Increasingly, the Liberian government gave up trying to observe them even minimally. The travel ban was widely violated and weekly sanctions-busting flights of ammunition were arriving in Monrovia. The panel also found its investigations in Liberia more difficult, with people less willing to talk and the authorities becoming obstructive and hostile. Public sympathy for sanctions had declined in the face of a growing rebel insurgency in the country, backed by neighbouring Guinea.

It was not possible to obtain a consensus in the Security Council on a new basis for sanctions in 2002. A continuation of the existing sanctions was preferred by a handful of states whose ultimate goal was regime change in Liberia. The involvement of Liberian troops in support of rebels in western Côte d'Ivoire in September

2002 also led France to drop its opposition to a US proposal for timber sanctions on Liberia. These sanctions were used to signal to President Taylor's supporters that they should drop him and by Liberia's rebels as encouragement for their efforts to remove Taylor. Following a bloody chain of events, with the Liberian rebels vigorously increasing their efforts to overthrow him, Taylor handed over the presidency to a stop-gap government, which in mid-October 2003 gave way to a transitional administration of national unity. Liberia is now entering its own drawdown stage in respect of sanctions and a debate has already begun about how this should be done. There are lessons from both Sierra Leone and Angola on how to go about this. For Sierra Leone, no panel of experts was reappointed in 2001 and much of the travel ban was lifted in 2002 in the run-up to presidential and parliamentary elections in December 2002. An arms embargo remains in place on Sierra Leone for non-state actors.

The Sierra Leone diamond embargo imposed in 2000 finally expired on 4 June 2003 and could prove to be a model for Liberia. Diamond exports started in late 2000 following the work of a trilateral mission sent to Sierra Leone by the UK, the US and Belgium in July 2000 to inspect a Certificate of Origin Monitoring System for imports of rough diamonds from the country. The certification regime was approved by the Security Council on 6 October 2000 and activated shortly afterwards. Since then there has been a huge upsurge in diamond exports. More than 1,000 diamond-mining licences have been issued in 44 chiefdoms, although smuggling still accounts for over 50 percent of the trade. Such a scheme could be replicated in Liberia. The Ministry of Lands, Mines and Energy is already at an advanced stage in discussions about establishing a credible Kimberley Process diamond certification scheme.[14]

The sanctions on Liberia are due to run until May 2004, with a formal review by the Security Council in December 2003. A review of many of the names on the travel ban list would signal progress in the post-Taylor period. The export of diamonds through the government should be permitted once a credible certification scheme is established and, as in Sierra Leone, the sanctions committee could monitor progress over several years prior to an eventual lifting of the embargo. The basis of the sanctions will change to take account of the new context after the removal of Charles Taylor, and the size of the panel of experts could be reduced

from its peak of six members: keeping it at this size is unnecessary. This would save money, in addition to signalling the start of a drawdown in response to positive political developments. What happens after the expiry of the sanctions in May 2004 will depend on how the peace is holding in Liberia at that time.

Panels of experts: their role and future

Panels of experts have increasingly played an important role in documenting violations of sanctions. Their reports have become an important source of information for sanctions committees, although many of their recommendations are never ultimately adopted by the Security Council.

The use of panels of experts and monitoring mechanisms may have peaked in 2002. The Angola Monitoring Mechanism has since ended and the DRC Panel of Experts was wound up on 31 October 2003. Liberia's panel is in a drawdown phase; investigations of violations of the Somalia arms embargo are the most likely to be mandated to continue for the foreseeable future.[15] The Somalia panel provides an opportunity for further refinement of monitoring systems and experimentation with how to monitor and implement sanctions better.[16] There is also growing momentum in the Security Council for a sanctions committee and investigative panel to be created to monitor the arms embargo on the Ituri and north and south Kivu regions of the DRC.[17]

Monitoring of sanctions is important. It is vital that the experts recruited to panels are competent and technically equipped for the task. Over time the appointment of experts has become less politically driven, with the UN Secretariat creating its own roster of potential experts to call on. Although geographical spread is important, to reflect the ethos of the UN, this carries the risk of politics trumping technical expertise. The solution is to ensure a creative balance of political spread and technical expertise. Here the UN Secretariat has a vital role to play. Experts appointed to panels mostly enjoy the prospect of automatic reappointment if their mandate is extended.[18] This system lacks any performance-related assessment, and the introduction of a system of rotation could avoid this. Such a system would bring in fresh ideas and skills, rotate off poor performers and ensure that cliques of experts with a self-interest in the indefinite perpetuation of the panels are less likely to emerge. (The most frequent recommendation made by panels of experts is that

the Council renew their mandate.[19]) However, the downsizing and termination of panels is always perceived as sending a political signal and such decisions should remain the Council's prerogative.

Panels also need to be encouraged to meet the highest standards of evidence. This was a key recommendation of the Stockholm Process on implementing targeted sanctions.[20] The controversy about the findings of the Panel on the Illegal Exploitation of Natural Resources of the Congo is salutary.[21] Some of its major findings were not supported by the annexed documentation, exposing the panel to unnecessary criticism and threats of litigation. The result was that Security Council members opposed to the work of the panel were strengthened in their opposition and it was wound up on 31 October 2003. The controversy also resulted in the final report of the panel focusing mostly on justifying its previous findings.[22]

The number of threats of litigation made against panels has been increasing and this should result in more rigorous investigations and more carefully worded reports.[23] The UN system is used to dealing with the complaints of governments, but dealing with commercial entities and individuals is unfamiliar territory. A due diligence assessment of panel reports by the UN Secretariat should be conducted before being submitted to sanctions committees.[24] There is also a case for some sort of system of peer review prior to submission to the committee. This need not undermine the independence of the reports, but could ensure greater consistency in quality. Pressure by the UN Secretariat for reports to be shorter—30 pages double-spaced at the maximum—will also encourage greater focus.

There have been a number of assessments of UN sanctions, most notably by the International Peace Academy (IPA), the Stockholm Process on the Implementation of Targeted Sanctions sponsored by the Swedish government, the Swiss Interlaken Process on financial sanctions, and Germany's Bonn–Berlin Process on arms embargoes, aviation sanctions and travel bans.[25] However, there has been no detailed lessons-learned assessment of a particular sanction and its monitoring. An opportunity was missed following the lifting of UN sanctions on Angola. The Trust Fund for Angola retained US$200,000 which could have funded an independent assessment, but the unspent funds were returned to the respective donors.

The purpose of panels should be to ensure that there are penalties for violating UN sanctions. In the case of the Sierra Leone and Liberia panels, great efforts were

made to obtain documents and evidence of a sufficiently high standard so as to permit law enforcement agencies to act. Sadly, although there have been a number of individuals cited in UN panel reports, there has as yet been no successful national prosecution for violation of UN sanctions. In terms of weapons trafficking, UN sanctions may have raised the costs, but they have certainly not significantly stopped violators from obtaining weapons.[26]

A key impediment to the better monitoring of sanctions is the weak capacity of the Subsidiary Organs Branch of the Security Council Affairs Division in the UN Department of Political Affairs, which administers the sanctions committees and supports the panels of experts. Currently the Branch only really provides administrative support to experts, although in the cases of Angola and now Somalia one staff member has been tasked to compile databases and assist with follow-up. The Subsidiary Organs Branch should be provided with extra analytical and budgetary capacity. Databases need to be improved, archives created and a follow-up system for panel reports established.

Currently there is no real advocacy system for the reports of panels of experts except by the experts themselves, by the media and through UN member states' permanent missions in New York. Given that panels are currently appointed on an ad hoc basis, this results in a lack of consistency and professionalism in the publicising of and follow-up to various reports.

Conclusion

The ad hoc character of the panels of experts helps to ensure their flexibility and independent authority. Mandates of between three and six months work well. Ad hoc panels are not, however, much of a deterrent to sanctions-busters, and even the best panel reports are simply comprehensive catalogues of sanctions violations. To change this would require the creation of a semi-permanent sanctions monitoring effort, led by a handful of technical experts who are employed on a set-term contract at the UN, and which could draw on a roster of independent experts for specific tasks. In 2002 France and the UK circulated non-papers on this subject, and there was some further debate during meetings of the Stockholm Process. Little further progress was made in 2003, mainly because of the UN's preoccupation with Iraq, but this debate is likely to become more visible again

in 2004. For the time being, the key to monitoring compliance with sanctions will remain the ad hoc panels, while the best way forward would be to strengthen the Subsidiary Organs Branch in the UN Secretariat.

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[6] United Nations, Security Council, Commitee Established pursuant to Resolution 864 (1993) concerning the situation in Angola, 'Report of the Chairman's visit to Central and Southern Africa, May 1999', UN document S/1999/644, 4 June 1999; and 'Report on the Chairman's visit to Europe and participation in the 70th ordinary session of the Organization of African Unity, July 1999', UN document S/1999/829, 28 July 1999.

[7] United Nations, 'Report of the Panel of Experts on Violations of Security Council Sanctions against UNITA', UN document S/2000/203, 10 March 2000.

[8] Its reports were: United Nations, 'Interim report of the Monitoring Mechanism on Angola Sanctions established by the Security Council in Resolution 1295 (2000) of 18 April 2000', UN document S/2000/1026, 25 October 2000; 'Final report of the Monitoring Mechanism on Angola Sanctions', UN document S/2000/1225, 21 December 2000; 'Addendum to the final report of the Monitoring Mechanism on Sanctions against UNITA, 11 April 2001', UN document S/2001/363, 18 April 2001; 'Supplementary report of the UN Monitoring Mechanism on Angola Sanctions established by Security Council Resolution 1295 (2000), in accordance with paragraph 6 of Security Council Resolution 1348 (2001)', UN document S/2001/966, 12 October 2001; 'Additional report of the Monitoring Mechanism on Sanctions against UNITA', UN document S/2002/486, 26 April 2002; 'Additional report of the UN Monitoring Mechanism on Sanctions against UNITA', UN document S/2002/1119, 16 October 2002; and 'Final report of the Monitoring Mechanism on Sanctions against UNITA submitted in accordance with paragraph 4 of Resolution 1439 (2002)', UN document S/2002/1339, 10 December 2002.

[9] Interview with a diplomat, UN Secretariat, New York, 20 March 2002.

[10] Interview with Alcides Sakala, Washington, DC, June 2002.

[11] United Nations, 'Report of the Panel of Experts appointed pursuant to Security Council Resolution 1306 (2000), paragraph 19 in relation to Sierra Leone', UN document S/2000/1195, 20 December 2000.

[12] United Nations, 'Report of the Panel of Experts pursuant to Security Council Resolution 1343 (2001), paragraph 19, concerning Liberia', UN document S/2001/1015, 26 October 2001.

[13] Its reports were: United Nations, 'Report of the Panel of Experts appointed pursuant to Security Council Resolution 1408 (2002), paragraph 16, concerning Liberia', UN document S/2002/1115, 25 October 2002; 'Report of the Panel of Experts appointed pursuant to Security Council Resolution 1395 (2002), paragraph 4, in relation to Liberia', UN document S/2002/470, 19 April 2002; 'Report of the Panel of Experts appointed pursuant to Security Council Resolution 1458 (2003), paragraph 4, concerning Liberia', UN document S/2003/498, 24 April 2003; and 'Report of the Panel of Experts appointed pursuant to paragraph 25 of Security Council Resolution 1478 (2003) concerning Liberia', UN document S/2003/937, 28 October 2003.

[14] 'Report of the Panel of Experts appointed pursuant to paragraph 25 of Security Council Resolution 1478 (2003) concerning Liberia', UN document S/2003/937, 28 October 2003.

[15] The appointment of panels to investigate Somalia arms embargo violations is innovative. A first panel was mandated on 22 August 2002 (UN document S/2002/951) and a second in May 2003 for 6 months.

[16] See United Nations, 'Report of the Panel of Experts on Somalia pursuant to Security Council Resolution 1425 (2002)', UN document S/2003/223, 25 March 2003.

[17] Just as in Angola after the Fowler Report, some Security Council members prefer appointing a monitoring mechanism rather than a panel in order to make a clear distinction from previous controversial panels.

[18] There have been some exceptions. The chair of the first Congo panel was not reappointed and an underperforming expert on one panel was replaced by another expert.

[19] United Nations, 'Report of the Panel of Experts in Somalia pursuant to Security Council Resolution 1474 (2003)', UN document S/2003/1035, 4 November 2003. Even when this does not appear in panel reports, it may be a key recommendation of panel members during their consultations with their sanctions committee.

[20] Peter Wallensteen et al., *Making Targeted Sanctions Effective: Guidelines for the Implementation of UN Policy Options. Results from the Stockholm Process on the Implementation of Targeted Sanctions,* University of Uppsala, Department of Peace and Conflict Research, Uppsala, 2003.

[21] United Nations, 'Final report of the Panel of Experts on the Illegal Exploitation of Natural Resources and Other Forms of Wealth of the Democratic Republic of the Congo', UN document S/2002/1146, 16 October 2002.

[22] United Nations, 'Final report of the Panel of Experts on the Illegal Exploitation of Natural Resources and Other Forms of Wealth of the Democratic Republic of the Congo', UN document S/2003/1027, 23 October 2003. Some confidential material was also provided by the panel in a separate confidential report to the Security Council. This report named actors and countries and was eventually leaked to the BBC, which broadcast a feature on it on its Newsnight and Reporters television programmes on 19 and 24 November 2003. This illustrated the dangers of panels presenting a confidential written report in addition to a public one. The chair of the panel justified the action to the BBC on the grounds that the information in the confidential report 'could be abused to endanger the peace process'.

[23] There have been legal challenges by individuals and companies to information published in the reports of the Angola, DRC, Somalia, Sierra Leone and Liberia panels.

[24] Poor drafting resulted in the Panel of Experts on Liberia needing to issue an addendum on 6 November 2003. See United Nations, 'Letter dated 28 October 2003 from the chairman of the Security Council Committee established pursuant to Resolution 1343 (2001) concerning Liberia addressed to the President of the Council', UN document S/2003/937/add.1, 6 November 2003.

[25] First Expert Seminar on Smart Sanctions, 'The next step: arms embargoes and travel sanctions', Bonn International Center for Conversion, Bonn, November 1999; and Swiss Confederation, United Nations Secretariat and Watson Institute for International Studies at Brown University, *Targeted Financial Sanctions: A Manual for Design from the Interlaken Process,* Institute for International Studies, Geneva, 2001.

[26] One UN report claims that monitoring has resulted in a decline in violations of the arms embargo. United Nations, 'Report of the Panel of Experts in Somalia pursuant to Security Council Resolution 1474 (2003) of October 2003, paragraph 9', UN document S/2003/1035, 4 November 2003.