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TECHNOLOGY DIFFUSION OF A DIFFERENT NATURE: APPLICATIONS OF NUCLEAR SAFEGUARDS TECHNOLOGY TO THE CHEMICAL WEAPONS VERIFICATION REGIME*

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ABSTRACT

The following discussion focuses on the issue of arms control implementation from the standpoint of technology and technical assistance. Not only are the procedures and techniques for safeguarding nuclear materials undergoing substantial changes, but the implementation of the Chemical Weapons Convention (CWC) and the Biological Weapons Convention (BWC) will give rise to technical difficulties unprecedented in the implementation of arms control verification. Although these regimes present new challenges, an analysis of the similarities between the nuclear and chemical weapons non-proliferation verification regimes illustrates the overlap in technological solutions. Just as cost-effective and efficient technologies can solve the problems faced by the nuclear safeguards community, these same technologies offer solutions for the CWC safeguards regime. With this in mind, experts at the Organization for the Prohibition of Chemical Weapons (OPCW), who are responsible for verification implementation, need to devise a CWC verification protocol that considers the technology already available. The functional similarity of IAEA and the OPCW, in conjunction with the technical necessities of both verification regimes, should receive attention with respect to the establishment of a technical assistance program. Lastly, the advanced status of the nuclear and chemical regime vis-a-vis the biological non-proliferation regime can inform our approach to implementation of confidence building measures for biological weapons.

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DISCLAIMER

I. INTRODUCTION

Given the inherent threat of weapons of mass destruction proliferation, a prudent approach to policy formulation entails a thorough assessment of the technical aspects of verification. In this vein, there is much to be gained from looking at the technological overlap between nuclear and chemical non-proliferation verification procedures. Furthermore, the success of the existing nuclear non-proliferation regime structures should inform our approach to chemical and biological non-proliferation regimes. What follows is a discussion that will focus on the technical and functional similarities of the nuclear and chemical non-proliferation regimes. The discussion will then be summarized in some basic policy prescriptions in the utilization of nuclear verification technologies to implement the Chemical Weapons Convention as well as for technical assistance to the Organization for the Prohibition of Chemical Weapons. Both of these regimes offer a solid blueprint for the formulation of comprehensive confidence building measures and their implementation in the realm of biological weapons.

II. THE CHEMICAL WEAPONS CONVENTION

A regime to eliminate the threat of chemical weapons was foreseen in the negotiation of the Chemical Weapons Convention (CWC). Since the CWC opened in Paris in January 1993, over 160 countries have signed and over 48 states have deposited their instruments of ratification.[1] The Convention bans the production, stockpiling and use of chemical weapons, and it includes strong verification provisions applicable to chemical weapons and to the production of industrial chemicals which could be used to make those weapons. The Preparatory Commission (PrepCom) for the Organization for the Prohibition of Chemical Weapons (OPCW) is working to ensure the organization's readiness to function when the convention becomes effective 180 days after ratification by 65 states; current predictions are that the trigger point will be reached sometime this autumn.[2]

A. Implementation of the CWC

Assuming eventual ratification and entry into force (EIF) of the CWC, verification and on-site inspection difficulties are likely to be a source of debate and continuing concern. Despite the fact that complete and full verification is not feasible, the effective application of reliable and comprehensive verification measures, backed by adequate responses in the event of a state's non-compliance, is essential to the viability of any non-proliferation regime. More specifically, the US needs to look at its role in ensuring the eventual efficacy of the OPCW through the funding and establishment of its National Authority and a technical assistance program to support the Organization, now and in the years to come.

The system of international inspections provided for under the Chemical Weapons Convention will help address not only the safety of the dismantling process and ongoing verification in the US and Russia, but proliferation threats of other states as well. The Convention allows for international inspectors to implement a system of accounting and tracking of the weapons until they are safely destroyed; proper control of new kinds of chemical weapons; routine inspections in the industry to make sure that these chemical compounds are used only for

commercial products; and challenge inspections at any place to investigate problem situations.

The CWC represents unprecedented verification measures, including extensive declaration requirements by industry actors and information-gathering opportunities through the aforementioned activities. Chemical weapons differ from nuclear in that their acquisition is not in and of itself significant; this difference is important in the implementation of a non-proliferation regime. Creating a chemical weapons arsenal of military significance includes the following steps: research, development, production, storage, munitions filling, and military training in their use. Since the CWC bans all of these activities and its verification measures are extensive, a sufficient web of deterrence and detection can be achieved via this regime.[3]

B. The Organization for the Prohibition of Chemical Weapons

The Organization for the Prohibition of Chemical Weapons (OPCW) now being established in The Hague is functionally equivalent to the International Atomic Energy Agency (IAEA) for chemical weapons. The PrepCom and the Provisional Technical Secretariat (PTS) have provided technical assistance to this agency during the initial stages. In recent months, the PTS has become increasingly occupied with responsibilities for recruitment, training, data handling and other activities; this, in turn, implies that the PTS is less capable of providing necessary technical services to PrepCom.[4] Currently PrepCom's duties focus on three areas: verification; establishment of the implementing organization, e.g. the OPCW; and establishment of national authorities to implement the CWC. Within the 180 days prior to EIF, if not before, technical assistance from signatory states will become essential, if the PrepCom is to meet treaty verification objectives. More technical assistance is necessary on a permanent basis to support planning and implementation activities of the PrepCom and the OPCW.

The assumption that the OPCW will require additional support is based on its similarities to the IAEA. The OPCW mirrors the IAEA in these specific areas: its infrastructure and its managerial, procurement and training tasks. Both of these agencies feature a multi-national governing body responsible for determining resources, programs and priorities. Upon reaching the benchmark of 65 ratifications, the OPCW will then have 180 days to begin implementation of extensive verification measures worldwide; in short, the OPCW must be able to immediately cope with a large obligation. That obligation appears formidable in light of its budgetary constraints.[5] As is true for the IAEA, moneys and capability for research and development of technologies for information-gathering and inspections will not be possible in-house. Lastly, the OPCW will require a staff with the necessary competence and expertise to accomplish its objectives; this will undoubtedly require assistance with training, as well as occasional specialists that can assist in finding solutions to technical problems that arise.

Moreover, the OPCW's actual verification activities are similar to those of the IAEA. In this regard, technical assistance would facilitate the formulation of the OPCW's pre-inspection, inspection, and post-inspection activities. To carry out its verification mandate, the OPCW must define each of its verification approaches in detail; standardize its analysis and evaluation of inspection results; develop an information treatment infrastructure; provide for maintenance and shipping of equipment; make provisions for utilizing experts in special cases; and train inspectors

from a multi-national pool of applicants. In all of these areas, technical assistance programs from signatories have allowed for the IAEA to fulfill its mandate. Thus, a similar model of technical assistance should be established for the OPCW.

III. THE IAEA AND OPCW: FUNCTIONAL SIMILARITIES, TECHNICAL SYNERGY

A. The IAEA: challenges and changes

On the heels of incidences in Iraq and North Korea, the IAEA set out to make its safeguards program more effective and efficient. "Effectiveness is measured by the extent to which IAEA verification and inspection activities achieve non-proliferation objectives; efficiency is determine by how well available resources...are used to achieve IAEA objectives."[6] The "92+3" program was initiated with the general objective of eliminating the weaknesses in the policy and procedures that these incidents brought to light.[7] In addition, some changes in the policy and procedures of the IAEA needed to be forthcoming given the additional burden of providing safeguards to an increasing number of states while remaining within their zero-growth budgetary constraints.[8] Funding shortfalls in conjunction with increasing demands for safeguards have forced the IAEA to scale back its safeguards programs. According to sources in recent years, these financial difficulties have adversely affected the safeguards programs.[9]

B. POTAS/ISPO: Background and Update

Since 1977 the International Safeguards Project Office (ISPO) has provided technical project management of US Program Office for Technical Support (POTAS) funding exceeding $90 million and is the primary mechanism to transfer technology from national laboratories and industry to IAEA safeguards. POTAS, through ISPO, has provided a wide array of technical assistance, which includes identifying and contracting US entities to provide equipment and instruments for verification procedures.[10] Another important need met by POTAS has been the provision of consultants, often called Cost-Free Experts (CFEs), to provide expert advice and/or assistance on a well defined short-term problem.[11] The IAEA has been heavily reliant on programs like POTAS to arrange access to nuclear facilities, materials or experts within the member state, in order to provide inspectors with realistic training. Since its inception POTAS has completed over 600 tasks and provided more than 50 different types of equipment.[12]

Not only does the technical assistance program to IAEA give it access to more technology and expertise than would otherwise be feasible, it has proven a particularly effective means to develop and acquire those technologies that match facilities inspectors needs in the field. Simultaneously, ISPO's ongoing dialog with national laboratories and private sector actors who provide the equipment and instrumentation results in the IAEA having access to the most reliable and efficient technology for the numerous tasks necessary for verification.[13] Establishing this type of access to technology, along with capacities for its development, procurement and maintenance, will be critical to the CWC's success.

C. Technologies for Verification

As part of the 92+3 Program, the IAEA has been taking measures to incorporate challenge inspections into its verification protocol. As previously mentioned, the CWC foresees challenge inspections as a key component of that regime. And, the results of the VEREX process on confidence building measures to strengthen the Biological Weapons Convention indicate incorporating short-notice, on-site inspections of undeclared facilities as well.[14] Inspections, whether routine or challenge, are a crucial element of any verification regime. To achieve either one of the these types of inspections in the context of nuclear, chemical or biological weapons, managed access capabilities will be necessary. In addition to this example, an analysis of the other tasks involved in implementation of these non-proliferation regimes indicate a great deal of technological similarity in the capabilities, instrumentation and equipment required to achieve verification objectives.

1. Managed Access

"Managed Access" refers not only to the facility agreements that incorporate restrictions on the inspectors access to certain areas and information, but it also is used in reference to the technology necessary for on-site, intrusive inspections, especially short-notice challenge inspections. Achieving challenge inspection objectives requires assembling, transporting and implementing the equipment necessary to verify compliance at any facility that may be suspected of clandestine activities. Whereas instrumentation and equipment for routine and in-situ verification activities already exists, a sufficiently lightweight, portable system that can handle the tasks of challenge inspections has yet to be designed. Given the specific provisions of current non-proliferation regimes to allow only minimal access in order to not endanger proprietary information, this system must attain "virtual presence", i.e., obtain the information requisite to satisfy verification of compliance but avoid unnecessary intrusiveness.

The Managed Access by Controlled Sensing (MACS) system developed by the Safeguards, Safety and Nonproliferation (SSN) at Brookhaven afforded "virtual presence" while denying personal access. The MACS system also used as much commercially available technology as possible in order to limit the complications and costs of designing new components. The MACS demonstrated that portable, managed access is possible with the right combination of communication devices, video capability, position monitoring and sensing equipment. What is needed is a concerted effort by safeguards and verification technology experts to streamline and rationalize a MACS type system, using both commercial and specially designed equipment. Of course, the specific components and instrumentation for a viable managed access system would have to be tailored to the material under scrutiny and the type of facility. However, this type of portable, self-contained unit offering "virtual presence" capabilities will be needed for inspections in nuclear, chemical and biological verification.

2. Remote Monitoring

Remote monitoring will provide a significant enhancement in international safeguards in the coming years. The term remote monitoring means "the transmission via telephone, Internet,

satellite, or other communication links, of information from unattended sensors and cameras installed in nuclear facilities worldwide directly to an inspector's personal computer for verifying safeguards obligations".[15] Unattended surveillance allows for a reduction in the volume of data, which also decreases the effort required for review and evaluation. This capability significantly reduces inspection costs, increases reliability in the detection of intrusion, and enhances worker or inspector safety by limiting exposure. Remote monitoring systems are currently being fielded in a variety of facilities in the US and abroad.[16]

While this technology is currently being introduced in the area of nuclear safeguards, its application extends to biological and chemical non-proliferation regimes. Advances in the area of remote monitoring make comprehensive verification and compliance monitoring more cost-effective and reliable than ever before, and chemical and biological verification regimes can benefit from these monitoring capabilities as well. To the extent that these regimes rely on on-site scrutiny, which all of them do, remote monitoring offers a means to diminish travel, decrease amounts of data and increase safety of inspections for verification purposes.

3. Data Management

Related to, yet distinct from, remote monitoring is the issue of data management. The issue of data collection, transmission and analysis underpins almost every activity in the overall process of verification. Improvements in computational capacity, more reliable and cost-effective transmission capabilities and enhanced analysis capabilities afford more efficient tools for verification tasks. Just as remote monitoring can reduce the amount of data collected at a particular facility, the transmission of that data is now feasible via a variety of media; in addition, the computational capacity exists to enhance most analysis techniques used in verification processes.

Again, the IAEA is trying to capitalize on these advances in order to meet increased demands and remain within budget; the OPCW and any agency created for biological weapons verification will rely on similar technologies.

4. Training

Unlike the foregoing examples, the recruitment and training of highly-skilled, professional personnel from an international pool of applicants remains a difficult task, one that, for the most part, increases in complexity with advances in technology. For example, the chemical industry has stipulated that only highly qualified industry professionals are to be hired for CW inspections; these persons will also receive additional training to ensure that inspections are performed efficiently and with minimum intrusion and compromise of confidential business information. Not surprisingly, the OPCW is currently experiencing a dearth of qualified candidates to staff its Provisional Technical Secretariat, which will become the CWC's inspection agency upon EIF. An anticipated cadre of 140 inspectors and technical inspector assistants will be necessary to proceed with implementation.[17] From the candidates interviewed so far, about one-third were found unsuitable. Individuals who would qualify appear reluctant to apply, since the salaries offered are not competitive, start dates are uncertain and initial employment is by short, fixed-term contract.[18]

Training of personnel in the procedures and use of instrumentation and equipment at international agencies has been an ongoing difficulty for the IAEA; already the OPCW is showing similar strains in its capacity to recruit and train a staff with the necessary skills to accomplish its objectives.

Upon EIF - 180 days after the 65th ratification - a trained staff must be ready to effect implementation of the Convention's measures. One would anticipate similar difficulties, regardless of the particular agency.

D. Budget Constraints and R&D

The financial means of an international secretariat whose main function is operational (e.g., verify compliance of parties to the treaty), such as that of the IAEA, require that "extrabudgetary assistance" in the form of programs like POTAS be established. The IAEA does not have the internal resources to develop improved verification technology or to adapt for international purposes commercial off-the-shelf (COTS) technology. Thus, technical assistance programs to the IAEA are common among member states of the Nuclear Non-Proliferation Treaty (NPT), thirteen of which were modeled after POTAS. Not only is POTAS the primary mechanism for the transfer of technology to facilitate the verification tasks required of IAEA inspectors, but technical assistance has proven the most effective means to protect US interests and influence Agency policies within the framework of the NPT. The OPCW mirrors the IAEA in its verification implementation and compliance monitoring of the CWC. As such, technical assistance to that entity will also be necessary.[19]

IV. POLICY PRESCRIPTIONS

A. Technological Similarities

This cursory overview of technologies for verification hopefully illustrated the overlap in technical capacities required by nuclear, chemical and biological regimes. Managed access capabilities will be necessary, especially for challenge inspections. Remote monitoring will greatly enhance capabilities and lower costs for the IAEA; remote monitoring to detect clandestine activities is also foreseen for chemical and biological non-proliferation. Efficient and cost-effective data collection, transmission and analysis is essential in all areas, for both international and domestic agencies. Lastly, adequate training for international and domestic personnel must also be accomplished.[20] Achievement of the technical means to achieve verification is prerequisite to implementation. Support for enhanced technological capabilities would promote not only the IAEA's non-proliferation objectives, but it would offer technical solutions for controlling chemical and biological weapons proliferation as well.

B. Technical Assistance

Support to the OPCW from government programs is foreseen in the following areas: operational requirements for inspection equipment, inspection procedures, planning for inspector training, declaration formats and model facility agreements. Other areas of importance include:

development of confidentiality procedures and information management systems. Assistance is especially needed in the area of information systems, logistics planning and program planning and management. After EIF the focus of technical assistance programs should be verification-related support. As mentioned, these are similar technical and procedural support as is offered to IAEA through the POTAS/ISPO model.

Aside from the overriding concern about curbing the proliferation of chemical weapons, several other compelling reasons exist for a US technical assistance program to the OPCW. The POTAS/ISPO program not only protects US capabilities and interests, it ensures that US capacity to operate within the IAEA is not diminished. Secondly, although some COTS technology is useful, a long-term R&D capacity is essential; in addition, even COTS equipment must be adapted for use by international secretariat and be maintainable. Lastly, technical assistance programs offer the international agency access to expertise, facilities and technology far superior than what is possible within the administrative and operational budget available. Because the technologies and procedures for implementing the terms of the CWC are relatively similar to those used in nuclear non-proliferation verification and the two agencies are functionally similar, one approach might be to expand the existing IAEA technical assistance program to include the necessary additional expertise for OPCW support. This would most likely create a synergy and avoid the cost and inherent redundancy of establishing a separate agency.

V. BIOLOGICAL WEAPONS: TRANSPARENCY AND CONFIDENCE BUILDING MEASURES

Although the Biological Weapons Convention entered into force in 1975, this particular regime does not have legally binding measures to assure compliance with its provisions. Confidence building measures (CBMs) were first adopted in 1986 by the Second Review Conference; the Third Review Conference not only improved and extended CBMs, but it also established VEREX to examine possible verification measures for their scientific and technical feasibility.[21]

Relative to the nuclear and chemical non-proliferation regimes, the BWC is nascent. The accomplishments of VEREX should provide the foundation for agreeing to CBMs that are legally binding; the lessons learned and blueprint offered by the nuclear and chemical verification regimes should allow for the creation of a BW agency, as well as mapping the course for implementation of verification protocol provisions.

VI. CONCLUSION

"Trust and verify" remains an appropriate motto in the realm of arms control, particularly in light of the increasing threat of weapons of mass destruction. The existing regimes, embodied in the Treaty for the Non-Proliferation of Nuclear Weapons and the Chemical Weapons Convention, will require ongoing support from national governments. In light of our success in the realm of nuclear non-proliferation, the experience accumulated in providing an international secretariat with sufficient means to meet its objectives suggests that technical assistance programs allow those agencies access to a worldwide pool of technologies, equipment and technical expertise to

successfully accomplish their mission. Almost 20 years of providing technical assistance to the IAEA has proven that targeted support furthers US policy objectives, fosters effective and efficient international verification of treaty obligations and increases the ability of the agency to respond to changing verification obligations. The core technologies that will underpin these regimes are providing more cost-effective and reliable means to accomplish verification objectives than ever before. Utilizing the technology and experience already implemented for nuclear non-proliferation purposes will facilitate progress in implementation of the CWC. Both of these regimes provide a backdrop for making technical decisions about BW verification and designating a path for the BWC.

Footnotes

1 OPCW Synthesis: Newsletter of the Provisional Secretariat of the Preparatory Commission for the OPCW, Issue No. 14 (22 March 1996) p. 1.

2 The most notable exceptions to ratification are Russia and the US, whose legislatures have yet to ratify the CWC. However, joint implementation of a bilateral agreement to destroy weapon stocks is underway and most recent indications are that when put to a vote the CWC will easily receive support of the Senate. "Over the Impasse" Chemical Weapons Convention Bulletin, Issue No. 30 (December 1995) p. 1.

3 For a thorough description of the CWC's verifiability in light of these activities see Michael Moodie "Ratifying the Chemical Weapons Convention: Past Time for Action" Arms Control Today, Vol. 26, No.1 (February 1996) pp.5-6.

4 Chemical Weapons Convention Bulletin, No. 30, Publication of the Harvard Sussex Program: Cambridge, Massachusetts (December 1995): p. 1.

5 Given its total budget of $35,800,000, about one-half of this ($18,570,000) has been designated for verification and inspection activities. About $6.5 million is for inspectors training; and $1.8 million on inspection equipment, and $200,000 for laboratory supplies and equipment at the OPCW. See beyond VEREX: A Legally Binding Compliance Regime for the Biological and Toxin Weapons Convention, The Federation of American Scientists (July 1994) p. 4. (http://www.fas.org/bwc/verex.html)

6 Hooper, Richard. "Strengthening IAEA Safeguards in an Era of Nuclear Cooperation" Arms Control Today, Vol. 25, No 9 (November 1995) p. 14.

7 The objectives of Program 92+3 included: increase the level of assurance against non-diversion; reduction of implementation costs yet maintain or improve safeguards effectiveness; improve capabilities to detect clandestine activities at undeclared facilities; increase safeguards effectiveness or efficiency through greater cooperation with state systems of accounting and control (SSACs); improve effectiveness of efficiency of the acquisition, processing and analysis of safeguards-relevant information; and improve the capabilities of agency inspectors and safeguards staff for testing and implementation. See also Hooper, p. 15.

8 In real (inflation-adjusted) terms, the IAEA budget, including "extrabudgetary" contributions, have remained flat since 1985. Kosiak, Stephen M. Nonproliferation and Counter-proliferation: Investing for a Safer World? (Washington, DC: Defense Budget Project, 1995) p. 11.

9 Ibid., p. 15.

10 ISPO, in communication with the contractor and IAEA inspectors, provides overall management of tasks - from the request process to the reporting and implementation (fielding) of new equipment. Such equipment includes the development and provision of: authenticated video surveillance systems; in-situ verifiable seals; non-destructive and destructive measurement equipment, techniques and procedures; personal computer based-software for use by inspectors in the field; training materials for inspectors; and preparation of system studies and computer models.

11 These experts are supported by POTAS and are therefore "Cost-Free" to the IAEA. About 50% of the U.S. support program budget has been allocated to support between 20 and 25 experts at the IAEA headquarters in Vienna. CFEs generally remain in Vienna for two to five years to offer support in training, data processing, systems studies, and the like.

12 Percentage allocations of POTAS funds since 1977 are as follows: equipment accounted for 41.2%, information treatment and evaluation 18.2%, procedures 14.4%, training 14.3%, system studies 10.9%, and 2% for orientation and recruitment purposes.

13 Instrumentation supports both on-site, as well as remote, activities of measurement, monitoring, sealing, and containment. At present, approximately 100 different instruments are available to IAEA inspectors, and the IAEA's inventory consists of some 5,000 of these. See Pellaud,Bruno, "Safeguards in Transition: Status, Challenges, and Opportunities" IAEA Bulletin, 26, No. 3 (September 1994) p. 2.

14 VEREX is an ad hoc group of experts established by the Third Review Conference on confidence building measures to identify and examine the technical and scientific feasibility of potential verification measures. See beyond VEREX p. 5

15 See Sheely, Kenneth B. Remote Monitoring Safeguards for the 21st Century in JNMM (January 1996) pp. 15 -18 for more information on existing remote monitoring capabilities and technologies.

16 Through the International Remote Monitoring Project of DOE's International Safeguards Program remote monitoring systems have been installed in facilities in Australia, Sweden, the U.S., Japan, Argentina and the European Union. More information is available in remote Monitoring in International Safeguards by Stephen A. Dupree,Cecil S. Sonnier, and Charles S. Johnson , JNMM (January 1996) pp. 19-30.

17 The CBW Chronicle, Henry L. Stimson Center, Vol. II, No. 1 (January 1996), p. 4. (http://www.stimson.org/pub/stimson/cwc/chron.htm)

18 Ibid, 5.

19 Instrumentation supports both on-site, as well as remote, activities of measurement, monitoring, sealing, and containment. At present, approximately 100 different instruments are available to IAEA inspectors, and the IAEA's inventory consists of some 5,000 of these. See Pellaud, p. 2.

20 Two differences in the CWC are worth noting. First, given the wide array of "dual use" chemical agents, material balance accounting will not be used as a measure of fundamental importance under the CWC. Secondly, the initial operational interpretation by the OPCW of the "Confidentiality Annex" could make the arrangements for the use of so-called Cost Free Experts much more difficult than for the IAEA.

21 Beyond VEREX, p. 1.