

Advances in science and technology. Maintaining the effectiveness of the Chemical Weapons Convention*

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Abstract: A truly chemical weapons-free world can be achieved only with the active support and backing of the international scientific community. With input from the scientific and industrial communities, the Chemical Weapons Convention (CWC) was finalized in 1992 and entered into force in 1997. This paper provides a summary of the operations of the Organisation for the Prohibition of Chemical Weapons (OPCW), describes some of the major challenges facing the Convention, and suggests ways in which scientific advances might be able to improve the implementation of the Convention.

It is perhaps worth asking the question, why have we all gathered here in the beautiful city of Bergen for the next three days? The easy answer is that we are here because OPCW has sought the views of the international scientific community on matters fundamental to the success of the CWC. But, as I hope to show, this answer, accurate though it is, gives little indication of the complex nature of the many issues before us.

DUALITY OF SCIENCE

Since time immemorial, scientific invention, allied with technological application, has been an inseparable part of the process by which society has evolved into the world in which we live today, characterized as it is by its stunning and unique blend of soaring creativity, achievement, beauty, sordidness, and human imperfection. And we are all familiar with the concept of the *duality* of science, i.e., that science itself is neither good nor evil, but simply neutral, and it is the use to which scientific discoveries are put that determines whether we hang the label of good or evil on the activity concerned. Thus, as chemistry has given us so much of what is good about the world we live in, it also gave us the first of what are now popularly known as weapons of mass destruction: chemical weapons. Both came about as a result of human choice. And in the context of our work at this workshop, it is worth reminding ourselves, as Julian Perry Robinson pointed out at the 17th Pugwash CBW Workshop, of

...the disturbing historical fact that every major new chemical warfare agent of the Twentieth Century—including the organophosphorus nerve gases—first emerged from academic or industrial laboratories, not military ones.

But, just as science gave us chemical weapons, so it has also given us the means to bring about their elimination, to verify that elimination, and to provide us with the means to prevent their re-emergence.

*Lecture presented at the IUPAC Workshop, Impact of Scientific Developments on the Chemical Weapons Convention, Bergen, Norway, 30 June–3 July 2002. Other presentations are published in this issue, pp. 2229–2322.

In my view, professional bodies such as IUPAC and Pugwash can and should function as links of fundamental importance between what C. P. Snow once termed “the two cultures”: science and society. Snow’s original concern, as articulated in his 1959 Rede lecture, was the gap between what he termed

...literary intellectuals at one pole—at the other scientists, and as the most representative, the physical scientists.

Just over 40 years later, in the OPCW context, the two poles might be considered the policy makers and diplomats at one pole and the scientists and the technocrats at the other. I would like to suggest that one of our principal objectives at this workshop is to find a way to bridge the gap—which is real—between the two, to see if we can establish just what are the advances in science and technology that are of relevance to the effective implementation of the Convention, and to summarize and articulate them in a way that the essence of the problem—and more importantly, the solution—is presented in a form that is easily understandable to policy makers and usable by them.

Scientists played a key role in the negotiation of the CWC. They continue to play a key role in its implementation. A truly chemical weapons-free world can be achieved only with the active support and backing of the international scientific community. The negotiators of the Convention fully understood and reflected this simple but inescapable truth in the provisions of the Convention, which is the first global multilateral disarmament treaty to enshrine scientific input as a critical element for its very survival. The Convention’s provisions provide, inter alia, that the OPCW shall “review scientific and technological developments that could affect the operation of this Convention”. It stipulates that a Scientific Advisory Board (SAB) will be established to “render specialized advice in areas of science and technology relevant to this Convention, to the Conference, the Executive Council or States Parties”. The SAB was established in September 1998.

Indeed, international legal instruments, such as the CWC, can only be effective if they are based on a sound understanding of achievements in the science and technology underlying them, and of trends in the industries that are affected by the treaty’s provisions. To keep pace with the times, any treaty needs to be periodically reviewed and updated. This includes taking into account the developments in science and technology on which the treaty is based.

ADVANCES IN THE CHEMICAL INDUSTRY

The world of chemistry and chemical manufacturing continued to change as the Convention was being negotiated. Change has, of course, continued to take place since the negotiations on the Convention were concluded, almost exactly a decade ago. At the time, while it was recognized that change was occurring and would of course continue, its consequences were not easily foreseen. Thus, many of the provisions of the Convention were influenced by the way the chemical industry had been operating in the past and at the time, rather than by the manner in which it might operate in the future. Just to mention a few factors:

- Compounds that could be used either as chemical weapons or as precursors to such weapons were more or less known, and those for which negotiators felt routine verification would be both feasible and practical were included in the Convention’s “schedules”.
- Research into new biologically active compounds for agricultural or pharmaceutical purposes was time-consuming and uncertain.
- Our understanding of the human genome was still quite limited, so was our knowledge of the functioning of many biomolecules, receptors, and so on.
- Proteomics was still in its infancy, and its future was only dimly perceived.

- Chemical industry operations were highly centralized and had gone through a process of diversification and growth, and the industry remained vertically integrated.
- Control of chemical processes by computers had only just begun.

All these realities of days long gone still remain at the foundation of the Convention's verification regime.

The CWC was finalized in 1992, after 20 years of negotiation in the Conference on Disarmament in Geneva. It was opened for signature in Paris in 1993, and entered into force on 29 April 1997. The Convention is largely based on the reality that existed a decade ago and that the negotiators tried to reflect in its provisions. Furthermore, there was no past record of how the verification and the other provisions of the Convention ought to be implemented. It needs a fresh and unbiased expert review by scientists, implementers, and politicians. It is also, frankly, greatly in need of some friendly advice.

FIRST REVIEW CONFERENCE

The CWC requires that its States Parties review its implementation every five years, to identify necessary changes in the way the Convention is being implemented, and, if necessary, to make amendments either to the Convention or to their past decisions on how to implement it, to ensure that the Treaty remains valid and effective. The first such review process is under way and will culminate in the First Review Conference of the Convention. It is planned that this Conference will open in The Hague on Monday, 28 April 2003 and will run for two weeks. Indeed, this first review is probably more critical than any of the subsequent ones because the review period this time around is in fact much longer than five years. We see this workshop as an important contribution to the review process.

The OPCW has established a working mechanism to prepare for the Conference. A special Working Group that is open to all States Parties was established as a subsidiary organ of the Executive Council, the OPCW's governing organ, and was tasked with preparing documents for adoption at the Conference.

The review embraces all aspects of the implementation of the Convention—verification, international cooperation and assistance, as well as structural aspects of the work of the OPCW and, of course, the scientific and technological environment in which the OPCW operates. In fact, as regards the core function of the Organization—verified destruction of chemical weapons as well as maintenance and strengthening of the global chemical weapons nonproliferation regime—advice from the scientific community is more critical and time-urgent than from any other source. The Convention has a strong scientific and technical basis, and implementing its provisions requires technical credibility and soundness. Scientific advice will affect what the OPCW needs to verify and, accordingly, which resources it would require for such verification and how these resources should best be utilized. In essence, science can give us the answer to some very fundamental questions. Have we been doing the right thing in our implementation activities? Is there anything in the world of chemistry that may pose a threat to the goals of the CWC that we may have overlooked? Are we still monitoring the right things and doing it effectively? Answers to these fundamental questions will then trigger a sequence of other questions to which answers would have to be provided by Member States.

OPERATION OF OPCW

Let me explain briefly the basic concept by which OPCW works. We rely on information voluntarily submitted on a regular basis by our Member States. This information creates transparency in relation to the chemical activities of the States Parties that are relevant to chemical weapons disarmament and non-proliferation, and is submitted by them to demonstrate to other States Parties and to the international community at large that they are in compliance with the Convention's requirements. Those Member States that have chemical weapons have declared to us their stocks and where these weapons were pro-

duced. Both the stocks and the production facilities are being destroyed under the OPCW's verification, and chemical weapons arsenals are inventoried on a regular basis. Some former chemical weapons production facilities are being converted for peaceful use. Over 50 Member States also declared to us a total of about 4500 chemical industry facilities that either produce chemicals monitored by the Convention, or that could be relevant because of their inherent technological capabilities. We have reasons to believe that more facilities have yet to be declared. Some Member States have yet to adopt legislation that would enable them to request such information on a legally binding basis from companies operating in their countries. Other facilities may have fallen off the OPCW's radar screen because of the continuing discussions among Member States about how to declare certain activities. When such criteria are not consistent, similar facilities declared by some States Parties may not be declared by others, or may be declared differently.

We verify declared and inspectable facilities—both military and civilian—through a process of on-site inspection. After just over five years of verification activity—our first inspection started on 1 June 1997—we have thus far conducted over 1200 such inspections, including over 300 inspections of chemical industry facilities. We could have done more had financial constraints not precluded our efforts. The OPCW has established an international network of designated laboratories that are ready to undertake chemical analysis of samples taken by the OPCW's inspectors in the course of their inspections. These laboratories have been selected on the basis of rigid criteria in relation to quality assurance and accreditation, and are required to participate successfully in proficiency testing organized by the OPCW in order to maintain their designation status.

The Convention also has a provision to address specific concerns about compliance, which may be raised by any of its States Parties. In such instances, the Convention provides for clarification procedures as well as short-notice challenge inspections requested by any State Party, which could take place “anytime, anywhere”. We have yet to conduct our first challenge inspection, and, unfortunately, at least one of our States Parties has adopted legislation allowing it to refuse such inspections on national security grounds. Not surprisingly, others have threatened to follow suit if this situation remains.

In addition to verifying the destruction of chemical weapons stocks and production capabilities, and periodically inspecting declared industrial chemical plants handling the so-called scheduled chemicals as well as discrete organic chemicals, should the OPCW also be doing other things, or focus more on new security threats involving toxic chemicals? Should its verification methodology be refined? Should the OPCW place greater reliance on challenge inspections? If all newly emerging threats were to be adequately monitored, would the OPCW have the tools—human, financial, and technical—at its disposal to catch violators of the Treaty, if they exist? If additional resources are required, would they not be prohibitively expensive?

Those of us who have spent most of our lives seeking greater international security through disarmament would, of course, want to implement an ideal disarmament treaty. Yet, we are well aware of the many constraints that make this an almost impossible proposition. We should not undermine the trust Member States have placed in the OPCW by coming up with ideas that would divert attention from our core responsibilities and that simply would not be implemented for lack of resources.

CHALLENGES TO THE CONVENTION

Let me turn to some of the trends that we have been watching at the OPCW with interest, if not with concern, over the last several years. These trends have the potential to affect the implementation of the CWC and represent new realities that we must come to grips with if the Convention is to survive and continue to be effective.

One such development is research into new chemical substances. In the not too recent past, it took months and years to synthesize and test the properties of new chemical compounds. Today—thanks to computers, combinatorial chemistry, and rapid-screening techniques—the same process can be accom-

plished in days or weeks. Is it feasible that new chemicals may be identified that do not appear on the Convention's schedules and that are highly toxic or have other militarily interesting physiological properties and physical properties that would make them suitable for military or terrorist use? The issue of potential new agents, or toxic chemicals not covered under the Schedules, is not entirely new, but what apparently has changed is the time needed for the initial screening of large numbers of newly synthesized compounds. Does this change potential breakout capabilities? There are, of course, many subsequent steps that a violator would have to take in order to develop a newly identified toxic compound into an effective weapons system. But how much has this overall time frame shortened as a result of these new techniques, and how acute is this threat?

Another development relates to new methods of chemical synthesis and the opportunities offered in this regard, for example, by biologically mediated processes, the wide use of batch processes for multi-purpose production, and the increasing use of microreactors. Many believe that the new and rapidly evolving science of proteomics also poses a substantial potential threat to the object and purpose of the Convention. In fact, the word "proteomics" had not yet been coined when the Convention was opened for signature in January 1993, a little under 10 years ago.

Proteomics and genomics clearly pose new challenges for us. This was brought home to me sharply by a presentation made by Jan Medema at the Pugwash Workshop, when he briefed us on the results of a recent NATO Long-term Scientific Study on Chemical and Biological Defence that took place in the Netherlands earlier this year. One of his viewgraphs contained the following statement:

Genomics and proteomics offer a grim future. Potentially large number of new agents.

He was looking at the issue from the point of view of chemical defence, but the viewpoint from the perspective of the arms controller may well be equally troubling.

What the laymen and policy makers at the OPCW need to know is the answer to questions such as: Just how relevant are these developments for the production of precursor chemicals, or, in fact, toxic chemicals that could be weaponized? If they are relevant, do the Convention's verification mechanisms provide the transparency, and hence confidence, in the industrial activities of the States Parties that is needed to have confidence in the functioning of the Treaty? If the scientific community can give us the answers (or, if not, the answers at least point us in the right direction), then we will certainly have achieved something at this workshop.

Still another development relates to the operation of the chemical industry. Chemical manufacturing is increasingly becoming a small, fast, and clean operation. We see compact, more flexible enterprises, which adapt their production quickly to changing market demands, producing one chemical today and another tomorrow. Manufacturing equipment, which in the past had to be housed in an industrial facility, can now fit into a laboratory space and still produce industrial quantities of chemicals. Changes in the way the chemical industry is run have already led to the phenomenon of "shrinking plant sites", where facilities declared under the CWC operate autonomously in business terms while they continue to rely on engineering infrastructure at large chemical complexes. They sit in the midst of other unrelated industrial plants, which, some Member States argue, may not be accessed by inspectors unless there were indications that something ambiguous was actually happening there. Yet, these other plants could, of course, be utilized by potential violators for prohibited purposes. Ambiguity sometimes can only be seen when access has been granted. Is it an effective, or credible, verification approach to ignore these other chemical plants during an inspection and hope for the best?

Still another area relates to transfers of chemicals. The Convention requires the OPCW to monitor the global chemical trade in precursor chemicals. It is impossible in current circumstances for the OPCW to do so with any degree of accuracy. However, this does not mean that Member States should not review the problem and should not propose a system for a more meaningful tracking of transfers than exists at the moment. Of course, it is essential that all States Parties use the same rules to collect data on trade with scheduled chemicals, and that they actually implement the regulations on such trade, including the prohibitions and restrictions in relation to exports to States not Party to the Convention.

OPPORTUNITIES FOR BETTER IMPLEMENTATION OF THE CONVENTION

Technological change and scientific progress does not, however, just create challenges for the Convention's verification regime. They also provide new opportunities. New technologies may help implement the CWC. Hyperspectral sensors could enable identification of chemicals and of their signatures from space. Nanotechnology could be used to identify traces of chemicals or biological materials in equipment, etc. Techniques for tagging chemicals could help track where a particular chemical is coming from, or what it is being used for. Even in the area of slightly more traditional analytical chemistry and quality assurance, a lot has changed over the past decade that could make field analysis for verification purposes more reliable and robust, showing less cross-sensitivity, lighter in weight, and cheaper.

Advances in science and technology will always create challenges for policy makers. Particularly for a treaty that is as strongly based on science and technology as the CWC is, they will always be a headache for scientists and diplomats alike. Yet, the same science and technology can also provide solutions to these challenges. In the end, as I noted at the beginning of my remarks, it is because of scientific progress that we are living today in a much better and prosperous world. Thoughtful and objective analysis and a realistic action plan are required to meet new challenges.