OPCW **Conference of the States Parties**

First Review Conference
28 April – 9 May 2003

RC-1/DG.2
23 April 2003
Original: ENGLISH

NOTE BY THE DIRECTOR-GENERAL

REPORT OF THE SCIENTIFIC ADVISORY BOARD ON DEVELOPMENTS IN SCIENCE AND TECHNOLOGY

1. Introduction

1.1 The Scientific Advisory Board (SAB) has prepared a comprehensive report on relevant developments in science and technology that States Parties to the Chemical Weapons Convention (hereinafter "the Convention") may wish to take into account in their review of its operation, as provided for in paragraph 22 of Article VIII. The Director-General hereby submits this report, which is annexed to this Note, for the attention of the States Parties, together with his own assessments and recommendations.

1.2 The SAB has recorded fourteen main findings in the report's executive summary, and has included other detailed observations and explanations elsewhere in the report.

2. The main findings of the SAB

2.1 The first three observations relate to the schedules of chemicals-i.e. the chemicals identified by the Convention for the application of verification measures. The SAB has not considered it practical to propose amending these schedules, although such amendments might be necessary in the future for a number of reasons: the increase in knowledge about toxic compounds, including toxins; the growth in the number of these compounds; and the issues related to novel agents-toxic chemicals that had not been considered by the time negotiations on the Convention were concluded. Instead, the SAB has suggested that States Parties that have information about these chemicals be encouraged to submit it to the OPCW for assessment. Furthermore, the SAB has referred to the Convention's definition of chemical weapons (CW) and observed that it provided protection against any unscheduled toxic compounds being used for CW purposes, whether old or new.

2.2 The Director-General, having considered the SAB's recommendations and cognisant of discussions among Member States on related matters, concurs with its view that it would not be practical at this stage to propose amending the schedules. Although new chemicals relevant to the Convention have been encountered and will undoubtedly be encountered in the future, the situation in relation to the existence of unscheduled chemicals that could be used for CW purposes has not fundamentally changed since

the Convention was concluded. At the same time, proliferation concerns continue, and adding new chemicals to the schedules may not at this moment be the best approach. It is, however, important that the OPCW be aware of such new chemicals, and that the States Parties have confidence in the effectiveness of the Convention's prohibitions in relation to CW. With these considerations in mind, the Director-General wishes to submit the following recommendations to the First Review Conference for consideration:

(a) the First Review Conference may wish to take note of developments in science and technology in relation to chemicals relevant to the Convention, and may wish to reaffirm that the definition of CW contained in paragraph 1 of Article II continues to ensure all unscheduled chemicals meeting its definitions of "toxic chemical" or "precursor" are covered by the prohibitions of Article I, if they were to be used for CW purposes. In this context, the First Review Conference may also wish to draw the attention of the States Parties to the provisions of paragraph 1 of Article VII, in relation to national implementation measures; and

(b) the First Review Conference may wish to invite States Parties that have information about relevant chemicals to submit that information to the OPCW for assessment, in confidence if necessary.

2.3 The SAB has studied developments in the production of relevant chemicals and has arrived at two conclusions: first, that it would be prudent to increase the number of inspections of other chemical production facilities (OCPFs) without decreasing the effectiveness of the verification regime for facilities involved with scheduled chemicals; and second, that that suitable training must be provided-for example, with the help of interested States Parties-to OPCW inspectors so that they can keep abreast of new production routes and processes.

2.4 The Director-General is well aware of discussions among Member States on the allocation of resources to the conduct of inspections under Article VI, and he wishes to emphasise that developments in science and technology are not the only factors that need to be taken into account in future decisions on this matter. At the same time, it is important that the States Parties have full confidence in the industry verification regime. As technology and industrial operations evolve, and as the experience of the OPCW in the conduct of industry verification expands, improvements to the verification regime and to the allocation of resources will be possible, within the framework established by the Convention. The SAB's observation that it would be prudent to increase the number of OCPF inspections without decreasing the effectiveness of the verification regime for facilities involved with scheduled chemicals, coincides both with the evolutionary approach that the Convention itself establishes for OCPFs, and the limited experience of the Technical Secretariat (hereinafter "the Secretariat") with the conduct of OCPF inspections. The Director-General also agrees with the SAB that inspectors must be familiar with technological developments in the chemical industry.

2.5 With these considerations in mind, the Director-General proposes that the First Review Conference consider doing the following:

(a) that when it reviews the overall verification regime for the chemical industry and makes recommendations so as to improve its effectiveness, as required under paragraph 26 of Part IX of the Verification Annex, it takes into account the SAB conclusion that developments in the production of chemicals call for an increase in the number of OCPF inspections; and

(b) that it confirms the need for OPCW inspectors to keep abreast of scientific and technological developments in the production of chemicals, and that it encourages those States Parties that have the capacity to do so to assist the OPCW in its efforts to maintain a high level of competence among its inspectors.

2.6 The SAB has observed that the current procedures for on-site analysis meet the needs of the Convention without being intrusive in a way that would threaten commercial confidentiality, and has concluded that the OPCW Central Analytical Database (OCAD) should be extended to include certain unscheduled chemicals that are either related to the scheduled chemicals (e.g. well-known impurities, additives, and degradation products) or are a cause for concern, given their potential as chemical warfare agents. States Parties should be encouraged to submit analytical data on such chemicals for possible inclusion in the OCAD. The sensitive nature of such information and the potential impact that its release beyond the OPCW could have on non-proliferation may warrant its submission as confidential data.

2.7 The Director-General notes with satisfaction the SAB's conclusion that the current procedures for on-site analysis conform to the requirements of the Convention. On-site analysis has regularly been used at chemical weapons destruction facilities (CWDFs) to verify the identity of declared chemical warfare agents and to confirm that such agents are absent from effluent streams. The frequency with which on-site analysis has been used in chemical industry inspections does not, however, currently reflect the role that the Convention assigns to this inspection tool. The Secretariat continues to study and to discuss with interested States Parties how best to use sampling and on-site analysis in chemical industry inspections.

2.8 The Director-General also firmly believes that the addition to the OCAD of data pertaining to certain unscheduled chemicals that are clearly related to scheduled chemicals would both enhance the usefulness of the database for verification purposes and further increase the reliability of the verification regime without increasing its intrusiveness. States Parties should be encouraged to submit such data for validation and inclusion in the OCAD, in accordance with existing procedures.

2.9 The above-mentioned proposal to invite States Parties to submit analytical data on chemicals whose potential as chemical warfare agents gives rise to concern warrants careful consideration. As mentioned in paragraph 2.1 above, the inclusion of such novel agents in the schedules could raise a number of difficulties, including the sensitive nature of such information and the potential impact that its release beyond the OPCW could have on non-proliferation. Such chemicals, however, do exist. If the tools in the CWC's verification regime (as opposed to its scope) are limited to the chemicals listed in the schedules, verification is blinded in relation to such unscheduled potential chemical warfare agents. This might not matter much in the majority of routine inspections. But there might be situations in which the

Convention's verification regime would be incapable of detecting relevant verification information if the OPCW had no knowledge of such chemicals, for example in the form of analytical data.

2.10 With these considerations in mind, the Director-General submits the following considerations to the First Review Conference:

(a) when addressing the general provisions of the Convention on verification, the First Review Conference may wish to take into account the SAB's conclusion that existing procedures for on-site analysis meet the needs of the Convention;

(b) in the same context, the First Review Conference may wish to take note of the present status of the OCAD, and encourage States Parties and the Secretariat to continue working on expanding it, in part by including data on chemicals directly related to the scheduled chemicals it already contains; and

(c) in relation to potential new chemical warfare agents, the review conference may wish to encourage States Parties that have analytical information on such chemicals to consider submitting it to the OPCW for validation and subsequent submission to the Executive Council (hereinafter "the Council") for its consideration and its recommendation on whether to include it in the OCAD.

2.11 In relation to toxins, the SAB has proposed that on-site analytical techniques other than gas chromatography coupled with mass spectrometry (GC-MS), such as immunoassays, be developed. It has also observed that, for off-site analysis, liquid chromatography coupled with mass spectrometry (LC-MS) offers a suitable alternative.

2.12 The proposal to develop immunoassays for on-site analysis of toxins would require, inter alia, an addition to the list of approved equipment. The Director-General is currently studying the SAB proposal and will consult with States Parties about the need to provide for an on-site analytical capability for toxin analysis. If necessary, he will submit a proposal for a new item of approved equipment to the Council, in accordance with the established procedures (C-7/DEC.20, dated 11 October 2002). The Director-General also understands that the using LC-MS primarily would affect the procedures and equipment used by designated laboratories. The Director-General does not believe that the First Review Conference needs to take specific action on this issue, other than taking note of it.

2.13 The SAB report contains two further recommendations related to sampling and analysis: that research be undertaken in order to improve on-site sample preparation, and that flexible procedures be developed for on-site sampling and analysis in inspections with short inspection periods (Schedule 3 and OCPF inspections).

2.14 The Director-General welcomes the proposal to further develop the OPCW's sample preparation procedures for on-site analysis. While the current procedures have been validated and work well, they are logistically complex and time-consuming. Developing alternative methods could lead to improvements in verification and to more efficient inspections. The Secretariat will take up this matter with interested

States Parties, to assess whether such alternative methods can be identified and developed. Their adoption would likely involve a requirement that the Director-General propose an update to the list of approved equipment, in accordance with the established procedures.

2.15 As for the SAB proposal to develop flexible procedures for on-site sampling and analysis in inspections with short inspection periods, the Director-General agrees that current procedures would be difficult to implement because it would take too long to set up and calibrate equipment, and to prepare and analyse samples. Also, these time constraints are not the only factor. The Secretariat has begun to study some of the technical aspects of on-site analysis during such inspections, with a view to developing practical solutions. At a later stage, it will be useful to discuss specific proposals with interested States Parties and eventually to submit proposals to the Council.

2.16 The Director-General is of the view that the First Review Conference need not take specific action on these issues, but can instead request the Secretariat to develop suitable proposals, consult with interested States Parties, and submit proposals to the Council.

2.17 The evaluation of approaches to the analysis of biomedical samples in investigations of the alleged use of CW is a matter that the SAB has been asked to consider and offer advice on. The temporary working group has not yet been formed, in part because of the OPCW's recent financial difficulties. The Director-General wishes to inform the States Parties that he will proceed with the formation of that group soon after the First Review Conference has completed its work.

2.18 The Director-General has taken note of the SAB's readiness to assist in the upcoming discussions on how to optimise the verification of CW destruction operations. The Director-General will invite comments from the SAB on the proposals the Secretariat developed for the consideration of the Council at its Thirty-Second Session, and then also make these available to the Council. Depending on which decisions the First Review Conference takes on this matter, the Director-General may, at the appropriate time, offer proposals on how best to involve the SAB in this future work. The First Review Conference may wish to invite the Director-General to involve the SAB in studies aimed at optimising the verification regime of the Convention.

2.19 The SAB has included in its report some reflections on the requirements regarding assistance and protection against CW. New requirements have been identified in the areas of detection, identification, and decontamination, in part because of the danger that terrorists might use toxic materials. The SAB has specifically suggested that the OPCW arrange advance training for States Parties, and that it further enhance its ability to investigate allegations of CW use. The review conference may wish to take these views into account when reviewing the operation of the Convention in relation to assistance and protection against CW.

2.20 In relation to international cooperation and related matters, the SAB has concluded that the OPCW needs to clearly establish what it requires in the field of education, outreach, and international cooperation. At the same time, the SAB has observed that

current OPCW international cooperation programmes appear to be making useful contributions to the development of States Parties' national capacities in the peaceful uses of chemistry. OPCW international cooperation programmes and its educational and outreach activities would benefit from increased cooperation with other international, regional, and national organisations.

2.21 The Director-General is submitting these views to the First Review Conference in the hope that this will facilitate its review of how the Convention is operating in relation to economic and technological development.

2.22 The SAB has observed that the technical capabilities of the Secretariat must be maintained by ensuring that staff receive the correct training and have fit-for-purpose equipment.

2.23 The Director-General is of the view that training has received insufficient attention and funding in the past. It is important to realise that the chemical industry is very dynamic, and that technologies and the equipment being used are subject to change. There is a risk that, the longer the time that inspectors with a chemical and/or industry background work with the OPCW, the more unaware they will become about these developments. In addition, there is a need for skill development and maintenance.

2.24 The First Review Conference may wish to consider and reaffirm the continuing need for the adequate training of staff, so that they can continue to carry out the tasks of the Secretariat effectively and competently. This need applies especially to the training of inspectors as they implement the verification provisions of the Convention. In relation to equipment, the Director-General will use the adopted procedures as and when required. It would appear that there is no need for the First Review Conference to take action on these matters.

3. Other matters related to the SAB report

3.1 In addition to the main findings mentioned above, the SAB report contains a good number of detailed observations and recommendations that the States Parties and the Secretariat may find useful for their implementation work. These are, however, of such a nature that they do not lend themselves to consideration by the First Review Conference. The Director-General wishes to suggest that States Parties use an approach similar to that used in past reviews of SAB reports, whereby the Council would review the suggestions contained in the SAB report and take appropriate action on them. This Council review could take the form of expert consultations, for example. If such discussions are to be scheduled, the Director-General will arrange for a number SAB members to be present, so as to facilitate the consultations and the free exchange of views between the SAB and the experts from the States Parties.

3.2 For the benefit of delegations attending the First Review Conference, the Director-General intends to make arrangements for some members of the SAB to attend the conference for a limited time (during the general debate).

Annex:

Report of the Scientific Advisory Board on Developments in Science and Technology for the First Special Session of the Conference of the States Parties to Review the Operation of the Chemical Weapons Convention (First Review Conference)

Annex

REPORT OF THE SCIENTIFIC ADVISORY BOARD ON DEVELOPMENTS IN SCIENCE AND TECHNOLOGY FOR THE FIRST SPECIAL SESSION OF THE CONFERENCE OF THE STATES PARTIES TO REVIEW THE OPERATION OF THE CHEMICAL WEAPONS CONVENTION (FIRST REVIEW CONFERENCE)

1. Introduction

1.1 Paragraph 22 of Article VIII of the Convention states that "The Conference shall not later than one year after the expiry of the fifth and the tenth year after the entry into force of this Convention, and at such other times within that time period as may be decided upon, convene in special sessions to undertake reviews of the operation of this Convention. Such reviews shall take into account any relevant scientific and technological developments.…". The first such session has been scheduled for 28 April to 9 May 2003.

1.2 The OPCW's SAB was established by the Director-General in accordance with Article VIII, subparagraph 21(h), and paragraph 45, of the Convention, so that he could offer to the Conference of the States Parties (hereinafter "the Conference"), the Council, and the States Parties specialised advice in those areas of science and technology that are relevant to the Convention. In keeping with this mandate, and as its contribution to the preparations for the review of the operation of the Convention by the First Review Conference, the SAB has prepared this report, which analyses relevant developments in science and technology over the past decade, and presents to the States Parties 14 recommendations and observations that the SAB feels are important both to the review of the operation of the Convention and to the future implementation of its provisions.

1.3 This report contains sections on the following topics:

(a) the schedules of chemicals;

(b) the production of chemical compounds;

(c) sampling and chemical analysis on-site;

(d) chemical analysis off-site;

(e) the destruction of chemical weapons and its verification;

(f) assistance and protection;

(g) education, outreach, and international cooperation; and

(h) the technical capabilities of the Secretariat.

2. Executive Summary

2.1 The findings of the SAB are elaborated below.

2.2 It is not practical at this stage to amend the Schedules of Chemicals. However, the existence of these schedules is in itself no guarantee against violations of the Convention. Furthermore, given the increasing number of toxic compounds, including toxins; the advances in what is known about these; and matters related to toxic chemicals that had not been considered when the negotiations on the Convention were concluded ("novel agents"), there may be a need to adjust the schedules in the future.

2.3 States Parties should be encouraged to submit data on potential novel agents for further assessment. The SAB stands ready to contribute to any such assessments.

2.4 The definition of "chemical weapons" in Article II continues to provide cover against unscheduled and new toxic compounds. However, it is not only toxicity, but the potential for weaponisation, that determines the threat. Unscheduled toxic chemicals that meet the above criteria must therefore not be ignored when the OCAD is being developed further.

2.5 The chemical industry has developed a range of highly flexible manufacturing facilities designed to respond rapidly to changing market demands. Many of these facilities also have extremely effective safety and containment features. Thus, it is to be expected that a small percentage of these industrial facilities will have the potential to be used directly, or to be easily converted, for the production of scheduled and unscheduled chemical warfare agents. Increasing the number of OCPF inspections would thus be prudent, but this should be done without decreasing the effectiveness of the verification regime for facilities involved with scheduled chemicals. In this context, there is a need to improve the selection mechanism for future OCPF inspections. It should be noted that the strong support of the chemical industry for the Convention remains unchanged.

2.6 To make inspectors aware of new production routes and processes, suitable training must be provided, for example, with the help of interested States Parties.

2.7 On-site-analysis procedures based on GC-MS, combined with the use of the AMDIS software and of the OCAD as the target spectral library, now comprise a technique that meets the needs of the Convention without being intrusive in a way that would threaten commercial confidentiality. Extending the database is necessary to allow for the possible inclusion of certain unscheduled chemicals that are either related to the scheduled chemicals (e.g. well-known impurities, additives, and degradation products), or that are of concern because of their potential as chemical warfare agents. States Parties should be encouraged to submit analytical data on such chemicals for validation and possible inclusion in the OCAD. Such data may need to be treated as OPCW-confidential information, to minimise proliferation risks.

2.8 The limitations of GC-MS for the analysis of toxins means that other on-site analytical techniques, such as immunoassays, need to be developed. For off-site analysis, LC-MS offers a suitable alternative.

2.9 To improve the overall verification capabilities of the OPCW and reduce costs, some research is needed to resolve those problems that have become apparent as a result of the experience gained from inspections. For example, there is a need to improve sample preparation on-site by improving its efficiency, reducing its cost, and simplifying the logistics involved. Such research could be conducted by the OPCW Laboratory, by designated laboratories, or by other adequately certified State Party laboratories.

2.10 Flexible procedures need to be developed and agreed, in order to allow for the on-site analysis of samples taken during Schedule 3 and OCPF inspections, where the inspection time is limited to 24 hours.

2.11 A temporary working group should be established to evaluate approaches to the analysis of biomedical samples in investigations of alleged use.

2.12 The optimisation of the verification of CW destruction operations, which currently is far too labour-intensive, needs to be accomplished without further delay. Technologies and procedures, such as remote monitoring and random checks instead of continuous on-site verification, offer the possibility of substantially reducing the size of the inspection teams without incurring a loss of confidence in the overall adequacy of verification measures. The SAB is ready to assist in resolving this issue.

2.13 Cooperation and exchanges among States Parties in assistance and protection have been accorded greater importance in the light of the increased risk that terrorists will use toxic chemicals. Additional efforts are particularly necessary in detection, identification, and decontamination. It is worthwhile assessing what role the OPCW could play in such situations. Such a role might include arranging advance training to States Parties, and the further enhancement of the OPCW's capabilities for investigations of alleged use of CW.

2.14 The OPCW needs to generate greater awareness among scientific and technical communities worldwide about the Convention's objectives and benefits, and about the key issues the OPCW faces. Current OPCW international cooperation programmes appear to be making useful contributions to the development of the national capacities of the States Parties in the peaceful uses of chemistry, but raising awareness about the OPCW and the CWC requires that these programmes be complemented by further efforts to create educational and outreach activities aimed at scientific and technical communities worldwide. Furthermore, these programmes and activities would benefit from increased cooperation with other international, regional, and national organisations.

2.15 The technical capabilities of the Secretariat must be maintained by ensuring that staff receive the correct training and have fit-for-purpose equipment. On this latter point, the SAB welcomes recent decisions that establish a mechanism to update the technical specifications for approved OPCW inspection equipment, and that delegate responsibility to the Director-General to pursue the approval of new inspection equipment whenever the need arises. The SAB is of the view that flexibility is needed in adjusting the approved equipment in order to keep pace both with progress in

science and technology and with changing supply situations, in order to avoid inefficiency and wastefulness in the conduct of inspections.

3. The Schedules of Chemicals

3.1 The relationship between the definition of CW and the schedules has been the object of extensive negotiations. The Schedules of Chemicals list those toxic chemicals and their precursors that were seen to pose a particular risk to the Convention when it was opened for signature, and they were therefore identified for the application of verification measures.

3.2 Some of the chemicals listed in Schedule 1 were developed during the 1940s and 1950s, while certain binary components were developed during the 1960s and 1970s. Other Schedule 1 chemicals are even older than that. In any case, all the chemicals listed in Schedule 1 have been in the public domain for more than 20 years. Consequently, the Schedules in their current shape do not contain any new CW agents that may have conceivably emerged during the past decades. They also take no account of any other highly toxic chemicals that could possibly be considered as potential candidates for CW purposes[1], and that have been discovered over the past two decades. The approach of including chemicals (and their homologues) in Schedule 1 only when their past weaponisation and/or stockpiling is a known fact, or when highly toxic compounds have no legitimate uses, carries the inherent risk that the OPCW and its State Parties could be caught entirely by surprise, should any unscheduled chemical(s) be used as CW.

3.3 It is not for the SAB to speculate about the likelihood of such an occurrence, nor can the SAB assess the vulnerability of the States Parties. The SAB is convinced, however, that the number and types of unscheduled chemicals that could cause considerable harm, if they were misused for CW purposes, have expanded significantly. This is the result of recent advances in science and technology. The inspection regime of the OPCW, perhaps with the exception of challenge inspection, would at this moment not be capable of detecting such a violation.

3.4 On the other hand, while Article I prohibits <u>any</u> type of CW, as defined in paragraph 1 of Article II, <u>not all</u> toxic chemicals or precursors are, or in fact should be, subjected to routine verification by the Convention.

3.5 The Convention contains a mechanism to amend the Schedules. Chemicals can be added to, or deleted from, the Schedules, or they can be moved from one Schedule to another, should the States Parties consider this beneficial for verification purposes. Threat perceptions would be important aspects of such decisions. The definition of CW contained in Article II, as well as the provisions of the Schedules of Chemicals, make it clear that the Schedules do not embrace the entire scope of the Convention. The Convention's prohibitions related to "chemical weapons" apply to all toxic chemicals and their precursors, except when intended for purposes not prohibited by

[1] The last addition of this kind was PFIB, a toxic chemical known for more than two decades.

the Convention, as long as the types and quantities are consistent with such purposes.[2] Without that broad scope, chemical warfare agents of novel identity (including those which are as yet undisclosed or undiscovered) would remain outside the reach of the Convention.

3.6 The SAB is fully aware of the wisdom of the drafters of the Convention – that international verification procedures complement the obligation of States Parties to take the necessary measures to implement the Convention, including legislation in relation to toxic and precursor chemicals. The distinction between scheduled chemicals (i.e. chemicals that need to be declared and that become subject to verification measures) and unscheduled chemicals is a regulatory matter. Wherever this distinguishing line is drawn, there will always be unscheduled chemicals that, if misused, would pose a risk to the Convention. In relation to the verification regime, a certain degree of risk is unavoidable in order to keep verification acceptable, feasible, and affordable. Scientific advances will, however, have an impact on that risk, and therefore they need to be reviewed. At the same time, scientific advances can help with enhancing the OPCW's verification capabilities.

Previous observations of the SAB

3.7 The SAB recalled its recommendations and observations in relation to the Schedule 1 chemical ricin[3] and resubmits to the States Parties the suggestion to apply in their implementation work an understanding that ricin should remain accountable as long as the A-S-S-B bond is not broken, irrespective of the isoform(s) present. The understanding could, for example, be incorporated into the OPCW Declaration Handbook.

3.8 The SAB furthermore recalled its observations with respect to salts of scheduled chemicals. These salts are chemically distinct from their parent compounds, and have different physical and chemical properties, as well as their own CAS registry numbers. However, the salt can easily be re-transformed into the base (with the exception of quaternary salts). In industry, a base is often converted to a salt if it is more convenient to handle a compound in that form. Normally, from the standpoint of the end user, there is no essential difference between the free base and the corresponding salt.[4] The SAB noted that States Parties, on regulatory grounds, had disagreed with its recommendation to treat all salts of scheduled chemicals in the same way as their corresponding free bases. Consequently, salts of scheduled chemicals are to be treated differently from their corresponding free bases in relation to, for example, the Convention's provisions on trade with scheduled chemicals. It should be pointed out, however, that there are cases when scheduled chemicals are an intermediate in the production of such salts. Even though these bases are not isolated or captured from the equipment, they could be removed from the production

---

2 See subparagraph 1(a) of Article II; some States Parties and many commentators on the Convention refer to this as the "general purpose criterion".

3 See subparagraph 2.2 of SAB-II/1, dated 23 April 1999.

4 See subparagraph 2.10 of SAB-II/1.

equipment if that was so decided. Declarations may thus still be due, depending on the amounts produced.[5]

3.9 One issue that the SAB noted in the context of the previous recommendations mentioned above is the role of the CAS registry numbers indicated in the Schedules of Chemicals. There appears to be a question whether these CAS registry numbers have a regulatory function. The SAB would like to caution against such a view, as there is not necessarily a one-to-one relationship between CAS registry numbers and chemical structures. While CAS registry numbers are a useful tool to clearly identify a chemical compound, this should not be confused with the assumption that CAS registry numbers should have any regulatory power. At the same time, it could be helpful if the OPCW Declaration Handbook would provide references to the different CAS numbers related to an entry in the Schedules (e.g. for mixtures containing a scheduled chemical).

Developments in chemical synthesis and screening of chemical compounds

3.10 Except as set out in paragraph 3.11 below, the SAB is not aware of any unscheduled toxic chemicals or precursors that were not already known when the Convention was concluded in 1992, and that have actually been weaponised or stockpiled as CW. The SAB, as an international advisory body, has no access to intelligence information related to the development of novel CW agents, nor to classified information other than confidential information submitted to the OPCW by the States Parties. It is therefore not in a position to speculate about the existence of new agents. It is possible, however, that there are such novel agents, including some that would meet the criteria for Schedule 1 chemicals. The SAB stands ready to assist in the assessment of any information that States Parties might submit on such chemical compounds, should they decide to do so.

3.11 An example of toxic chemicals that had not been considered when the Schedules were elaborated is the family of dialkylaminoalkyl (dialkylamido)fluorophosphates.[6] The information available on these compounds in the public domain indicates that their toxicity is comparable to that of other nerve agents, and that they have other (physico-chemical) properties that make them (as well as their precursors, i.e. dialkylamidophosphoryldifluorides) relevant for the Convention. In relation to the guidelines for the Schedules, these compounds meet some of the criteria for Schedule 1 chemicals, namely the criteria contained in subparagraphs 1(b)(ii) and 1(c) of the guidelines for Schedule 1. If a decision were to be taken to include these chemicals and similar compounds that have been alluded to in the literature into the Schedules, Schedule 1, from a scientific perspective, would be the appropriate category to place them.

---

5 Examples of such "captive use" of a scheduled chemical in the production of a corresponding salt that is not listed in the Schedules can be found in Schedule 1 (e.g. the production of HN-2 hydrochloride), as well as in Schedule 2 (e.g. the captive use of BZ in the production of clidinium bromide).

6 J. Matoušek and I. Masek, The ASA Newsletter, 94-5, Issue Number 44, pp. 1 and 10-11.

3.12 The SAB reviewed the report to the OPCW and its States Parties prepared by the International Union of Pure and Applied Chemistry (IUPAC) entitled the "Impact of Scientific Developments on the Chemical Weapons Convention".[7] Based on this information and after having conducted its own review of relevant scientific developments, the following observations were made by the SAB:

(a) over recent years, many new procedures have been developed to speed up the synthesis of new chemicals required, in particular, for biological evaluation by the pharmaceutical industry. Some relevant examples of this are combinatorial chemical techniques,[8] together with other methods for rapid synthesis and screening;

(b) advances in molecular biology (such as genomics[9] and proteomics[10]) are creating new opportunities both to design new biologically active chemicals and to develop processes to synthesise such chemicals using enzymes or cell-based systems. The rapid pace of developments in the biomolecular sciences, coupled with advances in chemical synthesis, increase the possibility that new toxic chemicals will be found that may have properties that would make them suitable candidates for CW. However, these advances do not significantly change the situation, in view of the large numbers of already known toxic compounds, many of which are not listed in the Schedules;

---

7 International Union of Pure and Applied Chemistry, "Impact of Scientific Developments on the Chemical Weapons Convention (IUPAC Technical Report)", prepared by George W. Prashall, Graham S. Pearson, Thomas D. Inch, and Edwin D. Becker, Pure and Applied Chemistry, Vol. 74 (2002), pp. 2323-2352.

8 "Combinatorial chemistry" refers to the use of combinatorial methods in chemistry. Combinatorial experiments involve three common features: combinatorial libraries of related compounds, the structures of which are built from a common set of chemical building blocks and a common structural core or synthetic linkage; attainable and useful diversity of the molecules contained in the library (ranging from thousands of compounds to hundreds of thousands per library); and a screening process using methods such as chromatographic affinity selection for binding partners from a common pool of all the members of a library or enzyme inhibition assays on each individual compound in a spacially addressable library (J. Ellman, B. Stoddard, and J. Wells "Combinatorial Thinking in Chemistry and Biology", Proceedings of the National Academic of Sciences, USA, Vol. 94, pp. 2779-2782, (April 1997). See also M. Wheelis' "Biotechnology and Biochemical Weapons", The Non-proliferation Review, Spring 2002.

9 "Genomics", a term coined by Thomas Roderick in 1986, refers to the new scientific discipline of mapping, sequencing, and analysing genomes. Genomic sequences allow possible targets for biologically active compounds to be identified, such as the ion channels of membrane receptor proteins. Many new such targets can be identified in genomic sequences, the corresponding genes can be cloned, and the corresponding protein synthesised in quantities sufficient for study and screening (combinatorial libraries). See also M. Wheelis' article, quoted above.

10 "Proteomics" is the study of the full complement of proteins in a cell. It involves the study of changes in the protein expression in a cell or system, relative to some control. An alternative description refers to the use of advanced technology to examine the multiple protein products of the genome. The word derives from "PROTEin complement to a genOME". Unlike the genome, the proteome is intrinsically dynamic, and the cellular complement of proteins changes throughout the cell life cycle. Current research included, inter alia, the identification of cellular proteins, the development of protein micro-arrays to search for ligand-target combinations, and predicting the three-dimensional structures from genomic sequences. These techniques may complement and eventually supplant traditional wet chemical methods of ligand identification in the search for new biologically active compounds. See also M. Wheelis's article, mentioned above.

(c) in particular, while the time required for the early stages of agent development may have shrunk considerably as a result of these developments, the subsequent stages in the development of such a new toxic chemical into an effective CW (in the traditional meaning of the term, but see also paragraph 3.13 below) are much less affected by these developments in science and technology; and

(d) these developments underline, on the other hand, the importance of the assertion that the Schedules do not constitute a definition of CW.[11] They also suggest the need to look beyond the Schedules in the future development of the OCAD, by proposing the addition of analytical data of new toxic compounds that are directly relevant to the Convention (see also paragraph 5.11 below).

3.13 Notwithstanding these scientific developments and the SAB's conclusion that they do not significantly change the situation with respect to CW, it must also be noted that experience has shown that there is a possibility that less sophisticated CW may be opted for, with little regard to agent stability and shelf life (i.e. weapons filled for immediate use). In that context, even toxic chemicals (as well as precursor chemicals) that would not normally be considered to pose a risk to the Convention may be relevant. The same would apply to terrorists using toxic materials as weapons.

3.14 The SAB was also aware of concerns about the development of new riot control agents (RCAs), and other so-called "non-lethal" weapons utilising certain toxic chemicals (such as incapacitants, calmatives, vomiting agents, and the like). There are specific provisions in the Convention that deal with RCAs and the legitimate use of toxic chemicals for law enforcement purposes. The SAB noted that the science related to such agents is rapidly evolving, and that results of current programmes to develop such "non-lethal" agents should be monitored and assessed in terms of their relevance to the Convention. However, based on past experience and the fact that many of these compounds act on the central nervous system, it appears unlikely from a scientific point of view that compounds with a sufficient safety ratio would be found.

3.15 The SAB stressed the importance that all new toxic chemicals, no matter what their origin or method of synthesis, are covered by the Convention's definition of CW, unless they were intended for purposes not prohibited by it, and only as long as their types and quantities would be consistent with these purposes. The SAB underlined the importance of this aspect of the definition of CW as a safeguard for the validity of the Convention.

3.16 In summary, the SAB, at this stage, did not consider it practical to make recommendations aimed at amending the Schedules of Chemicals. The SAB observed, however, that the composition of the Schedules should be kept under review because:

(a) scheduled chemicals are not the only means of breaching the Convention's regime;

---

[11] See Section B of the Annex on Chemicals.

(b) there is a distinct risk associated with certain types of unscheduled novel compounds, and the number of such chemicals posing a potential threat continues to increase; and

(c) the route of unscheduled chemicals could be appealing to anyone who would want to minimise the chances of being detected.

3.17 States Parties may wish to consider submitting to the OPCW information on those unscheduled chemicals that they consider pose a direct threat to the Convention. Without such information present in its data base, the OPCW could be caught by surprise.

4. The production of chemical compounds

4.1 Significant developments have taken place in the industrial production of chemicals. These developments are relevant for the application of the verification regime under Article VI of the Convention. Their impact is twofold. First, the significance for the object and purpose of the Convention of certain facilities to be declared under the different sub-regimes under Article VI (i.e. Parts VI through IX of the Verification Annex) may have changed as a result of these developments. Second, new technologies and equipment used for the industrial-scale production of chemicals are likely to be encountered more often by OPCW inspectors, who must be able to recognise them and draw accurate conclusions about the nature of the activities at an inspected plant site.

4.2 Changes in the chemical industry are related not only to production technology and processes, but equally to organisational and structural developments. Vertical integration of chemical manufacturing, which was typical until the 1980s, has changed. Environmental and safety regulations, liability concerns, as well as market pressures, made industry change production in a number of ways: production was taken up in countries previously not known for their chemical production; the industry focussed on core business and outsourced synthesis to contractors, while at the same time, production volumes of bulk chemicals became global; multiple ownership became a typical feature; principles of just-in-time production were introduced; and transfers of chemical materials increased considerably. Furthermore, the versatility of chemical manufacturing increased and chemical plants, due to environmental and safety regulations, tend to be more easily convertible to the production of a variety of chemicals than they used to be in the past. At the same time, they tend to be more highly regulated. The chemical industry’s commitment to the Convention has remained as strong as ever, but the industrial environment in which the Convention is being implemented has become much more complex.

Previous observations by the SAB

4.3 In relation to the production by synthesis of discrete organic chemicals, the SAB concluded that, from a scientific standpoint, it is no longer possible to make a clear distinction between "chemical" and "biological and biologically mediated" processes.

The emphasis should be on the product rather than on the process.[12] That view was not shared by a meeting of governmental experts, but there was agreement that the issue should be kept under review. The SAB reassessed this issue and observed that it is indeed increasingly difficult to say whether in certain cases a process is chemical or biological, or mixed. The SAB recognises that the concerns of some States Parties in relation to biological processes and the production of discrete organic chemicals relate to facilities in the food and drink industry that use fermentation. The declaration and inspection provisions of the Convention should not cover these facilities. From a product point of view, the food and drink industry is not relevant to the Convention, and their products should not be considered as DOCs.

New developments in the production of relevant chemicals

4.4 The SAB reviewed the IUPAC Report on the "Impact of Scientific Developments on the Chemical Weapons Convention".[13] Based on this information, and on the results of its own review, the SAB submitted the observations below:

(a) many parts of the chemical industry around the world operate with multipurpose batch facilities that can readily be switched from one product to another. The versatility of chemical manufacturing is being enhanced by technological developments (process automation, microwave chemistry, catalysis, supported chemistry, biotechnology, and continuously operated microreactors that can be run in parallel to increase output). This increased versatility also changes the appearance of chemical production plants. Some of these plants have safety and containment features not dissimilar to those seen in the past at CW production facilities. As a result, although features that distinguish chemical plants that manufacture highly toxic chemicals from other chemical plants continue to exist (such as remote operations, or protection of personnel), there is a small, yet increasing number of small-to-medium scale chemical plants with high technological relevance to the objectives of the Convention in the category of "other chemical production facilities" (OCPF plant sites). It should also be noted that the two matching components of a binary weapon (whether scheduled or not) could conceivably be produced in many of the existing OCPF plant sites, given their lack, or moderate level, of toxicity. With the increasing globalisation of the industry, there is a need to review the verification regime for OCPF plant sites, to ensure that this regime is effective in monitoring the relevant parts of the chemical industry. There would appear to be a need for conducting a larger number of inspections at OCPF facilities than in previous years, because there are some OCPF facilities that are highly relevant to the Convention, and because the OPCW has as yet little knowledge about the OCPF plant sites from on-site inspections. This is not, however, to suggest that the risk assessment in relation to the chemicals regulated by the Convention ought to be changed;

---

[12] See subparagraph 2.3 of SAB-II/1.

[13] See footnote 7 for this reference.

(b) the experience gathered from inspections of Schedule 1 facilities, Schedule 2 plant sites, Schedule 3 plant sites, and OCPF plant sites must be evaluated carefully to reduce costs and increase effectiveness. While declaration and inspection conduct is governed by the actual activities of these facilities (in terms of which chemicals they produce and in what quantities), the capability of the facilities to produce Convention-relevant chemicals may be an even bigger concern. Some increase of the overall number of OCPF inspections would thus be prudent, if this could be done without decreasing the effectiveness in the inspection regime of facilities involved with the production of scheduled chemicals;

(c) there also would appear to be a need to develop guidelines for the conduct of OCPF inspections. If CW capability is the driving factor for OCPF inspections, inspection conduct would have to emphasis qualitative features and assessments, which would be accomplished in a walk-through talk-through fashion, rather than by the application of quantitative, audit-like inspection methodologies; and

(d) it may be helpful to devise criteria and risk assessment methodology for prioritising and better targeting OCPF inspections to those facilities that pose a particularly high risk to the Convention, rather than to go for an all-out, non-targeted increase in the frequency of inspections at OCPF plant sites. The selection methodology for OCPF plant sites should then be applied in such a way that these criteria and methodologies can be effectively used.

4.5 Furthermore, the SAB concluded that these developments in the production of chemicals at industrial scale over the past decade or so, involving both processes (e.g. biological processes, biocatalysis, and supported reagents) and equipment (e.g. multi-purpose production equipment, micro-reactors, and microwave reactors) have resulted in some of these plants looking considerably different from traditional chemical plants. While the versatility of such plants is increasing, the nature of some components of the production equipment is changing and certain "traditional signatures" that in the past were associated with the handling or manufacturing of hazardous and/or volatile compounds are disappearing. It is important that OPCW inspectors are capable of recognising and assessing such novel industrial operations and equipment.

5. Sampling and chemical analysis on-site

5.1 Sampling and analysis are inspection activities that OPCW inspection teams may employ, in accordance with the applicable provisions of the Convention, in both routine and challenge inspections, or in investigations of alleged use. Samples are, as a rule, taken by the representative of the inspected State Party or the inspected facility in the presence of OPCW inspectors. Wherever possible, the analysis of the samples is done on site. The inspection teams have the right to use their approved equipment for such on-site analysis. Alternatively, they may request the assistance of the inspected State Party to perform the analysis in the presence of the inspection team.

Current OPCW capabilities for sampling and on-site analysis

5.2 Sampling and on-site analysis is required for routine inspections, challenge inspections, and investigations of alleged use of CW. For routine inspections, effective on-site analysis has the advantage over off-site analysis in that, while meeting the need of the OPCW inspection teams, it also minimises the risk of any loss of confidential information.

5.3 The main equipment currently available to the OPCW for on-site analysis is GC-MS[14], with associated databases and software, as well as sample preparation methods. The mode of operations is that, following appropriate sample preparation, the chromatography and mass spectroscopy data of the sample run through the equipment is compared with data contained in an instrument database. Inspection teams on site can load either commercial spectral databases, or extract the OCAD as the instrument's target database. If the instrument database was extracted on-site from the OCAD, it would only contain validated data pertaining to (at the moment) some 600 scheduled chemicals, including toxic chemicals, precursors, and degradation products. This allows for a convenient check for the presence (or absence) of the most relevant scheduled chemicals without otherwise revealing the composition of the sample. If, on the other hand, the instrument database was extracted from a commercial database, the likelihood of false-positive results would decrease, but the actual sample composition would be revealed to a considerable degree.

5.4 The capability of the equipment is sufficient to allow detection of scheduled chemicals at levels likely to be present in production and storage facilities (i.e. chemicals in bulk, materials contained in mixtures at concentration levels regulated by the decision of the Conference on low concentration guidelines, and scheduled chemicals and their degradation products in environmental samples collected in close proximity to the production or storage equipment), and therefore is most suitable for use in routine inspections. The software was specifically designed for this purpose, and also allows information to be purged from the hard disk of the instrument's computer after the instrument has been used by the inspectors. To all intents and purposes, as operated and designed, this is a very non-intrusive method of analysis, which is very well suited to the purpose of avoiding compromising confidential information contained in the sample.

5.5 The SAB concluded that the OPCW has established an adequate, state-of-the-art sampling and on-site analysis capability. There are, however, factors that limit the utility of this capability. These factors are primarily in the area of logistics, and are thus affecting the cost of inspections as well as causing certain practical problems (e.g. long set-up times on site, and considerable time and effort required for sample preparation).

---

[14] The SAB suggested that the use of LC-MS also be considered in the future, particularly in relation to the detection of larger molecules. Other options that the SAB believed should be explored related to chemical sensors and biochemical analysis.

Past recommendations by the SAB in relation to on-site analysis

5.6 The SAB observed that in routine inspections, simple methods such as infrared spectroscopy would suffice for identifying declared chemicals in bulk. The SAB was told, however, that infrared spectroscopy is no longer in use by the OPCW for on-site analysis. Alternatively, the SAB pointed out that analytical equipment belonging to the inspected State Party could be used when this has been regulated in a facility agreement, and when conditions are fulfilled to ensure the independence of the analytical results.[15]

5.7 The SAB also observed that simple screening techniques will not be sufficient if, during a routine inspection, sampling and analysis become necessary to demonstrate the absence of scheduled chemicals (in particular the absence of Schedule 1 chemicals in industry inspections). At the same time, the removal from the inspection site of a large number of samples for analysis at designated laboratories would be impractical and expensive. The best approach, in cases when immediate on-site analysis is not feasible, would be to collect for subsequent analysis an appropriate number of samples, and leave them on site under secured conditions, and under conditions aimed at minimising sample degradation.[16] An analytical team could then be sent to the site, with the agreement of the inspected State Party, and the analysis could be undertaken at a later stage. The SAB continues to believe that concepts such as this, or the use of analytical equipment belonging to the inspected State Party under conditions that demonstrate the independence and reliability of the analytical results, could help resolve problems associated with logistics, and reduce the cost of sampling and analysis in routine inspections.

5.8 In relation to the OCAD, the SAB continues to believe that data relating to characteristic degradation products (whether scheduled or unscheduled), chemicals found in old and abandoned CW, salts of scheduled chemicals, non-scheduled precursors and by-products of the synthesis of scheduled chemicals, and standard riot control agents should be incorporated, and that priorities must be set for the inclusion of additional spectra.[17] The SAB noted the inclusion of the retention indices and mass spectra of additional compounds, and concluded that the database is rapidly becoming a reliable reference point for on-site analysis. This is important when on-site instruments use the OCAD database as the instrument's target database and the AMDIS software is being used, because the scope of the on-site database extracted from the OCAD sets the limits according to which scheduled chemicals can and cannot be identified.

---

15 See subparagraph 2.10 of SAB-III/1, dated 27 April 2000.

16 See subparagraph 2.11 of SAB-III/1.

17 See subparagraph 2.14 of SAB-III/1, dated 27 April 2000 and subparagraph 2.5 of SAB-IV/1, dated 6 February 2001.

New developments

5.9 The SAB then reviewed developments in chemical analysis relevant to on-site sampling and analysis, taking into account the issues presented in the IUPAC Report to the OPCW entitled "Impact of Scientific Developments on the Chemical Weapons Convention".[18]

5.10 In future, the analytical capability should be increased by continuing to expand the validated OCAD by:

(a) including data on chemicals likely to be confused with scheduled chemicals, as well as well-known impurities, additives, and degradation products of scheduled chemicals; and

(b) adding data on certain non-scheduled toxic chemicals which have the potential to be used in chemical warfare (see also paragraph 3.11 above).

5.11 The latter could be done in a manner that would keep the data confidential within the domain of the OPCW (i.e. the data would be available to all States Parties, but would otherwise be kept confidential), and would allow the OPCW to have and to use data on potential threat agents without alerting terrorist organisations or States not party to the existence of these chemicals. In other words, this approach would be an important step in assuring the Convention's verification regime with minimum inconvenience to the chemical industry. The SAB recognised that new compounds are not automatically incorporated into the OCAD, and that care must be taken that the adopted procedures of OPCW for the inclusion of new data into the OCAD are followed.[19]

5.12 Thus, what is being developed is an analytical system that could fully meet the requirement of not being too intrusive, while meeting most requirements for inspections at Schedule 2 and Schedule 3 facilities, as well as at OCPFs. In future, as further development occurs, GC-MS will become more effective, easier to transport, and easier to use, so it will be necessary for the OPCW to keep up to date with commercially available equipment.

5.13 The above discussion relates generally to small molecules and not to toxins, including ricin and saxitoxin, for which generic GC-MS procedures that are currently being used are inappropriate. It is suggested that for toxins, consideration should be given to obtaining and validating a range of specific immunoassays. If these were available, the OPCW would have a battery of techniques that would be suitable for the purpose of on-site inspections and that would also be of considerable value for challenge inspections and investigations of alleged use. The SAB observed that, at the moment, the OPCW has no on-site capability for analysing toxins.

---

[18] See footnote 7 for this reference.

[19] See EC-IV/DEC.2, dated 5 September 1997, which was adopted by the Conference at its Second Session (subparagraph 11.2(c) of C-II/8, dated 5 December 1997).

5.14 The rate-determining step for on-site analysis is the time and effort necessary for sample preparation. For Schedule 2 facilities, the 96 hours allocated for inspection conduct provide ample time for analysis, if this is required. For Schedule 3 and OCPF inspections, where only 24 hours are available for the inspection, there may be problems, depending on the number of samples to be analysed. Thus, alternative procedures may need to be agreed, such as those previously suggested by the SAB, i.e. storage of samples and subsequent analysis on site by a separate analytical team.

5.15 Furthermore, the OPCW should devote more research efforts to addressing the problems related to sample preparation. This would not only reduce the time needed for analysis on site, but would also reduce the amount of auxiliary equipment to be transported. The SAB noted that it is important for the OPCW to understand that it needs to invest adequate resources into research that is aimed at developing analytical and sampling techniques. Such research could be done at the OPCW laboratory or by designated or other competent States Parties' laboratories. The SAB stands ready to assist in such endeavours.

6. Off-site chemical analysis

6.1 To perform off-site analysis of samples acquired by OPCW inspection teams during on-site inspections, the Convention assigns the primary responsibility for the security, integrity, and preservation of those samples, and for the protection of the confidentiality of samples transferred off-site to the Director-General. The Director-General is required to do this in accordance with procedures which the Conference was to adopt at its First Session. The States Parties continue to negotiate these procedures, and no decision has yet been taken by the Conference.

6.2 The Convention requires that the Director-General establish a stringent regime for the entire chain, from sample collection to sample transportation for off-site analysis. The Director-General must certify that the laboratories designated to perform different types of analysis, must oversee the standardisation of equipment and procedures for both on-site and off-site activities related to sampling and analysis, including the monitoring of quality control, and must select from among the designated laboratories those which shall perform analytical or other functions in relation to specific investigations.

6.3 Although the Conference has yet to adopt the procedures for sampling and analysis, the OPCW has developed and tested technical procedures for sampling and analysis as part of its quality assurance policy, and has designated laboratories to analyse authentic samples.

Current capabilities of the OPCW for off-site analysis

6.4 The proficiency testing for the designated laboratories organised by the OPCW has been targeted primarily on analysing scheduled chemicals and related compounds (in particular, degradation products) in environmental samples. Good progress has been made in developing techniques and protocols, and in ensuring that the staff of designated laboratories are well trained and experienced. Some of the lessons learned, particularly in regard to sample preparation, are also applicable to on-site analysis.

6.5 If, however, on-site analysis becomes the normal approach, particularly during routine inspections, it will become necessary to redefine the primary anticipated role of the designated laboratories, and to ensure that they are experienced in terms of responding to likely scenarios.

6.6 For example, perhaps the main role of designated laboratories will be to analyse environmental samples in instances of alleged use or for challenge inspection, typically in situations where the levels of concentration are too low for unequivocal analysis by on-site techniques or by some of the off-site techniques currently being used. If this is the case, the designated laboratories will need to become well versed in analytical methods and protocols for both scheduled and unscheduled chemicals in trace concentrations. Some preparatory work in this direction is necessary.

6.7 Additionally, there may be a need, in incidents of investigations of alleged use, for there to be a capability to analyse other types of biomedical/forensic samples, in addition to toxic chemicals and their metabolites. A small number of laboratories have undertaken research in identifying and analysing biomarkers resulting from poisoning by scheduled chemicals. There are good prospects that analysis of other biomarkers will soon be possible. Much more work is needed in order to validate these techniques. These techniques should be shared so that more laboratories are capable of carrying out such an analysis. There are many issues connected with this kind of analysis, not least on how to set standards and maintain expertise so that, as in the designated laboratories, there can be high confidence in the results. The SAB suggested dealing with these issues as soon as possible.

New developments

6.8 The SAB reviewed developments in chemical analysis relevant to off-site analysis by designated laboratories.

6.9 The SAB concluded that there were few developments that would drastically change the current potential in the near future. The above discussion of on-site and off-site analysis is based on this premise. One major problem was the cost of developing new equipment that would be specifically designed to meet the OPCW's requirements. The one development necessary to meet OPCW needs seems to be the necessity to introduce immunoassays for toxins. The SAB supported the need to have such techniques available to inspectors, as well as to designated laboratories.

6.10 Most other techniques would have to be specifically developed or would await their development for commercial purposes. The SAB concluded that the only action necessary is for the OPCW (and the SAB itself) to continue monitoring these advances, until such time that specific developments for the OPCW occur.

7. Destruction and verification of destruction of CW

CW destruction technologies

7.1 The SAB noted a recent publication that provided a comprehensive and authoritative overview on the chemistry underlying the current technologies for the destruction of CW.[20] The SAB welcomed this publication.

7.2 Selecting and assessing CW destruction technology is the responsibility of the individual State Party concerned. This will involve not only technological assessments, but also the consideration of other factors, including workplace safety, any environmental impact, and commercial factors. The SAB stressed that there is an opportunity for enhanced international cooperation in the field of CW destruction technologies, and that the OPCW could play a role in facilitating such cooperation. Members of the SAB, furthermore, are ready to make their expertise available in relation to CW destruction technologies.

Verification of CW destruction

7.3 Previously, the SAB discussed measures to reduce the number of inspector days in the field that are necessary for permanent on-site monitoring of CW destruction operations. It concluded that the approach developed within the Secretariat was sound.[21] The SAB's temporary working group on equipment will continue monitoring developments in relation to available instrumentation.

7.4 The Secretariat informed the SAB in September 2002 that work was under way to further refine the verification approach for, inter alia, CWDFs, and to develop proposals for methodological and instrumental solutions that would enable the inspection team sizes to be reduced, without compromising the verification objectives of the Convention. The SAB reviewed with interest a recent informal Secretariat paper on CW verification. The SAB noted that specific CWDFs require their own verification approaches. Some progress has been made in economising verification resources, but if the methodology is not changed (finding an alternative to the tracking of individual weapons through all aspects of the CWDF), a limit will soon be reached. The SAB continued to be concerned that more progress has not been made in identifying the critical steps that require monitoring, and in introducing statistically based methods for random, rather than continuous, inspections, as well as the use of instruments such as CCTV monitoring or remote monitoring with computer-based cameras combined with proximity sensors and remote data transmission. The SAB stressed that the question of how the inspection conduct at CW facilities can be further economised may not primarily be a matter of identifying new technologies, instruments, or scientific solutions to existing problem. These technologies and equipment exist at an affordable price. It is essentially a matter of improved management and agreed verification policy.

---

[20] IUPAC's technical report, entitled: "Critical Evaluation of Proven Chemical Weapons Destruction Technologies," prepared for publication by Graham S. Pearson and Richard S. Magee, Pure and Applied Chemistry, Volume 74, No. 4, pp.187-316, February 2002.

[21] See subparagraph 2.7 of SAB-IV/1, dated 6 February 2001.

7.5 The SAB requested an early opportunity to review the proposals that are presently being prepared to optimise verification resource utilisation.

8. Assistance and protection against CW

8.1 The SAB noted the different projects implemented by the OPCW in the area of assistance and protection against CW. These relate to the further development of national capacities in the field of protection, as well as increased cooperation between States Parties. Some of the activities form parts of the offers for assistance submitted to the OPCW by States Parties under Article X. There is also an OPCW Protection Network to coordinate activities in the field of protection, to share information and experiences, and to provide assistance to States Parties upon request for expert advice on how to enhance their protective capacities. Finally, the Convention requires that the OPCW maintain, for the benefit of its States Parties, a databank on protection.

8.2 The SAB noted that cooperation and exchanges between the States Parties in these areas have received additional significance in the light of the increased terrorist threat, including with respect to the possible use of toxic, infective, or radiological materials by terrorist organisations. The threat associated with CW has changed from fully-fledged chemical warfare operations to an increased potential of smaller-scale incidents involving other types of toxic chemicals in addition to "classical" CW agents. States Parties with developed capabilities in the area of protection against toxic chemicals have a responsibility to help others in developing their capabilities for protection against these new threats. Enhanced cooperation between the States Parties in the field of protection is not only a matter of increasing their preparedness to respond to attacks with CW, but also involves increasing the readiness of the States Parties to respond to other incidents that could threaten their security, including any deliberate releases of toxic chemicals during conventional attacks.

8.3 The requirements that need to be met in the context of a terrorist threat involving toxic chemicals differ significantly from those for which military forces have made preparations in the past. In addition to a sharing of experience and technology between the States Parties, particular areas where the SAB felt additional scientific and technical work was needed in the areas of detection, identification. and decontamination. In respect to the latter, there also is the question of the level of contamination that can be accepted as a reasonable end-point of decontamination measures.

8.4 Another area that will need attention, and where extended cooperation between the States Parties could be beneficial, is sampling and on-site analysis at incident sites. The OPCW and some of its States Parties have acquired considerable experience with respect to field analysis. It may be worthwhile analysing how that experience could be made available on a broader scale, to the States Parties as well as to agencies within States Parties that at the moment lack experience and capacity in this respect, but which might get involved, should a terrorist attack with toxic chemicals ever have to be dealt with.

8.5 It may also be worthwhile assessing what role the OPCW inspectors, as well as the OPCW Laboratory, could play in such situations. The OPCW is, of course, not a first

responder. The OPCW could, for example, arrange advance training to States Parties, and develop and maintain its own on-call field-investigative capability for situations when requests for investigations of alleged use of chemical weapons are received.

9. Education, outreach, and international cooperation

9.1 Greater publicity is needed by OPCW about its aims and objectives, and about the key issues it faces. This must include information on the requirements in relation to the declaration, destruction, and verification of CW and related facilities; the methodologies the OPCW uses (particularly for analysis); the nature of and the reasons for industrial declarations; the nature of and reasons for industrial inspections and the value gained from such inspections; the role of National Authorities; and the requirements to provide assistance and to foster international cooperation.

9.2 Greater efforts in terms of education and outreach to the worldwide scientific and technical community are needed in order to increase awareness of the Convention and its benefits. An informed scientific community within each country can be helpful in providing advice to States Parties and in disseminating unbiased information to the public. Education of, and outreach to, signatory States and non-signatory States could be helpful in increasing the awareness of the importance of universal adherence to the Convention, thereby enhancing the safety and security of all states.

9.3 The SAB noted that the Secretariat had developed certain projects that supported these goals, in particular the Associate Programme and the Ethics Project.

9.4 The SAB was convinced that efforts in the area of education and outreach are important to further the objectives of the Convention; these efforts include raising awareness, assuring that the principles of the Convention become firmly anchored in professional ethics and teaching, and promoting international cooperation in the field of chemistry. International cooperation and outreach were also important with respect to attracting additional countries to adhere to the Convention. The SAB expressed a strong desire to further discuss and clarify its own role in relation to education, outreach, and international cooperation. At the same time, the SAB noted and welcomed the contributions that certain non-governmental organisations, as well as national chemical societies and science academies, have been making in relation to creating awareness about the Convention. Public awareness and education about the Convention can contribute significantly to encouraging compliance with its norms and provisions.

9.5 There are a number of opportunities in the area of outreach, education, and international cooperation. In particular, the SAB reviewed the OPCW's programmes in the area of international cooperation in the light of the developments in science and technology, and concluded as follows:

(a) there is good reason for close cooperation between the OPCW and other relevant international organisations, such as UNITAR, WHO, or UNEP, in further developing the international cooperation programmes of the OPCW;

(b) the programmes and projects currently being implemented by the OPCW in the area of international cooperation appear to be contributing to the development of the national capacities of the States Parties in the area of the peaceful uses of chemistry. Two members of the SAB are involved in one of these programmes (i.e. the programme for support of research projects implemented by the ICA Division); and

(c) in further enhancing these programmes, particular attention should be given to projects aimed at improving the capabilities of the States Parties to monitor chemical compounds.

9.6 The SAB considered it useful for the OPCW to continue and intensify its dialogue with other organisations, such as the IUPAC and its chemistry education division; with other international science unions in relevant fields such as biochemistry and molecular biology (IUBMB) or biological sciences (IUBS); with professional and chemical industry associations; with international institutes and programmes; with organisations of engineers and scientists committed to CW disarmament; and with national as well as regional science academies.

9.7 The SAB concluded that it will need to continue discussing practical and useful measures in relation to education, outreach, and international cooperation as part of its future work programme.

10. The technical capabilities of the Secretariat

10.1 The SAB noted the observations included in the IUPAC report to the OPCW[22], and endorsed the following statements made in the report:

(a) "Given the rapid pace of developments in the screening of new unscheduled chemicals and in the development of new, more flexible production processes for chemicals, attention needs to be given to ensuring that the Technical Secretariat is kept up to date and has the necessary competence to take such developments into account in the implementation of the Convention."

(b) "For sampling and analysis only the highest standards are acceptable because of the importance of accurate results. Such standards, both in the OPCW Technical Secretariat and in the designated laboratories that support the OPCW analytical activities, cannot be achieved and sustained without all the staff involved being well trained and well practised. There is a need to review what training is provided, how it is provided and whether sufficient resources are available to sustain the process."

(c) "Consideration should be given to the organisation of periodic workshops to review relevant scientific and technological developments. Such workshops should be part of the ongoing training of staff members but could also benefit States Parties. Planning for such workshops is principally the responsibility of the Technical Secretariat and the OPCW Scientific Advisory Board, but

[22] See footnote 7 this for reference.

IUPAC and other appropriate international scientific bodies might be consulted as appropriate."

10.2 In addition, the SAB strongly supported the following:

(a) that as analytical techniques and instruments evolve and supply situations change on the market, the previously agreed equipment specifications for approved equipment that were adopted, together with the list of approved equipment by the Conference, need to be updated by the Secretariat ; and

(b) that there is a need to have a sufficiently flexible mechanism to approve new inspection equipment in order to increase verification efficiency, reduce costs, improve logistics, and/or improve the health and safety of inspection teams. That mechanism should give adequate authority to the Director-General to pursue the approval of new equipment, when needed. The States Parties should focus on the functionality of such proposals, as well as on such aspects as cost, improved verification effectiveness, improved protection of confidentiality, commercial availability and the like, rather than on the equipment itself.

10.3 In this respect, the SAB noted two decisions taken recently on procedures for updating the list of approved equipment[23] and on procedures for revising the technical specifications for approved equipment.[24]

10.6 From the perspective of a scientist, only with flexibility in adjusting the available approved equipment to reflect both the progress being made in science and technology and the prevailing supply situations, will it be possible to avoid inefficiency and wastefulness in the conduct of inspections.

- - - o - - -

[23] Conference decision C-7/DEC.20, dated 11 October 2002.
[24] Council decision EC-31/DEC/8, dated 12 December 2002.