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Author(s): Whitby, S.M.

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Biocontrol Agents and Plant Inoculants:  
Implications for Strengthening the BTWC

Simon M Whitby

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Department of Peace Studies

University of Bradford

UK

## **Biocontrol Agents and Plant Inoculants: Implications for Strengthening the BTWC**

By Simon Whitby

Article I of the Biological and Toxin Weapons Convention<sup>1</sup> (BTWC) on the Prohibition of the Development, Production, and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction in 1972 states that:

*Each State Party to this Convention undertakes never in any circumstances to develop, produce, stockpile or otherwise acquire or retain:*

*(1) Microbial or other biological agents, or toxins, whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes;*

*(2) Weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict.*

Concern has been expressed, particularly in the last decades, regarding the effectiveness of the Biological and Toxin Weapons Convention regime in the light of the rapid pace of scientific and technological developments.

Provision is included under Article XII of the Convention that periodic reviews of the implementation of the Convention would take place and that during the course of such reviews assessments of scientific and technological developments would be compiled by Co-Depositories and States Parties, thus:

*Five years after the entry into force of this Convention, or earlier if it is requested by a majority of Parties to the Convention by submitting a proposal to this effect to the Depositary Governments, a conference of States Parties to the Convention shall be held at Geneva, Switzerland, to review the operation of the Convention, with a view to assuring that the purposes of the preamble and the provisions of the Convention, [...] are being realized. Such review shall take into account any new scientific and technological developments relevant to the Convention.*

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<sup>1</sup> The text of the Biological and Toxin Weapons Convention (BTWC) on the Prohibition of the Development, Production, and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction is available at, <http://www.opbw.org>.

## Recent Concern

In 2001, scientific and technological developments in the area of plant biology were identified as being of particular significance to the Convention and to future efforts to strengthen the Convention against their hostile use. In a statement<sup>2</sup> by the South African Delegation to the Fifth Review Conference of the 19 November 2001, Peter Goosen, Chief Director: Peace and Security, Department of Foreign Affairs, Pretoria, reminded States Parties that in all of the work undertaken by States Parties related to the BWTC, the threat against plants was usually considered to be of a lower priority or importance than the threat against humans. This had occurred, Goosen pointed out, in spite of the widespread appreciation amongst States Parties that major elements of past biological weapons programmes since the 1920's had been directed against crops and that numerous plant pathogens had been researched, developed and produced together with weapons as part of offensive BW programmes for the purpose of the widespread dissemination of anti-crop agents<sup>3</sup>.

Goosen's comments were intended to draw our attention to a much neglected issue area, namely, the rapidly advancing pace of scientific, technological, and commercial development of biocontrol agents and plant inoculants, their widespread application, and their related production facilities, and of their role in the threat against plants.

In its closing remarks, the South African Statement reflected on the failure of the Ad Hoc Group (AHG) to meet its mandate – to negotiate and agree a legally binding Protocol to strengthen the 1972 Convention prior to the BTWC's Fifth Review Conference in 2001. However, at the time of its publication, the South African Statement could not have anticipated at the Fifth Review Conference of the Convention, the proposed termination of the mandate of the Ad Hoc Group itself together with its limited but useful focus on how States Parties to the Convention might strengthen the prohibition *inter alia* in respect of this much neglected issue; the subsequent adjournment of the Fifth Review Conference for a period of twelve months until November 2002; and, the further marginalisation of the issue in question in the new nationally-focused so-called inter Review Conference process.<sup>4</sup>

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<sup>2</sup> Statement by Peter Goosen, Chief Director: Peace and Security, Department of Foreign Affairs, Pretoria, Geneva, 19, November 2001, South African Delegation to the Fifth Review Conference of the Convention on the Prohibition of the Development, Production, and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction. Available at: [http://www.opbw.org/rev\\_cons/5rc/docs/statements/5RC-OS-SAFRICA.pdf](http://www.opbw.org/rev_cons/5rc/docs/statements/5RC-OS-SAFRICA.pdf).

<sup>3</sup> For a systematic study of such state offensive anti-crop biological warfare programmes, see: Whitby, S. (2001) *Biological Warfare against Crops*, Palgrave, London.

<sup>4</sup> At its eighth plenary meeting on 14 November 2002, the Conference decided by consensus, as follows: (a) To hold three annual meetings of the States parties of one week duration each year commencing in 2003 until the Sixth Review Conference, to be held not later than the end of 2006, to discuss, and promote common understanding and effective action on: i. The adoption of necessary, national measures to implement the prohibitions set forth in the Convention, including the enactment of penal legislation; ii. National mechanisms to establish and maintain the security and oversight of pathogenic microorganisms and toxins; iii. Enhancing international capabilities for responding to, investigating and mitigating the effects of cases of alleged use of biological or toxin weapons or suspicious outbreaks of disease; iv.

As Pearson and Sims<sup>5</sup> have pointed out, the Review Conference is “a vital element in the evolution of the BTWC”. As we look forward toward to 2006, this paper is intended to facilitate the preparation by States Parties for a successful outcome at the Sixth Review Conference of the Convention, and it is both timely and instructive to develop an evaluation of work since entry-into-force of the BTWC by focusing specifically on information relating to scientific and technological developments submitted by Co-Depositaries and by States Parties in the area of biological control<sup>6</sup> as part of the Review Conference process.

This paper first defines plant inoculants and biocontrol agents and offers a brief overview of the ways in which such agents are used for peaceful purposes. Second it sets down a systematic review of the work of States Parties during the periodic reviews of the Conventions implementation in the light of scientific and technological developments affecting biological control. Finally, it concludes with recommendations relating to how the BTWC could be strengthening regarding biocontrol agents and plant inoculants. Such recommendations might be usefully considered by States Parties and acted on prior to the Sixth Review Conference of the BTWC in 2006.

### **Biocontrol Agents and Plant Inoculants**

Biocontrol agents are living organisms, such as bacteria, fungi, insects, mites or weeds, or microorganisms that are used in the control of microbes or other organisms. A large number of biocontrol agents are currently available, for example, in the US, where they are marketed as biopesticides and include bacteria such as *Agrobacterium*, the widely-used *Bacillus thuringiensis* that produces a protein toxic to species of insects pests belonging to the orders lepidoptera (caterpillars), diptera (flies), and coleoptera (beetles and weevils), *Pseudomonas*, and *Streptomyces*. Further biopesticides include fungi such as *Ampelomyces*, *Candida*, *Coniothyrium*, and *Trichoderma*.<sup>7</sup>

Plant inoculants are formulations containing living microorganisms, used in the treatment and propagation of seeds and plant propagation materiel for enhancing growth and disease resistance in plants. They are also used for the restoration of the microflora of soil.

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Strengthening and broadening national and international institutional efforts and existing mechanisms for the surveillance, detection, diagnosis and combating of infectious diseases affecting humans, animals, and plants; and, v. The content, promulgation, and adoption of codes of conduct for scientists.

<sup>5</sup> Bradford Review Conference Paper No 10, Preparing for the BTWC Sixth Review Conference in 2006, by Graham S. Pearson & Nicholas A. Sims, February 2005, p. 5. Available at: <http://www.brad.ac.uk/acad/sbtwc>.

<sup>6</sup> For the purposes of this discussion the term biological control agent will be used, where appropriate to do so, to refer to both biocontrol agents and plant inoculants.

<sup>7</sup> McSpadden Gardener, B. B., and Fravel, D. R. 2002. Biological control of plant pathogens: Research, commercialisation, and application in the USA. Online, *Plant Health Progress* doi:10.1094/PHP-2002-0510-01-RV.

## **The BTWC Review Conference Process, Scientific and Technological Developments, and the Relevance to the Convention of Biological Control Agents**

The need to strengthen the Convention had been recognised since it was opened for signature in 1972 and the BTWC has remained what Tucker has described more recently as essentially a “gentleman’s agreement”<sup>8</sup> that lacked measures to verify that States Parties were in compliance with their treaty obligations. In addition to the absence of the inclusion of verification measures and concerns over compliance, another central concern was that *inter alia* the Convention did not adequately cover future scientific and technological developments. Indeed it is apparent that such developments have proceeded at a much more rapid pace than had been envisaged at the time of the conclusion of the Convention and it is now timely to evaluate the work of States Parties in addressing this issue in the light of these developments.

### **First Review Conference of the Biological and Toxin Weapons Convention 1980.**

Prior to the First Review Conference of the Biological and Toxin Weapons Convention a meeting of the Preparatory Committee was held in Geneva from 9 to 18 July 1979. The Preparatory Committee decided to request the Secretariat to prepare a background paper on compliance by States Parties with all their obligations under the Convention. The Preparatory Committee also decided to request the Depositary Governments to prepare a background paper<sup>9</sup> on new scientific and technological developments relevant to the Convention and, in addition, to invite States Parties who wished to do so to submit their views on new scientific and technological developments relevant to the Convention. In addition, the Preparatory Committee decided to request that the Secretary of the Committee should invite the comments of States Parties on the background paper to be provided by the Depositary Governments and to compile these comments along with national contributions on the subject.

The review<sup>10</sup> of scientific and technological developments was prepared by experts of the Depositary Governments and focussed only on major developments that appeared to have direction connexion with a review of the Convention’s operation. The review of scientific developments titled: New scientific and technological developments relevant to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction was organised into the following subsections focussing on I. Recombinant DNA Techniques; II. New Infectious Diseases; III. Chemical Synthesis of Toxins; IV. The Industrial Use of

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<sup>8</sup> Jonathan Tucker, J. Tucker, Strengthening the BWC: Moving Toward a Compliance Protocol, *Arms Control Today*, January/February, 1998, p.20.

<sup>9</sup> Report of the Preparatory Committee for the Review Conference of the Parties to the Convention on the Prohibition of the Development, Production, and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, BWC/CONF I/5, 6 February 1980. Available at: <http://www.opbw.org>

<sup>10</sup> Not all States Parties submitted information to the Secretary General of the United Nations that referred either directly or indirectly to potential problems posed by the use of microbial agents against crops. For the purpose of this discussion it has been necessary to refer selectively from the official documentation

Fermentation Techniques; V. Microbial Control of Pests; and, VI. Scientific and Technological Findings.

Section V. of the above review relates to Microbial Control of Pests<sup>11</sup>. Driven in part by a concerns for human health and the environment relating to the use of synthetic chemical pesticides; and by concern relating to the efficacy of the use of such agents and the natural ability of plants to develop resistance to their use, the review notes that there had been a remarkable increase in interest in this area and summarises its relevance to the Biological and Toxin Weapons Convention as follows:

*Microbiological methods involve the large-scale production of certain live micro-organisms or their extractable toxins, the formulation of a liquid or powder product and dissemination of the product by vehicle or aircraft-borne sprays (or in rodent control, the use of ground bait) over crops or forests. With live microbial agents death of insect or rodent occurs through infection; with microbial toxins death is produced by toxic effects. **In some basic respects the whole sequence resembles biological warfare** (emphasis added).*

The review of scientific and technological developments summarises how viral, bacterial and fungal agents of relevance to the Biological and Toxin Weapons Convention are produced and disseminated in the following table:

<b>Viruses</b>	Nuclear polyhedrosis and granulosis viruses: produced on a large-scale by a few nations, using mass rearing of insect hosts. The viruses extracted at a concentration of $12 \times 10^6$ infective unites/ml are sprayed by aircraft. Viral insecticides are more expensive to produce than bacterial insecticides but they have the possible advantage of high target-specificity.
<b>Bacteria</b>	<i>Bacillus thuringiensis</i> : produced by several nations on a multi-tonne basis in deep-aerated vessels. The final product contains about $3 \times 10^{10}$ bacterial spores/g. and is stable for 2 to 3 years. Disseminated by aircraft spray as liquid or powder aerosol, the bacterium is highly valued for controlling a wide variety of insect pests.
	<i>Bacillus popillae</i> : is another agent produced and used in much the same way as <i>Bacillus thuringiensis</i> for controlling Japanese beetle larvae.
	<i>Pseudomonas seruginosa</i> (and <i>Pl. fluorescens</i> ) and <i>Chromobacterium prodigiosum</i> : produced and used in a few countries for dissemination by aircraft spray on reservoirs (at $10 \times 10^6$ organisms/cm <sup>2</sup> water surface) in mosquito larvae control. These agents are, however, facultative pathogens for man.

<sup>11</sup> Report of the Preparatory Committee for the Review Conference of the Parties to the Convention on the Prohibition of the Development, Production, and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, BWC/CONF I/5, 6 February 1980. Appendix E. Available at: <http://www.opbw.org>

<b>Fungi</b>	Various species such as <i>Trichoderma</i> , <i>Sporotrichum</i> , <i>Beauveria</i> and <i>Cuelomemvces</i> are produced on a multi-tonne basis by several nations. They are disseminated by aircraft spray to infect insect pests and sometimes to attack other fungal diseases of crops. Additionally, a number of other microbial agents are currently being studies, or evaluated in field trails.
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In spite of similarities between the process of production for peaceful use of agents used in the microbial control of pests and their means of dissemination and the relevance of this to the development and production of biological warfare agents the review noted that the risks posed, "...appeared to be outweighed by the significant peaceful potential in this method of pest control".<sup>12</sup> Further to this the Scientific and Technological Findings of the review noted that such developments, "...do not appear to alter substantially capabilities or incentives for the development or production of biological or toxin weapons".<sup>13</sup>

As a consequence no changes were thought appropriate to be included in the Final Declaration of the First Review Conference of the Biological and Toxin Weapons Convention and thus no extended understandings of Article I relating to the scope of the Convention were required in 1980 with respect to relevant science and technological developments in the area of plants. Article I of the Final Declaration<sup>14</sup> of the First Review Conference thus reads:

*The Conference notes the importance of Article I as the Article which defines the scope of the Convention and reaffirms its support for the provisions of this Article.*

*The Conference believes that Article I has proved sufficiently comprehensive to have covered recent scientific and technological developments relevant to the Convention.*

### **Second Review Conference of the Biological and Toxin Weapons Convention 1986.**

The Second Review Conference was held in Geneva for three weeks from 8 to 26 September 1986. As in the case of the First Review Conference of the Biological and Toxin Weapons Convention the Preparatory Committee for the Second Review Conference decided to request each of the Depositary Governments, to submit to the Review Conference information on new scientific and technological developments relevant to the Convention. The Committee also decided to invite State Parties who wished to do so to communicate to the Secretary General of the United Nations their views on new scientific and technological developments relevant to the Convention. In the case of the 1986 Second Review Conference the Co-Depositaries and States Parties therefore prepared and distributed to all States Parties separate national papers on new

<sup>12</sup> *Ibid.* Appendix E, p. 292.

<sup>13</sup> *Op cit.* Appendix E. p. 292.

<sup>14</sup> Final Declaration of the First Review Conference, BWC/CONF.1/10, II Final Declaration, available at: <http://www.opbw.org>.

scientific and technological developments of relevance to the BTWC prior to the Conference.

The review by States Parties of scientific and technological developments was titled: Background Document on New Scientific and Technological Developments Relevant to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction.<sup>15</sup> The submission by Sweden noted that the use of micro-organisms in the control of plant pests had increased with the technique spreading to more countries. According to Sweden:

*Knowledge and techniques for large-scale production of insect pathogens (bacteria and viruses) and methods for aerosol dissemination have been developed which have many similarities with methods essential for employing biological warfare agents.*

Sweden, however, went on to acknowledge that in accordance with the understanding that resulted from the First Review Conference that regardless of the production method, the results of new scientific and technological advances were covered by the Convention.

The United Kingdom of Great Britain and Northern Ireland contribution<sup>16</sup> was organised into the following sub sections preceded by 1. an Introduction: 2. Biotechnology, 3. New Infectious Diseases, 4. Toxins, 5. Industrial Microbiology, 6. Microbial Control of Pests, and 7. Conclusions. The UK contribution noted the analogies between the peaceful methods of microbial pest control and BW that had been drawn at the previous Review Conference; and included significant information regarding the extent to which interest had increased in the area of the production of microbial control of pests and their means of dissemination. The UK paper offered an assessment of increase in interest biological control and noted apparent changes to the methods of production<sup>17</sup>:

*Increases in use since 1980 have not been spectacular except possibly in the nations of Eastern Europe, where Lepidoptera pests are a greater agricultural problem than elsewhere. In such nations about 30 different microbial preparations or formulations have been developed and some are produced on often multi-tonne scales. GE [genetic engineering] is being applied in many nations to the development of improved and novel agents for pest control.*

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<sup>15</sup> Background Document on New Scientific and Technological Developments Relevant to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, BWC/CONF. 11/4; and BWC/CONF. 11/4/Add. 1, and BWC/CONF. 11/4/Add.2. Available at: <http://www.opbw.org>

<sup>16</sup> Background Document on New Scientific and Technological Developments Relevant to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, BWC/CONF. 11/4, 6. Microbial Control of Pests, p. 8. Available at: <http://www.opbw.org>

<sup>17</sup> Background Document on New Scientific and Technological Developments Relevant to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, BWC/CONF. 11/4, paragraph 6.2, p.8. Available at: <http://www.opbw.org>

*Obviously large-scale industrial microbiology is a key aspect of production.... Insect viruses for pest control continue to be relatively expensive to produce but the possibility that viruses could be more cheaply and effectively produced through GE, rather than by bulk production in insects, is likely to result in widely-adopted production methods in nations where susceptible pests are a problem.*

Regarding methods of dissemination for microbial methods of pest control the UK contribution<sup>18</sup> noted the following:

*Methods of dissemination of microbial pest control agents continue to be the subject of increasing R&D and trials. Mobile jet-engined devices are capable of disseminating agent aerosols, notably insect viruses, over vast tracts of land. There has been continuing R & D on ultra-low volume spraying systems, methods of studying spray deposition, formulations, the problems of disseminating dusts and powders, micro-encapsulation and other relevant topics.*

A section on recent developments of relevance to the Convention in regard to the microbial control of pests was also included in the UK contribution which noted the following:

	<b>Recent developments of relevance include:</b>
a.	GE-derived bacteria with high toxin yields
b.	The production through GE, of toxins in species beyond those bacteria which produce them in nature.
c.	Development of formulations aimed at enhanced retention of microbial viability during storage and in aerosol.
d.	Protection of aerosolised micro-organisms by the incorporation of protective UV-light screening dyes.
e.	Improvements in the spray-drying and milling of micro-organisms and toxins.
f.	The formulation of synergistic combinations of live micro-organisms and toxic anti-coagulants, together with drug delivery systems.
g.	Development of automated production lines for insects, used in the production of some viruses.
h.	Vastly increased knowledge on aerobiological aspects of dissemination and the elucidation of the factors which control viability and stability in dissemination, aerosol and in respect of persistence.
i.	Computer controlled continuous culture systems and improved purification systems.

<sup>18</sup> Background Document on New Scientific and Technological Developments Relevant to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, BWC/CONF. 11/4, paragraph 6.3, p.8. Available at: <http://www.opbw.org>

In its concluding remarks the UK contribution noted a greater potential for abuse across a range of civil capabilities than was present at the time of the First Review Conference in 1980. In particular with regard to microbial methods of pest control, it noted :

*..the “biotechnology explosion” in the civil sectors of many nations and the realization of the potentials of GE and industrial microbiology. We have drawn attention again to developments in microbial methods of pest control and to the increasing knowledge of nations in the large-scale production and dissemination of micro-organisms and microbial products. Such developments in the civil sector are relevant to the BWC and could be abused to support offensive programmes.*

Whilst no other contributions by States Parties addressed the problems posed by the microbial control of pest the contribution from the United States (US) included in its general concluding remarks observations of relevance to this area. The US contribution noted the following:

*In many ways, recent progress in biological technology affects the ease of concealment of manufacturing plants and the availability of new delivery systems....Verification of the Convention, always a difficult task, has been significantly complicated by the new technology. The confidence derived from the belief that certain technical problems would make biological weapons unattractive for the foreseeable future has eroded. The ease and rapidity of genetic manipulation, the ready availability of a variety of production equipment, the proliferation of safety and environmental equipment and health procedures to the number of laboratories and production facilities throughout the world, are signs of the growing role of biotechnology in the world’s economy. But these very same signs also give concern for the possibility of misuse of this biotechnology to subvert the Convention.*

As at the First Review Conference, the Second Review Conference in its Final Declaration<sup>19</sup> reaffirmed that the scope of the Convention covers all scientific and technological developments but also agreed to reaffirmations and extended understandings of relevance to the area, *inter alia*, of biological control as follows:

*The Conference, conscious of apprehensions arising from relevant scientific and technological developments, inter alia, in the fields of microbiology, genetic engineering and biotechnology, and the possibilities of their use for purposes inconsistent with the objectives and the provisions of the Convention, reaffirms that the undertaking given by the States Parties in Article I applies to all such developments.*

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<sup>19</sup> Second Review Conference of the Parties to the Convention on the Prohibition of the Development, Production, and Stockpiling of Bacteriological (Biological) and Toxin Weapons, Final Document, Part II, Final Declaration, BWC/CONF.II/13/II. Available at: <http://www.opbw.org>

*The Conference reaffirms that the Convention unequivocally applies to all naturally or artificially created microbial or other biological agents or toxins whatever their origin or method of production. Consequently, toxins (both proteinaceous and non- proteinaceous) of a microbial, animal or vegetable nature and their synthetically produced analogues are covered.*

### **Third Review Conference of the Biological and Toxin Weapons Convention 1991.**

The Preparatory Committee for the Third Review Conference was held in Geneva from 8 to 12 April 1991. As had happened prior to the Second Review Conference, the Preparatory Committee requested the preparation of background papers by the Secretariat on the compliance by States Parties with all their obligations under the Convention and on new scientific and technological developments relevant to the Convention.

The Third Review Conference was held in Geneva for three weeks from 9 to 27 September 1991. As at the Second Review Conference the Secretariat distributed papers containing information provided by Co-Depositary States and by other States Parties on new scientific and technological developments of relevance to the Convention<sup>20</sup>. The review by States Parties dated 26 August 1991, on scientific and technological developments was, as during the Second Review Conference titled: Background Document on New Scientific and Technological Developments Relevant to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction<sup>21</sup>.

The submission by Australia included a note in its general introductory remarks to its section titled: Impact of recent advances in science and technology on the Biological Weapons Convention<sup>22</sup>, regarding the continued exploitation since the Second Biological Weapons Convention Review Conference in 1986, of biotechnology in the fields of medicine and agriculture which has lead to:

*...major advances in the production, harvesting and preservation of micro-organisms and plant and animal cells. National capabilities for the large-scale production of micro-organisms and cell products have increased as the industrial potential in the exploitation of biotechnology has been recognised. While this has been beneficial from the point of view of public health and agriculture, it has also the potential, if misused, to provide the expertise and experience needed for developing and producing BW agents.*

As was noted in the review of scientific and technological developments provided at the First Review conference, the Australian submission cited environmental concern as a major driver in the increase in research into biological control. Australia also noted in a

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<sup>20</sup> Background Document on New Scientific and Technological Developments Relevant to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, BWC/CONF. III/4. Available at: <http://www.opbw.org>

<sup>21</sup> Ibid.

<sup>22</sup> Op cit. Impact of recent advances in science and technology on the Biological Weapons Convention.

sub section titled: Dissemination and Delivery, similarities in the scientific and technological production of both biological control and BW agents thus:

*Many of the problems encountered in applying biological control are similar to problems that would be encountered in BW. Agents are readily inactivated by exposure to air, or to ultraviolet light (sunlight) or by desiccation. Methods of microencapsulation of agents have helped to overcome these problems. Microencapsulation involves covering particles or droplets of an organism or toxin with a thin but very protective coat which will release the agent when it reaches a target environment (eg inner lung). The size and the smoothness of micocapsules can be controlled so that they will disperse well and carry properly through or with the air to their target. Such control would also allow easier, standardized weaponization or spraying methods for a range of agents. The inclusion of UV protective pigments such as those that have recently been discovered in marine soft corals and sponges would provide further protection of aerosolised micro-organisms. The dissemination methods for biological pesticides have also improved, with the development of low-volume spraying devices and jet engined sprayers. These methods are as applicable to BW agents as to microbial pesticides.*

In its concluding remarks the Australian submission noted the worldwide spread of biotechnology-related capabilities and with that the increased possibility of its misuse.

In its review of scientific and technological developments since 1986, the UK in its subsection 2 titled: General Developments Relevant to the BWC, noted the increasing emphasis being placed in educational provision for students worldwide on issues related to GM and biotechnology techniques:

*There has been an increase in teaching and research programmes on the principles involved in applications of biotechnology, including post graduate courses specifically aimed at students from developing countries. Study areas include process biotechnology and specifically the scale-up of operations using GM materials, the genome engineering of plants in order to improve disease resistance, and the biocontrol of plant pathogens and of insects including by infection with fungi....*

In its concluding remarks to subsection 2, the UK submission raised areas of concern relating to advances in the area of scientific and technological developments:

*There has been steady refinement of those biotechnology aspects other than GM that an aggressor nation could misuse in developing an offensive BW capability; important among the capabilities that could be misused are techniques for the large scale production of natural or modified micro organisms and toxins that are now established in a considerable number of countries. Further advances in capabilities of producing micro organisms and other biological agents are to be expected.*

The UK submission, however, also notes with some optimism that studies relating to the genetics of crop species are likely to result in the long-term in improvements in resistance to disease in plants and with that there is the suggestion that this might result in a reduction in the likelihood that crops might be targeted for purposes related to economic warfare.

Sub-section 6 of the UK submission, titled: Microbial Control of Pests, addressed matters relating to biological control more directly. The UK notes the increase in emphasis in studies concerning environmental release of pathogens, and goes on to outline increase in research activities with bacteria, fungi, and viruses; and increases in the study of aspects of production, improvements in biological control formulations, and methods of dissemination, and simplification of production techniques. According to the UK<sup>23</sup>:

*The bacteria Bacillus thuringiensis is still the most widely used entomopathogen, but there is increasing research on about 20 of the several hundred entomopathogenic fungi known. Of the viruses, baculoviruses continue to receive the most attention. Aspects of the use of these micro organisms that are being studied include production, problems of low pathogenicity, and constraints posed by temperature and humidity in the field. Novel and improved formulation are being developed to extend shelf life and to extend residual activity in the field eg by the use of ultraviolet protectants. Formulations are also being developed to ensure compatibility with existing agricultural spray devices, to remove the need for dedicated high-cost equipment. Because Lepidoptera are far more of a problem in tropical areas, microbial control technology including 'cottage industry' production of pathogens is being developed in those areas with the help of the developed nations.*

In its concluding remarks to this subsection the UK notes increases in knowledge in the production of biological control agents and in methods relating to their dissemination, and notes the increased potential for misapplication. However, in its general conclusions whilst noting the relevance to the Convention of developments in this area the UK submission also notes an increase in the potential for improvements in areas related to development of defensive measures including improvements in identification and diagnosis of disease, and in the development of vaccines.

The submission by the United States of America (USA) titled: Technological Developments of Relevance to the Biological and Toxin Weapons Convention, echoed the sentiments expressed in the concluding remarks of the UK submission noting increased potential for both misapplication and increased potential for the development of defensive measures. The US submission identified the area of Advances in Industrial Applications as most noteworthy with advances since 1986 in basic research and

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<sup>23</sup> Background Document on New Scientific and Technological Developments Relevant to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction. BWC/CONF.III/4, p. 25. Available at: <http://www.opbw.org>

subsequent applications occurring across the fields of medicine, agriculture and industry. Matters relating to scientific and technological advances in the area of biological control were addressed in sub-section 2.2 titled: Advances in production. In regard to improvement in the production of bio pesticides, the US note the following:

*...once a suitable recombinant organism has been engineered, exploiting it becomes a matter of using established procedures. Biological production technology has proceeded to the point where large quantities of biological products can be produced quickly in small facilities....Two genetically altered pesticides are about to be approved for commercial use which represent a "second-generation" of bio pesticides which will not degrade quickly in the environment due to a microencapsulation process.*

The US submission goes on to note areas relating crops where scientific and technological improvements have resulted in the adaptation of cereals, forages, fibre crops and fruits and vegetables to environmental stresses caused by drought, cold, heat and toxic soil.

In its concluding remarks the US submission warns that advances in biological technology have significantly complicated the issue of the verification of the Convention.

As at the Second Review Conference, the Third Review Conference reaffirmed in its Final Declaration<sup>24</sup> that the scope of the Convention covers all scientific and technological developments but also agreed to extended understandings of relevance to the area, *inter alia*, of biological control as follows:

*The Conference, conscious of apprehensions arising from relevant scientific and technological developments, inter alia, in the fields of microbiology, genetic engineering and biotechnology, and the possibilities of their use for purposes inconsistent with the objectives and the provisions of the Convention, reaffirms that the undertaking given by the States Parties in Article I applies to all such developments. The Conference also reaffirms that the Convention unequivocally covers all microbial agents or toxins, naturally or artificially created or altered, whatever their origin or method of production.*

#### **Fourth Review Conference of the Biological and Toxin Weapons Convention 1996**

The Preparatory Committee for the Fourth Review Conference met in Geneva 9 and 10 April 1996. As had happened prior to the Third Review Conference, The Preparatory Committee also requested the preparation of background papers by the Secretariat on the compliance by States Parties with all their obligations under the Convention and on new scientific and technological developments relevant to the Convention. The papers were

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<sup>24</sup> Third Review Conference of the Parties to the Convention on the Prohibition of the Development, Production, and Stockpiling of Bacteriological (Biological) and Toxin Weapons, Final Document, Part II, Final Declaration, BWC/CONF.III/23/Part II, Page 9. Available at: <http://www.opbw.org>.

distributed to States Parties prior to the Fourth Review Conference of the Biological and Toxin Weapons Convention that was held in Geneva for two weeks from 25 November to 6 December 1996.

The review by States Parties dated 30 October 1996, on scientific and technological developments was, as during the Third Review Conference titled: Background Document on New Scientific and Technological Developments Relevant to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction<sup>25</sup>.

In its sub-section titled: Major Results, Cuba identified several areas where scientific and technological developments had taken place in the area of plants of relevance to the Convention.

Development of diagnostics for detection of plant pathogens.
Obtaining of transgenic plants and animals (sugar cane, cabbage, potatoes, tobacco, tilapia, rabbits, etc.) and commercial varieties of pest-resistant plants.
Use of electron microscopy, serology and molecular biology for diagnosis of phytopathogenic micro organisms.
Obtaining of antisera and production of diagnostic kits for plant pathogens.
Development of technologies for the biological production of substances for pest control in cultivated plants.
Use of integrated management techniques for farm pest control.
Development of commercial crops for commercial production of biological substances.
Development of biological products for vector control: the larvicides “Griseler” ( <i>Bacillus sphaericus</i> ), “Bactive” ( <i>Bacillus thuringiensis</i> ); and the rodenticide “Biorat” ( <i>Samonella enteritidis</i> ).

The UK submission assessed scientific and technological developments since the Third Review Conference and considered advances and changes in science, medicine and industrial applications. Under sub-sections 6 titled: Trends in infectious diseases and their treatment<sup>26</sup>, the UK submission draws attention to developments relating to biological control thus:

*Research has continued into new compounds active against plant pathogens, but there are still no anti-virus compounds and no good plant bactericides except for antibiotics (which are not approved for crop application in the United Kingdom and are relatively expensive to use). There is still a lack of fungicides effective against the important wilt pathogens in the genera Fusarium and Verticillium. Genetic modification of plants to express viral coat proteins and thus confer*

<sup>25</sup> Background Document on New Scientific and Technological Developments Relevant to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, BWC/CONF.IV/4\*. Available at: <http://www.opbw.org>

<sup>26</sup> Background Document on New Scientific and Technological Developments Relevant to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, BWC/CONF.IV/4\*, p. 16. Available at: <http://www.opbw.org>

*some protection against infection by the virus of viruses concerned is now relatively commonplace in research but such plant have not yet been released for commercial use in the United Kingdom....*

More specifically and in detail, in sub section 8 titled: Microbial Control of Pests the UK offers an overview of developments in areas relating to bacteria, viruses, fungi, and improvements in diagnosis of plant disease.

In regard to bacteria, the UK offers the following overview of developments:

*Bacillus thuringiensis (Bt) continues to be the most important agent being used to control insect pests. From fundamental studies of the mode of action of these bacteria and the use of advanced genetic modification techniques, Bt toxin genes have been transferred to create transgenic plants. This enables the plant to protect itself from pests by producing an insect-specific Bt toxin. The first major releases of commercial crops based on this principle have occurred, heralding what could turn out to be a major new era in environmentally benign farming avoiding the use of chemicals. The bacterium Bacillus sphaericus, pathogenic for some mosquito species, is another promising biological alternative for pest control.*

In regard to viruses, the UK offers the following overview of developments:

*The use of viruses to control insect pests has been advancing with the appearance of new commercial pesticides based on the nuclear polyhedrosis virus to control pest species resistant to chemicals. Genetic modification is also being used to improve the performance of these pathogens: new, faster acting strains of virus have been created by incorporating into the genome specific insect toxins derived from other animals such as scorpions. The creation of transgenic plants incorporating genes of insect viruses is also a promising new line of development in crop protection.*

In regard to fungi, the UK offers the following overview of developments:

*Fungal agents such as Metarhizium spp, and Beauveria bassiana are being actively developed as biological control agents against important pests such as locusts in Africa and aphids on field crops.*

Significant advances in the development of diagnostics, and in the control of weeds, the latter resulting from developments in the area of the study of molecular biology are also described.

The concluding remarks of the UK's submission echoed previous submissions which balanced peaceful developments in this area and the potential for improvements regarding defensive measures against the world-wide spread of the science and technology and the increased potential for its misapplication.

The US submission again shared the sentiments expressed in the UK's concluding remarks and in its submission identified major areas of scientific and technological development including the "fields of analytical developments and vaccinology, both of which have applications in the field of medicine and public health as well as in industry and agriculture", and went on to note the importance of reviewing developments in basic research and in applications across the areas of biotechnology, molecular biology, medicine, microbiology, biochemical engineering, and pharmaceutical and vaccine production.

In sub section 2.0 which addressed Advances in industrial applications of biotechnology, the US submission noted the dual use potential of modified micro organisms in the area of plants, thus:

*In the area of plant pathogens...developments are being pursued to produce environmentally safer and more effective pesticides. All of these developments can provide significant benefits to the public health and welfare of society, however, in examining these same developments from the point of view of the BWC, we cannot ignore the potential misuse of biotechnology to produce new biological agents or improve certain characteristics in those agents already recognised as potential biological agents. Transferring certain genetic characteristics into naturally occurring organisms can potentially create organisms of greater virulence, antibiotic resistance and environmental stability....A nearly infinite variety of biological compounds designed for specific uses and given specific characteristics is possible.*

The US submissions concluding remarks echoed the stance adopted at the previous Review Conference which again noted that compliance with the Convention has been "significantly complicated" by the new technologies.

The submission by Sweden titled: Background Information on New Scientific and Technological Developments Relevant to the Biological and Toxin Weapons Convention, identified the areas of biotechnology and genetic modification as those that have revolutionised biological and medical science and noted both potential benefits and the increased potential for misapplication. In particular, in regard to plants, under a subsection titled: Disease-causing mechanisms, the Swedish submission noted an increase in basic research into mechanisms of virulence – referred to as "shared strategies for causing disease"<sup>27</sup> - that a number of plant pathogens share with bacterial pathogens affecting humans. According to the submission from Sweden:

*This shared strategy for virulence has led to an intense research where the goal is to target components of this system and to develop a common strategy to prevent infections by several different pathogens. But also here there is a potential threat that this knowledge can be misused to change the virulence of pathogens.*

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<sup>27</sup> Ibid. Page 3.

Further to this under a sub-section titled: Release of genetically modified microorganisms in the environment, Sweden notes the increasing application of living microorganisms in medicine, industry and agriculture, the increase in knowledge in the behaviour of microorganisms in different environments, and increases in capacity for large-scale production.

In its concluding remarks the Swedish submission notes the relevance to the Convention of developments in the area of biological control as follows<sup>28</sup>:

*The exploitation of biotechnology and the trend to establish commercial cooperation worldwide significantly contributes to the spread and increase of knowledge in this field of research and development. Continuing expansion of activities in industrial microbiology and increasing demand on control of survival and spread of microorganisms in the context of control of pests can have implications that have to be considered in relation to the BTWC.*

The German submission expressed concern regarding increased risk posed by the worldwide spread of biological technology together with acknowledgements relating to the potential of far-reaching benefits, in particular, in the area of advances in the rapid identification of agents, but no specific information relating to scientific and technological development in the area of biological control was included.

As at the Third Review Conference, the Fourth Review Conference reaffirmed in its Final Declaration<sup>29</sup> that the scope of the Convention covers all scientific and technological developments but also agreed to extended understandings of relevance to the area, *inter alia*, of bio-control as follows:

*2. The Conference reaffirms that the Convention prohibits the development, production, stockpiling, other acquisition or retention of microbial or other biological agents or toxins harmful to plants and animals, as well as humans, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes.*

....

*5. The Conference also reaffirms that the Convention unequivocally covers all microbial or other biological agents or toxins, naturally or artificially created or altered, as well as their components, whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes.*

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<sup>28</sup> Op cit. Page 7.

<sup>29</sup> Fourth Review Conference of the Parties to the Convention on the Prohibition of the Development, Production, and Stockpiling of Bacteriological (Biological) and Toxin Weapons, Final Document, Part II, Final Declaration, BWC/CONF.IV/9/Part II, Page 14. Available at: <http://www.opbw.org>.

*6. The Conference, conscious of apprehensions arising from relevant scientific and technological developments, inter alia, in the fields of microbiology, biotechnology, molecular biology, genetic engineering, and any applications resulting from genome studies, and the possibilities of their use for purposes inconsistent with the objectives and the provision of the Convention, reaffirms that the undertaking given by the States Parties in Article I applies to all such developments.*

### **Fifth Review Conference of the Biological and Toxin Weapons Convention 2001**

The Preparatory Committee met in Geneva from 25 to 27 April 2001. As had happened prior to the Fourth Review Conference, the Preparatory Committee also requested, the preparation by the Secretariat of background papers on compliance by States Parties with all their obligations under the Convention and on new scientific and technological developments of relevance to the Convention. As had happened prior to the Fourth Review Conference this information should cover developments relating to scientific and technological applications and their relevance to various aspects of the Convention. The papers were distributed to States Parties prior to the Fifth Review Conference which was held in Geneva between 19 November and 7 December 2001.

The review<sup>30</sup> by States Parties dated 14 September 2001, on scientific and technological developments was, as during the Fourth Review Conference titled: Background Document on New Scientific and Technological Developments Relevant to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction. The latter review contained information submitted by the following countries: Bulgaria, South Africa, Sweden, United States of America. Further to this, a submission by the United Kingdom<sup>31</sup> was circulated by the Secretariat also titled: Background Document on New Scientific and Technological Developments Relevant to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction.

A great deal more information of relevance to biological control was included in the reviews of scientific and technological developments at the Fifth Review Conference with the UK's submission also covering a broad-range of issues relevant to the Convention in significant detail and numbering some 29 pages. In its sub-section titled: Pest control in agriculture<sup>32</sup>, the UK submission noted the world-wide spread of

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<sup>30</sup> Background Document on New Scientific and Technological Developments Relevant to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction. BWC/CONF.V/4, 14 September 2001. Available at: <http://www.opbw.org>

<sup>31</sup> Background Document on New Scientific and Technological Developments Relevant to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction. BWC/CONF.V/4/Add.1, dated 26 October 2001. Available at: <http://www.opbw.org>

<sup>32</sup> Ibid. Page 21.

agricultural applications involving genetic modification in disease control. In regard to applications involving crops inserted with the Bt toxin expressing gene, the following data cited suggest widespread application thus:

*Data for 2000 indicates that, of the 29 million hectares of genetically modified crops grown in the USA, Argentina and Canada, 24% was transgenic maize (corn) or cotton hybrids containing cry genes derived from Bt. China, Mexico and Australia are also major growers of these Bt crops, and commercial production in India is planned. In many cases Bt crops allow use of chemical pesticide to be reduced, and there have been reports of significant increases in yields and profits.*

The UK submission also notes the large number of laboratory and epidemiological studies relating to the potential risks to human health and the environment of direct applications of Bt as an insecticide. With regard to methods of dissemination and facilities involved in the production of biological control agents, the UK submission in its concluding remarks to this subsection notes<sup>33</sup> that:

*Some of the above technologies, including microbial manufacturing plants and field delivery systems, could be misused in illicit BW programmes.*

Under a subsection titled: Use of pathogens to control weeds and ‘criminal’ crops, the UK addresses the controversial issue of the use of biological control against drug crops such as coca, opium and marijuana and notes that a number of countries are supporting the UN Drug Control Programme for the use in this context of ‘bioherbicides’. The agents in question, according to the UK include:

*The fungus Fusarium ... considered for use against coca plants from which cocaine is manufactured, and another fungus, Pleospora papaveraceae, [which] is being considered to attack opium poppies.*

This subsection also notes environmental concerns that have been raised in connection with the above and includes a recommendation that the Fifth Review Conference address this issue directly.

The US submission<sup>34</sup> contains an overview of advances across a broad range of fields including genetic modification, genomics, proteomics, bioremediation, biocontrol agents, vaccine developments and bioinformatics and reports the growth across a broad range of areas of concern for the BTWC including advances in genomics, proteomics, computational biology, and industrial biotechnology.

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<sup>33</sup> Op cit. Page 22.

<sup>34</sup> Background Document on New Scientific and Technological Developments Relevant to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction. BWC/CONF.V/4, 14 September 2001, page 13. Available at: <http://www.opbw.org>

However, in its review of scientific and technological developments since the Fourth Review Conference, the US submission raises and number of issues which bring into question assumptions held about anticipated demand in the agricultural sector for biological control agents; and, further raises issues which challenges claims that the biological control industry might be a source of BW proliferation. In regard to the former the US submission notes<sup>35</sup>:

*An expected surge in demand for biopesticides arising from increasing environmental awareness has failed to materialize. The lack of demand for biopesticides has resulted from the fact that biopesticides, are: (1) not as effective or consistent, (2) work slower, (3) cost more to produce, (4) have a limited pest spectrum, and (5) are more difficult to store when compared to chemical pesticides. Given such limitations, all of these factors affect the viability of this technical discipline.*

Further, in regard to the biological control industry as a source of proliferation concern, the US submission notes the following:

*Reliance on adaptive technology makes it highly unlikely that biocontrol would be a source of unique or special processes or techniques that would enable BW proliferation. This is not to say that facilities used to produce biocontrol agents couldn't be exploited for dual-use purposes. For example, facilities that produce Bt (*Bacillus thuringiensis*) as a biopesticide could easily be converted to produce anthrax (*Bacillus anthracis*) within a matter of days. However, this is not unique to this industry.*

The Swedish submission set out a detailed overview of scientific and technological development relevant to the Convention and identified a number of areas where the impact of the rapid spread of biotechnology was in evidence. This submission was organised around the following subsections: Genomics, proteomics and treatment of disease; Vaccines; Industrial microbiology and production; and Identification of disease causing agents. The issue of biological control was not addressed directly in the Swedish submission although the worldwide increase in applications across a broad range of areas including agriculture is noted. The Swedish submission also identified developments relating to Industrial microbiology and production as an area of particular relevance to the BTWC:

*Large-scale production of biological active substances, with a microbiological agent origin, in relatively small production facilities, is also possible due to biotechnological development. Within the pharmaceutical industry research is intense for methods to stabilize drugs for aerosol or oral delivery of, for example toxins, chimeric toxins, modulators of the immune system and bioregulators. The outcome of this research could also increase the risk for development of more stable biological and toxin weapons.*

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<sup>35</sup> Ibid. Page 22.

The Bulgarian submission related details of domestic research and development activities on combating infectious and parasitic diseases and epidemiology and in the area of the development of anti-viral prophylaxis but reports no activity in regard to scientific and technological development on biological control relevant to the Convention.

The South African submission<sup>36</sup> commented extensively and in considerable detail in regard to developments relating to biological control and plant inoculants relevant to the Convention. In terms of definitions both the former and the latter are defined thus:

*A plant inoculant is a formulation containing pure or predetermined mixtures of living micro organisms for the treatment of seed, seedlings or other plant propagation material for the purpose of enhancing the growth capabilities or disease resistance of the eventual plants or crops.*

In contrast biocontrol agents are defined thus:

*A Biocontrol agent can be defined as a living organism or biologically active substance originating from such an organism, used for the prevention, elimination or deduction of plant disease, pests or unwanted plants.*

In regard to plant inoculants, separate detailed subsections of the South African submission give an overview of: the history of their use and development; their purpose, their mode of action; types of inoculants; methods of inoculation; production methods; and, the relevance of plant inoculants for the BTWC. And in regard to biocontrol agents, separate detailed subsections of the South African submission give an overview of: differing approaches to biological control; the complexity of factors affecting their application; and biological agents against plants – the latter including the controversial area of attacking drug crops. However, the object here is to draw attention to the conclusions to this subsection which suggest the relevance of biological control agents and plant inoculants to the Convention.

According to the South African submission<sup>37</sup> plant inoculants are relevant to the Convention in terms of:

- a. A growing industry and more sophisticated production facilities that have the potential to be diverted to BW producing facilities, as in the case of vaccine production facilities.*
- b. The genetic research and development that is conducted to improve the micro-organisms that form the active ingredients of inoculants.*
- c. The development of liquid inoculants that will make their application by spraying and aerosolisation a possibility.*

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<sup>36</sup> Op cit. Page 5.

<sup>37</sup> Op cit. Page 7.

Whereas the control of plant pests, weeds and plants with biological control agents are relevant to the Convention in terms of:

- a. The less clear distinction between the peaceful use of biocontrol agents and their use as BW due to the dual use nature of these agents.*
- b. Undesired plants, exotic plants or even noxious plant in one country may be natural, essential and in many cases utilised for commercial purposes (crops) in other countries.*

Fifth Review Conference resulted in the failure of States Parties in producing Final Declaration and although agreement on an inter-Review Conference process was agreed by States Parties when the Fifth Review Conference resumed in Geneva, 11 November 2002, no attempt was made to produce a Final Declaration and thus, as Pearson and Sims<sup>38</sup> have pointed out, “the opportunity to continue to strengthen the Convention through further extension of the understandings agreed at previous Review Conferences was missed.”

The latter concludes this overview of the various periodic reviews of scientific and technological developments in the area of biological control relevant to the Convention and demonstrates the increasing concern that has been expressed during the course of the Review Conference process, since entry-into-force of the Convention, regarding the world-wide spread of dual use scientific and technological knowledge in this area; and in the area of the increasing extent of the emergence of dual use applications, and production facilities.

As at previous Review Conferences the Preparatory Committee will be prior to the Sixth Review Conference in 2006, requesting that Co-Depositaries and States Parties submit their views on new scientific and technological developments relevant to the Convention. The reviews are a vital component in the Review Conference process and inform action by Co-Depositaries and States Parties in regard to the formulation of and agreement on re-affirmations and extended understandings and their subsequent incorporation into the Final Declaration of the up-coming Sixth Review Conference. Co-Depositaries and States Parties in drafting their reviews should be mindful of, *inter alia*, increasing concerns that have been raised in connection with scientific and technological developments in the area of biological control as outlined above.

## **Confidence Building Measures**

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<sup>38</sup> Bradford Review Conference Paper No. 10: Preparing for the BTWC Sixth Review Conference in 2006, by Graham S. Pearson & Nicholas A. Sims, February 2005. Available at: [http://www.brad.ac.uk/acad/sbtwc/briefing/RCP\\_10.pdf](http://www.brad.ac.uk/acad/sbtwc/briefing/RCP_10.pdf)

Further to the above, another vital component in strengthening the prohibition regime lies in qualitative – and quantitative<sup>39</sup> - improvements in the area of BTWC confidence building measures. As agreed in the Final Declaration of Second Review Conference States Parties decided to hold an *ad hoc* meeting of scientific and technical experts from States Parties to finalize the modalities for the exchange of information and data in regard to measures to be implemented on the basis of mutual cooperation, soon to be called confidence-building measures, in order to prevent or reduce the occurrence of ambiguities, doubts and suspicions. This *ad hoc* meeting<sup>40</sup> was held in Geneva from 31 March to 15 April 1987 and agreed the modalities for the exchange of information and data to implement the agreed confidence-building measures.

The four confidence-building measures, which were subsequently elaborated upon in March / April 1987, addressed the following:

1. *Exchange of data, including name, location, scope and general description of activities, on research centres and laboratories that meet very high national or international safety standards established for handling, for permitted purposes, biological materials that pose a high individual and community risk or specialise in permitted biological activities directly related to the Convention.*
2. *Exchange of information on all outbreaks of infectious disease and similar occurrences caused by toxins that seem to deviate from the normal pattern as regards type, development, place, or time of occurrence. If possible, the information provided would include, as soon as it is available, data on the type of disease, approximate area affected, and number of cases.*
3. *Encouragement of publication of results of biological research directly related to the Convention, in scientific journals generally available to States Parties, as well as promotion of use for permitted purposes of knowledge gained in this research.*
4. *Active promotion of contacts between scientists engaged in biological research directly related to the Convention, including exchanges for joint research on a mutual agreed basis.*

The confidence building measures agreed at the Second Review Conference were again extended<sup>41</sup> at the Third Review Conference thus to include:

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<sup>39</sup> For a discussion on Confidence Building Measures see: Bradford Briefing Paper No. 11, Preparing for a Successful Outcome to the BTWC Sixth Review Conference in 2006, by Jez Littlewood, December 2003. Available at: [http://www.brad.ac.uk/acad/sbtwc/briefing/BP\\_11\\_2ndseries.pdf](http://www.brad.ac.uk/acad/sbtwc/briefing/BP_11_2ndseries.pdf)

<sup>40</sup> United Nations, Ad Hoc Meeting of Scientific and Technical Experts from States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, Geneva, 31 March-15 April 1987, BWC/CONF.II/EX/2, 21 April 1987. Available at <http://www.opbw.org>.

<sup>41</sup> Graham S. Pearson, Briefing Paper No 14 (Second Series) *Two Decades of Strengthening CBW Prohibitions: Priorities for the BTWC in the 21st Century*, November 2004, p. 18. Available at: [http://www.brad.ac.uk/acad/sbtwc/briefing/BP\\_14\\_2ndseries.pdf](http://www.brad.ac.uk/acad/sbtwc/briefing/BP_14_2ndseries.pdf)

1. Declaration form on "Nothing to declare" or "Nothing new to declare"
2. Confidence-building measure "A":
  - Part 1: Exchange of data on research centres and laboratories;
  - Part 2: Exchange of information on national biological defence research and development programmes.
3. Confidence-building measure "B":
  - Exchange of information on outbreaks of infectious diseases and similar occurrences caused by toxins.
4. Confidence-building measure "C":
  - Encouragement of publication of results and promotion of use of knowledge.
5. Confidence-building measure "D":
  - Active promotion of contacts.
6. Confidence-building measure "E":
  - Declaration of legislation, regulations and other measures.
7. Confidence-building measure "F":
  - Declaration of past activities in offensive and/or defensive biological research and development programmes.
8. Confidence-building measure "G":
  - Declaration of vaccine production facilities.

Confidence building measures were again the subject of revisions and additions in 1991 and although the measures originally agreed by States Parties in 1986 have been politically binding their success has been hampered by low submission rates<sup>42</sup>. However, in the light of concerns that have been expressed in regard to scientific and technological developments, *inter alia*, in the area of biological control, Co-Depositaries

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<sup>42</sup> For a further discussion on Confidence Building Measures see Bradford Briefing Paper No. 10, Towards the BTWC Sixth Review Conference: Making the Best Use of the 26 March 2005 Anniversary, by Nicholas A. Sims, December 2003. Available at: [http://www.brad.ac.uk/acad/sbtwc/briefing/BP\\_10\\_2ndseries.pdf](http://www.brad.ac.uk/acad/sbtwc/briefing/BP_10_2ndseries.pdf)

and States Parties might give effect to such concerns by giving careful consideration at the Sixth Review Conference of the Convention in 2006 to the proposals to strengthen confidence building measures as set out in the Working Paper<sup>43</sup> titled: Strengthening Confidence Building Measures as submitted to the Fifth Review Conference in 2001 by South Africa so that CBM declarations are extended **to include research and production facilities working with working with animal and plant pathogens**, as well as research and production facilities relevant to humans. Whilst the Proposals set forth in this Working Paper for Strengthening CBM Declarations as submitted by South Africa to the Fifth Review Conference is included below (as Appendix A), the justification for strengthening CBM declarations as recommended to the Fifth Review Conference by South Africa are set forth as follows:

*a. The Confidence-Building Measures as defined by the Third Review Conference provide only for declarations relevant to humans in terms of research facilities and production facilities.*

*b. Similar facilities working with animal or plant pathogens are equally relevant to the Convention and should therefore be declared in the CBM declarations.*

### **Conclusion**

Re-affirmations and extended understandings as expressed in the Final Declaration of the Sixth Review Conference, together with the strengthening of CBM's, form vital elements in re-affirming that scientific and technological developments, *inter alia*, in the area of biological control are covered by the prohibitions in the Convention; and in increasing levels of transparency in regard to Co-Depositaries and States Parties compliance with the Convention. It is vital that both re-affirmations and extended understandings and strengthened confidence building measures be pursued in earnest by the States Parties at the Sixth Review Conference of the Convention in 2006.

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<sup>43</sup> Working Paper by South Africa: Strengthening Confidence Building Measures, BWC/CONF.V/COW/WP.1, 16 November 2001. Available at: <http://www.opbw.org>

**Appendix A.**

**Strengthening Confidence-Building Measures**

**Working paper by South Africa**

**FIFTH REVIEW CONFERENCE OF THE  
STATES PARTIES TO THE CONVENTION  
ON THE PROHIBITION OF THE  
DEVELOPMENT, PRODUCTION AND  
STOCKPILING OF BACTERIOLOGICAL  
(BIOLOGICAL) AND TOXIN WEAPONS  
AND ON THEIR DESTRUCTION**

BWC/CONF.V/COW/WP.1  
16 November 2001

Original: ENGLISH

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Geneva, 19 November - 7 December 2001

**STRENGTHENING CONFIDENCE – BUILDING MEASURES**

**Working paper by South Africa**

**Introduction**

The Confidence-Building Measures as defined by the Third Review Conference provide only for declarations relevant to humans in terms of research facilities and production facilities.

Similar facilities working with animal or plant pathogens are equally relevant to the Convention and should therefore also be declared in the CBM Declarations.

**PROPOSALS FOR STRENGTHENING CBM DECLARATIONS**

**CONFIDENCE BUILDING MEASURE “A”**

It is proposed that the text describing the modalities for CBM “A” be amended to read:

“The **Fifth** Review Conference agreed that data should be provided by States Parties on each facility, within their territory or under their jurisdiction or control anywhere, which has any maximum containment laboratories meeting those criteria for such maximum containment laboratories as specified in the 1993 WHO Laboratory Biosafety Manual such as those designated as biosafety level 4 (BL4) or P4 or equivalent standards; **or those designed and used to handle and work with biological agents causing disease and known or suspected to meet the classification criteria of Group 4 animal pathogens, as determined by each State Party for itself and specified in the Amendment to the International Animal Health Code adopted by the International Committee of the Organisation Internationale des Epizootics during its 66th General Session, 1998.**”

*(Proposed text in bold)*

**CONFIDENCE-BUILDING MEASURE “G”**

It is proposed that the text describing the modalities for CBM “G” be amended to read:

- Declaration of Vaccine production facilities

“To further increase the transparency of biological research and development related to the Convention and to broaden scientific and technical knowledge as agreed in Article X, each State Party will declare all facilities, both governmental and non-governmental, within its territory or under its jurisdiction or control anywhere, producing: ~~vaccines licensed by the State Party for the protection of humans.~~

- (a) **Any vaccine for humans that is for the general public or for armed forces, or which was licensed, registered or otherwise approved by a component of the government of the State Party for distribution or sale;**
- (b) **Any vaccine for animals that is available to the general public, or which was licensed, registered or otherwise approved by a component of the government of the State Party for distribution or sale.**

Information shall be provided on Form G attached.” *(Proposed text in bold; text to be deleted, struck out).*

**ADDITIONAL CONFIDENCE-BUILDING MEASURE “H”**

- **Declaration of plant inoculant and biocontrol agent production facilities**

**“To further increase the transparency of biological research and development related to the Convention and to broaden scientific and technical knowledge as agreed in Article X, each State Party will declare all facilities, both governmental and non-governmental, within its territory or under its jurisdiction or control anywhere, producing biocontrol agents or plant inoculants. Information shall be provided on Form “H” attached.**

Modalities

**The Fifth Review Conference agreed the following definitions:**

**Biocontrol agent means a living organism or biologically active substance originating from such an organism used for the prevention, elimination or reduction of plant diseases, pests or unwanted plants.**

**Plant inoculant means any formulation containing a pure culture or a predetermined mixture of micro-organisms that alter the properties of plants or crops.**

**Form H**

**Declaration of biocontrol agent and plant inoculant production facilities**

1. **Name of facility:**
  2. **Location (mailing address) :**
  3. **General description of the products produced:**
-

