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Journal on Chemical and Biological Weapons
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INSTITUTE FOR DEFENCE STUDIES AND ANALYSES

Editorial

The seventh BTWC review conference is scheduled to be held in December 2011. With this as the backdrop in the current issue of the magazine, Cindy Vestergaard argues that during the Seventh BWC Review Conference the participating states will get an opportunity to recognise the scope of biology's peaceful use.

Rajiv Nayan discusses the export control mechanism of the Australia Group of chemical weapons which have military implications. He argues that India has an elaborate export control mechanism for chemical agents which if need be can be used for chemical warfare. Shashank Mayank in his article argues that biometric provides a comprehensive defence capability against threats from adversaries.

This issue also features other regular features like Country Profile, Kaleidoscope, Chemical and Biological News and Book Review.

As per our readers' feedback, we wish to publish issues in the future that focus on a subject of particular concern. We would like to inform our readers that the CBW Magazine is now a bi-annual online publication.

Contributions and feedback are welcome and can be addressed to: editorcbw@gmail.com

Biometrics against Bioterrorism; Steps for Trans-national Countermeasure Strategies

Mr. Shashank Singhal

The author is a graduate student at IIT Roorkee.

Summary

Biometric provides a comprehensive defence capability against threats from adversaries which increases its robustness. This can be done by using a detector to detect virus, bacteria, other micro organisms and biotoxins. It is expected to provide the complete safety of the individual and the country.

Introduction

Due to various factors like advances in biomedical technology, emerging infectious diseases research and other related activities, knowledge, materials, and equipment needed for manufacturing biological weapons are spreading rather rapidly. Consequently, fears relating to mass casualty terrorism and gross violations of Biological Weapons Convention (BWC) are also rising. Unlike nuclear weapons, where at least 5–15 kilograms of fissile material is required to build a rudimentary fission bomb, no such barrier exists for biological weapons. The dual-use nature of the equipment and supplies make biological weapon programs easy to hide under the guise of legitimate biomedical activities. Only small quantities of pathogens are required for seed stocks, and biological agents emit no detectable signal, making them virtually impossible to detect remotely. There is a general term, biometrics, which includes processes for verification and identification of individual or a group to ensure safety and security for the general public from any threat. Biometrics involves the autonomous recognition of human's physical and behavioral characteristics through sensory mechanism. Biometric provides a comprehensive defence capability against threats from adversaries which increases its robustness. This can be done by using a detector to detect virus, bacteria, other micro organisms and biotoxins. It is expected to provide the complete safety of the individual and the country.

History

Biometrics has become a critically important topic of research for scientist, researchers and engineers after 9/11. Following the fears of Anthrax and other agents' usage, there is a heightened level of attention to this kind of

threats and more measures are being put in place in order to avert these threats. It is needless to stress that biometrics plays a major role in serving the purpose. On the other hand, India relies heavily on the traditional security apparatus of the police and other security agencies to deal with many security challenges including cross border terrorism, illegal migration and monetary exchanges. Since 26/11, there is a need to do more with reference to maritime security as well. These kinds of threats make it necessary for the Indian security system to adapt biometric applications. However, despite this, research and development activities in this field are lagging behind in India as not many institutes are involved in biometrics research. Therefore, its time India brings strong institutional support for research and development in this area since it can play a crucial role in counter-terror strategies.

Developed countries like the United States are paying much attention to add biotechnology to their biometrics approach. This can be observed by looking at the advancement of biotechnology in the United States. It is estimated that by the end of the 20th Century, biotechnology contributed nearly half a million jobs and $47 billion in business revenue annually to the US economy.[1] Similarly, China now has about 20,000 people working in 200 biotechnology laboratories.[2] Mostly laboratories like these work towards developing defence mechanism against biological attacks.

Using biotechnology in identifying a biological attack

Biotechnology applications are extremely useful for tracking the source of any biological attacks and also for taking further action against the culprits of that attack. However, the complexity of the system would require advance setup of coordination efforts between different agencies of the government and outside. This is because a large count of known viruses and bacteria can be used in attacks and there can be unknown new microorganisms used for the same. These can cause disease in humans, animals and crops. Even the worst case is that the terrorists can project their attack from the subtle to the apocalyptic. Therefore, the first task would be to bring about congruence in the disease-surveillance data from a variety of government and public health sources towards determining which areas might get affected and to what degree. An effective defence requires setting priorities which includes indentifying the most likely near-term threats and implementing research, detection and response agendas designed to be able to better mange future threat scenarios.

Biometrics is a source that is rich in profiling information related to the biology like all DNA synthesis orders from all suppliers worldwide. Importantly, anticipation of potential terrorist strategies, analyses of the symptoms related to all the probable diseases etc forms the basis for a promising technology. A biometric system makes use of various sensory mechanisms to assess both identity and physiological state of an agent. It also includes checking the symptoms of the individual by face recognition and diagnostic tests. These data are then transferred to data management body where it is matched with disease surveillance data. In case an emergency situation is identified as a biological attack, the next step is to identify the source organism which leads to the next step of speedy disbursement of necessary antibiotics and drugs in the affected areas. Fumigation of the ozone and other disinfectants are immediately used in the disease prone area. Improved international disease surveillance might also detect the presence of covert biological weapon programs in the event of an accident that infects the local population.

International efforts

a. Diplomatic Coordination:

Efforts by the World Health Organization (WHO) to implement the Global Outbreak Alert and Response Network are well placed and the recently revised WHO International Health Regulations, which require reporting of any disease of international public health concern within 24 hours, when fully implemented, will have public health and security benefits for all nations. These efforts need sustained and global diplomatic and financial backing.[3] Ultimately governments around the world must know that this spreading of disease does not depend on boundaries and public health is a great issue for all mainly during international travel and commodity transfer. Also this leads to the development of vaccine against that particular microorganism and to be served to people for their future security.

b. Research Coordination:

Exchanges of best practices at pathogen collections or biocontainment facilities that work with deadly pathogens can be undertaken in order to improve safety and security so that the risks associated with accidents or diversion could be reduced. This would help promote interaction among biomedical practitioners engaged in potentially dangerous research. International association and collaboration among biologists, medical professionals, and public health practitioners would help address emerging infectious diseases and the transparency produced through such collaborations would have, as a collateral benefit, the potential to detect covert activities.

Implementing defensive countermeasures against biological attacks will require not only research but drug development and distribution plan. According to the reports of the Biotechnology Industry Organization, nearly 100 companies are seriously engaged in advanced research on finding answers to bioterrorism and its effects.[4] Their research includes using technology facilities to develop new antibiotics, vaccines and antiviral drugs. Some of these are reported to be in the advanced medical trial stages. Research is also in progress in order to develop advanced oral vaccines that are capable of boosting immunity in a shorter period compared to the existing medicines[5]. These developments, if effective will be useful against bioterrorism attacks. Similar research is underway on other diseases as well

Pre-emptive measures can be taken to destroy the weapon before they can be launched, it can be done practically by opening the wings of biological facilities and weapons are easy to find. Research is also underway to identify simpler way to destroy these pathogens. Efforts to improve intelligence on suspect groups or individuals are useful; however, there are no technical fixes in the offing that will allow intelligence agencies to improve their ability to detect covert biological weapon programs in the future.

Conclusion

The best way for the defence is to discover and implement anti factor on organism-by-organism basis so that one can win in this biological arms race.[6] It will be vital from a strategic perspective to consider carefully what types of biodefence work should be classified. It needs to be debated further whether it would be legal and wise to have classified biodefence research produce genetically modified pathogens that to our knowledge, no adversary has yet created. Claire Fraser once said, “Terrorists could potentially make use of public genome sequences, however it is also argued that

such sequences should remain in the public domain because these 'maps' are still relatively rough. Genomics should be used to identify and fight bioterrorism, not to restrict research.[7] Hence with the advancement of biotechnology, its results and new products should be included to biometrics so that the future biological attack can be easily recognised and may be stopped before it will become epidemic. It is the right time for India to pay attention to the biometric side along with the research in biotechnology. This will certainly make the nation to stand against any future bioterror attack. Vaccines, antibiotics and drugs should also be produced against every new microorganism. There should be complete database of all discovered genome sequences which can help in the research activities of the nation.

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Endnotes:

1 Ernst & Young Economics Consulting and Quantitative Analysis, prepared for the Biotechnology Industry Organisation, The Economic Contributions of the Biotechnology Industry to the US Economy, May 2000, http://www.bio.org/news/ernstyoung.pdf

2 David Barboza, 'Development of Biotech Crops is Booming in Asia', New York Times, 21 February 2003.

3 Dean A Wilkening, C. f. Combating Bioterrorism. Encyclopedia of Violence, Peace, & Conflict, 3; p. 359.

4 Brower, V. (2003). Biotechnology to fight bioterrorism. EMBO reports, vol. 4, no. 3, p. 228.

5 ibid

6 Greninger, C. F. (2004). Biotecnhology and Bioterrorism: An Unprecedented World. Survival, vol. 46, no. 2, p. 154.

7 Brower, V. (2003). Biotechnology to fight bioterrorism. EMBO reports, vol. 4, no. 3, p. 229.

Indian Chemical Export Controls System and the Australia Group

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Summary

Set up in 1985, the Australia Group has been controlling exports of chemical agents with military ramifications from the very beginning. It included Biological agents in the early 1990s.

India has an elaborate and comprehensive export controls system for chemical agents that can be used for chemical warfare. Strict control of chemical agents is considered important because, of all the dual use items, chemicals constitute the largest category of Indian exports. President Obama, during his trip to India, endorsed India's candidature for the Australia Group. Later, France supported the Indian candidature. A team of the Australia Group visited India in the last week of April 2011 and interacted with Indian officials and experts working on export controls.

Set up in 1985, the Australia Group has been controlling exports of chemical agents with military ramifications from the very beginning. It included Biological agents in the early 1990s. After the operationalisation of the Chemical Weapons Convention (CWC), it was assumed that this informal group would cease to exist. The Australia Group reinvented itself. The CWC has detailed provisions for export controls. It has three schedules of chemical considered relevant for chemical weapons. The Australia Group controls some additional items outside the CWC list and uses this as one of the reasons for its continued existence. [1]

The international community, of late, has realized the importance of bringing India into the multilateral export controls regimes because of the increasing Indian profile. The move started at the track-II level and resulted in the acceptance at the governmental level. Some countries have explicitly supported the Indian membership for the multilateral export controls regimes and many more are informally accepting the merit of India joining the regimes. Generally, analysts think that of all the multilateral export control regimes, the membership for the Australia Group will come first. However, the Government of India wants membership

to all the regimes as a package and not in an incremental fashion.

Since the group is going to exist, it is recommended that India should join the Australia Group since it issues informal guidelines and classifies new items for export control. True, strategically, it is not as fascinating as the Nuclear Suppliers Group (NSG) or the Missile Technology Control Regime (MTCR) is. The membership may provide India an opportunity in managing export of global commerce in chemical and bio-technology. There are a couple of issues regarding the future of the Indian membership to these groups. The first is that India may have to move a third party application to the Chair of the group that it has fulfilled all the criteria. Secondly an associated question that will be asked is whether India has indeed fulfilled all the criteria.

India has fulfilled all the criteria but putting additional items of the Australia Group in its export controls policy. The move is facing resistance from chemical industry. Putting additional item on the Indian Control list called Special Chemicals, Organisms, Materials, Equipment and Technology List, which is more popular by its abbreviation SCOMET, means additional licensing burden may be imposed on Indian exporters. The item 1 of the SCOMET list contains special chemical items.

The Indian export control system has impressive legal, institutional and enforcement frameworks. India is a signatory to the CWC. As a result, it has to incorporate all the three schedules of CWC into its control list which India has already done. India has passed laws such as the Chemical Weapons Convention Act of 2000. Section 17 of the Act lays down: "No person shall export from, or import into, India a Toxic Chemical or Precursor listed in any of the Schedules 1 to 3 in the Annex on Chemicals to the Convention except in accordance with the provisions of the Export and Import Policy determined by the Central Government from time to time... ." India is further amending the CWC Act to include some enforcement provisions, especially regarding personnel.

According to a government of India notice[2]:

1. Exports of schedule 1 chemicals are prohibited. Further, no import of schedule 1 chemical can take place except with prior permission from the National Authority obtained under Section 15 of the CWC Act 2000.

2. Export of schedule 2 chemicals to a non-State Party of the Convention is prohibited. Similarly, import of schedule 2 chemicals from a non-State Party to the Convention is prohibited.

3. Export of schedule 2 chemicals to State Parties can be made only by those exporters who have obtained a general permission from the DGFT for two years (at a time). They are further subject to information and disclosure requirements as laid down in the DGFT Notification.

4. Export of schedule 3 chemicals to State Parties is conditional upon information and disclosure requirements as laid down in the concerned DGFT notification.

5. Exports of schedule 3 chemicals to non-State Parties can be made only after obtaining an export license in this behalf and also subject to information and disclosure requirements as well as End-Use/End User Certificate as laid down in the concerned DGFT Notification.

6. All importers and exporters of schedule 2 and schedule 3 chemicals are required to submit declarations to the Department

of Chemicals on an annual basis as detailed in the Chapter on declarations.

India issues notifications on trade policy under another law, the Foreign Trade (Development & Regulation) Act. This 1992 Act has been amended in 2010. One of the principal objectives of the amendment was to bring about tighter control on export or trade of dual-use goods and related technologies. Through the new act, the Government of India seeks to control services as well. The amended act has included other than services technology as well. The Amendment also focuses on provisions such as transfer, re-transfer, transit and trans-shipment in the act, though these provisions had already existed in the Indian regulatory system. Transshipment control along with capability to monitor the export of Australia Group controlled items is one of the criteria for the Group membership. The amended rules also provide for the search and seizure with the approval of a very senior officer of the Directorate General of Foreign Trade. This amendment also grants enabling provisions for establishing controls as in the Weapons of Mass Destruction and their Delivery Systems (Prohibition of Unlawful Activities) Act, 2005 or the WMD Act.

In 2005, the WMD Act was passed to implement India's commitment on United Nations Security Council Resolution (UNSCR) 1540. The Section 11 of the Act explicitly states: "No person shall export any material, equipment, or technology knowing that such material, equipment, or technology is intended to be used in the design or manufacture of a biological weapon, chemical weapon, nuclear weapon or other nuclear explosive device, or in their missile delivery systems." In addition, it has an intricate and graded penalty system for dealing with acts of violation. One of the criteria of the membership of the Australia Group is legal penalty. The Act introduced several new elements into the Indian export controls system such as transit and trans-shipment controls, retransfer provisions, technology transfer controls, brokering controls and end-use based controls. Besides, the Customs Act and the Unlawful Activities (Prevention) Amendment Act, 2004 provide statutory authority for export controls.

At the implementation level, the Directorate General of Foreign Trade is the nodal agency for granting license for SCOMET controlled chemicals. However, all the licenses for such export are referred to inter-service agency. The Directorate has devised several parameters and a license application is scrutinized on these.

At the enforcement level, there are enforcement officers. The amendment in the 2000 CWC Act is in progress to introduce some enforcement related provisions. Once this amendment is passed, enforcement arm of the nodal agencies will be further strengthened. As for the chemical industry, there are certain global problems, such as difficulties in distinguishing a commercial consignment from a chemical weapons-related consignment, establishing appropriate commodity thresholds, personal safety inspectors and the diversified but highly specialised nature of chemicals. Importantly, all major customs houses in India have their own chemical labs so any suspicious items are immediately tested. If there is need for further clarification, the item is sent to a laboratory of the Defence Research and Development Organisation.

India will abide by the guidelines of the Australia Group for export of chemicals. It could and should strike a right balance between confidentiality and transparency. India has also an unblemished track record on not only nonproliferation but also on disarmament. It completed the task of chemical weapons destruction within the set time limit. Membership of the Australia Group will not only further authenticate India's principled nonproliferation policy on the chemical weapons, but also enhance India's participation in the global non-proliferation drive. To that extent, it is a welcome step.

Endnotes:

1. For the comprehensive lists of the items controlled by the Australia Group see, Australia Group Common Control Lists, accessed on 23 June 2011, available at http://www.australiagroup.net/en/controllists.html

2. Government of India, National Authority Chemical Weapons Convention, Export and Import of Schedule Chemicals, http://nacwc.nic.in/,accessed on June 6, 2011

The BWC and Industry: A Plea for Industry Outreach

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Summary

Seventh BWC Review Conference will provide the States Parties with an opportunity to move the next intersessional process (2012-2015) beyond simple discussion. It will expand the scope of biology's peaceful uses while taking into account the impact of scientific and technological advances on the treaty.

After a history of violations, failed compliance negotiations and almost a decade of annual intersessional discussions, the Biological and Toxin Weapons Convention (BWC) remains essentially, a paper tiger, a five-page gentleman's agreement with no international means to instill confidence in compliance. The intersessional process of 2002-2005 and 2007-2010 did increase stakeholder participation in BWC issues and provide some areas of common understanding, specifically in expanding the scope of biological activities for peaceful purposes. Looking ahead to the Seventh BWC Review Conference, States Parties have an opportunity to move the next intersessional process (2012-2015) beyond simple discussion to further recognizing and expanding the scope of biology's peaceful uses while taking into account the impact of scientific and technological advances on the treaty. For this to happen, however, bioindustry needs to be engaged.

A General Purpose Paper Tiger

Article I of the BWC categorically bans biological agents and toxins in types and quantities that have no peaceful justification. This definition or so-called 'general purpose criterion' has been reiterated in past Review Conferences to encompass all future scientific and technological developments relevant to the Convention. It however contains no definitions or scope of what constitutes biological activities for peaceful purposes or those that would be expressly prohibited by the Convention. It is this ambiguity that leaves the treaty open to wide interpretations and makes it difficult for states to reconcile the obligation which commits parties to the 'fullest possible exchange' of peaceful scientific and technological aspects (Article X) with the treaty obligation that prohibits the transfer of biological sciences for 'hostile purposes'

(Article III). The intersessional process of annual meetings did not bridge the peaceful/hostile purposes gap; but it was useful in increasing stakeholder input and for elaborating some scope of peaceful purposes, specifically the recognition of the benefits of cooperation on activities such as enhanced disease surveillance, promotion of vaccines and treatment, biosafety and biosecurity, and the education of scientists.[1] Accordingly, it could be said that these activities are now more commonly recognized to be falling within the treaty's scope of 'peaceful purposes.'

A Role for Industry

Unlike its chemical counterparts that are actively engaged in drafting and implementing the verification annex of the Chemical Weapons Convention (CWC), bioindustry's position against BWC verification created a strong commercial factor in the political failure of compliance negotiations. While various national and regional pharmaceutical associations noted in the 1990s that a compliance protocol could help mitigate the threat posed by biological weapons, they argued that regular inspection visits of dual-use facilities could compromise sensitive commercial information and potentially harm a company in good-standing if it were falsely accused of producing biological weapons.[2] It is not surprising then – even ten years later - that many government officials are wary of re-opening compliance discussions. The involvement of bioindustry is therefore notably minimal in the BWC process compared to a much higher level of participation by the nuclear industry in issues regarding the Nuclear Nonproliferation Treaty (NPT) and chemical industry in CWC implementation.

With the United States making it clear that it "will not seek to revive negotiations on a verification protocol,"[3] the idea of third-party oversight and implementation of the BWC remains off the negotiating table for the foreseeable future. The treaty however needs to move beyond its status as a paper tiger to inspire public confidence through substantive action. For States Parties to expand further the scope of peaceful biological activities, they have to move beyond (but still keep relevant) disease surveillance, biosafety and biosecurity issues to focus on delineating the scope of Articles I, III and X. Without it, the treaty will linger in ambiguity with no global guidance on peaceful biological activities and advances, or their exports.

To this end, bioindustry's innovation, direct application and management of scientific and technological advances are crucial toward a common understanding of peaceful science. Bioindustry's awareness and engagement in biological diplomacy is therefore necessary for further delineating the BWC's peaceful scope, thereby strengthening Articles I, III and X of the treaty. In other words, without industry's involvement, there will be no real study on how it can be done.

A Role for the ISU

As States Parties to the BWC convene for the Seventh Review Conference in December, there is an anticipation that a third intersessional process – and an expanded Implementation Support Unit (ISU) to support it - will be agreed upon for the period 2012-2015. To further increase stakeholder participation, the ISU should be tasked alongside its plan of outreach to non-states parties to also conduct outreach to global biological industry with the objective of increasing their annual intersessional participation.[4] An increase in the personnel at the ISU already generally supported by States Parties along with the development and implementation of industry outreach would fit in with an expanded ISU role,

particularly given its operation as an independent organ that serves all stakeholders of the treaty, including industry. Such an outreach program would help to further bridge common understandings by states parties and industry – a necessity if they are ever to work together to clarify the BWC's provisions while also ensuring commercial propriety.

The intersessionals yielding some elaboration on the treaty's peaceful scope, the objective for the 2012-2015 annual process is to move the BWC beyond talk to substantive action. By engaging industry through the third-party ISU rather than (but also including) national outreach, States Parties will indirectly begin to frame the treaty's provisions for peaceful purposes and prepare the Eighth Review Conference in 2016 for a more consensus-based approach to BWC clarity and compliance.

Endnotes:

[1] For a fuller d iscussion on the BWC's ambiguities, the intersessional process and the prospects for a third intersessional round in expanding the BWC's peaceful scope see: Cindy Vestergaard and Animesh Roul, "A (F)utile Intersessional Process?" The Nonproliferation Review, Forthcoming November 2011.

[2] See. Statement of Principle on the BWC, Pharmaceutical Research and Manufacturers of America (PhRMA), Washington, D.C., 16 May 1996; European Federation of Pharmaceutical Industries and Associations (EFPIA), Position Paper, 1998; Forum for European Bioindustry Coordination (FEBC) Position Paper 1998; Compliance Protocol to the Biological Weapons Convention: A Joint Position of European, United States and Japanese industry, issued by the FEBC, PhRMA, and Japan Bioindustry Association, July 2001.

[3] Under Secretary of State Ellen O. Tauscher, Address to the Annual Meeting of the States Parties to the BWC, 9 December 2009.

[4] Only a handful of bioindustry companies participated in annual meetings during the 2007-2010 intersessional process such as Bavarian Nordic, Amyris Biotechnologies, Emergent Biosolutions, Glaxo Smith Kline, Astra Zeneca, Ganymed Pharmaceuticals AG and Sloning BioTechnology GmbH.

Chemical Weapon Profile: Libya

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Summary

Libya's association with chemical weapon is not a recent phenomenon. It first began as a victim when, in 1930, Italy's autocratic leader Benito Mussolini authorized the use of sulfur mustard against the Libyan rebels.

Recently, Colonel Muammar Gaddafi's regime in Libya drew a lot of international attention following the violent crackdown on the protests there. As the situation deteriorated further, the possibility of Colonel Gaddafi using chemical weapons against the rebels opened a new dimension to the Libyan crisis. Soon, reports regarding Libya's possession of weapons grade chemical stockpile started pouring in.

Libya's association with chemical weapon is not a recent phenomenon. It first began as a victim when, in 1930, Italy's autocratic leader Benito Mussolini authorized the use of sulfur mustard against the Libyan rebels. However, since mid-1980s, Libya itself has pursued an offensive chemical warfare programme. At that time, several factors were offered as drivers of Libya's chemical weapon programme. Firstly, in order to compensate Libya's military weakness vis-à-vis neighbouring states (particularly Egypt and Israel), Libyan leader Gaddafi felt it necessary to pursue such a programme. Secondly, it has been argued that Libya went 'chemical way' in concert with an aggressive programme to develop a ballistic missile delivery capability. Finally, increasing security threat posed by the alleged pursuit of chemical weapons by neighbouring states (particularly Egypt, Iraq and Syria) also largely pushed Libya to pursue a chemical weapons strategy.[1]

In the second half of 1980s, Libya initiated its chemical weapon programme with the help of foreign suppliers (mostly from Western Europe). Its first chemical weapon production facility was established near the village of Rabta in 1998. It was believed that the new pharmaceuticals facility, known as Pharma-150, could produce at least 100 metric tons of blister and nerve agents in the span of three years. Later on, two more facilities, Pharma-200 and Pharma-300

(Rabta II) were established. Of the two, Pharma-300 or Rabta II was established in Tarhuna, near the Libyan capital-Tripoli, to serve as a secure storage location. It was built using sandstone shields and reinforced concrete in order to survive air strikes.[2] Therefore, it can be said that Libya was aware of the illegality of its chemical weapons strategy.

In September 1987, allegations that Gaddafi was willing to use chemical weapons against Chadian forces drew international attention. What concerned the West most was that although Libya had the capacity to start chemical warfare even when it was not going to be decisively useful or even legitimate. Subsequently, in order to deal with the increasing threat from Libyan chemical weapons, the then US President Ronald Reagan hinted at the possibility of a military strikes on the Rabta plant. However, before any attempt could be made against it, the production capability of the Rabta plant was reportedly destroyed by a fire. Later on, the fire was discovered to be a hoax, intended to discourage the US strike.

Nevertheless, soon enough, details of foreign assistance in Libya's pursuit of chemical weapons were revealed. Several West German companies, including Imhausen-Chemie, were allegedly involved in Libya's chemical weapon programme. Finally, a total of twelve firms from both Eastern and Western bloc countries, including a few from Japan, were named for their alleged assistance to Libya's chemical weapons program.[3] Such revelations had a substantive impact in isolating Libya from the international community.

In January 1993, the Chemical Weapons Convention (CWC) opened for signature and it came into force on April 29, 1997. However, Libya, along with Egypt and other Arab countries, abstained from signing it due to Israel's alleged nuclear arms programme. They further argued that chemical weapons disarmament could be effective only within the context of a regional WMD ban. Still, Libya attended the first CWC Review Conference (RevCon) from April 28 to May 9, 2003 as a non-state party. By October 2003, Libya consented to US and British inspections of its WMD-related facilities to verify the state and extent of the former's chemical weapon and other WMD programmes.[4] Interestingly, it was only on December 20, 2003 that Gaddafi publicly acknowledged his government's pursuit of WMD in the past and pledged to abandon all such programnes. In its statement, the Libyan government declared: "The Great Socialist People's Libyan Arab Jamahiriyah has urged the countries in the region to make the Middle East and Africa a region free of weapons of mass destruction."[5] Gaddafi pledged to abide by all relevant nonproliferation treaties, including the CWC.

It is worth noting that in 2003, the US reached an important agreement with Libya under which the latter agreed to give up its pursuit for WMD in return for the restoration of normal diplomatic relations with the US. Accordingly, among other things, Libya destroyed its longer-range missiles. 3,300 aerial munitions which were used to disperse mustard gas and other chemical agents were also abolished. In 2004, Libya joined the International Organization for the Prohibition of Chemical Weapons (OPCW).[6] Soon, OPCW inspectors started monitoring the destruction of its aerial bombs designed to deliver chemical agents. It also began the verification process of Libya's initial declaration of possessing 50,700 lbs. (~ 23 MT) of mustard agent and 2.9 million lbs. (~1.315MT) of nerve agent precursor

chemicals. On March, the Hague-based body confirmed the presence of 23 MT of sulfur mustard and approximately 1,300 MT of sarin precursors. The inspections however also revealed poor storage and maintenance of the chemical agents. It was believed that Libya manufactured some poor quality CW agents as well which probably began degrading rapidly.[7] This indicated Libya lacked either the technical know-how or the desire to maintain and manufacture robust storage of chemical weapons.

Although the Libyan regime claimed to extend unwavering support for international arms control and disarmament initiatives, the eradication process of its chemical agents as well as chemical weapons production facility could not be completed as fast as was initially expected. It was primarily due to the spats between Washington and Tripoli over funding and logistics. Besides, Libya was allegedly reluctant to provide US and British officials visas to monitor the process. The Gaddafi regime however cited environmental concerns for slowing down.[8]

In November 2005, Libya was granted an extension by the OPCW to destroy its entire stockpile of chemical weapons by May, 2011.[9] The OPCW recently reported that all of Libya's delivery systems-the 3,300 unloaded aerial bombs- were crushed by bulldozers in 2004. Nearly 13.5 metric tons (15 Tons) of sulfur mustard-which constitutes about 54% of Libya's chemical stockpile, have also been destroyed. Since 2005, nearly 40% of the chemicals used to make sulfur mustard have also been destroyed. The twice-yearly inspections conducted so far also have not indicated Libya's intention to revive its chemical weapon programme.[10]

Although Libya pledged to fulfill its destruction obligations by 2011, due to slow progress and the recent political turmoil, it seems unlikely that it would able to meet that deadline. As of February 2011, Libya reportedly still possessed 9.5 MT of mustard gas and more than half of the 1,300 MT of precursor chemicals used for developing chemical agents.[11] It reportedly also possesses Scud B missiles. Although under the 2003 agreement with the US, Libya agreed to destroy the chemical weapons only after the US helped Tripoli upgrade its defence through purchasing of other weapons, later on, Tripoli alleged that Washington backed out on its pledge.[12]

During the recent political crisis in Libya, there was an increasing concern that not only Col. Gaddafi could resort to use chemical agents against the rebels, the extremists also might exploit the deteriorating security situation in the country and try to misappropriate the mustard gas. All such speculations however were largely put to rest when OPCW spokesman Michael Luhan stated that Libya destroyed its capacity to deliver chemical agents seven years ago[13] and without the delivery systems, the utility of the chemical agents is lessened. Extending the argument further, a former Western government official stated: "The (mustard) gas isn't weaponized and I doubt if it could be within a military significant timeframe. The residual stocks of mustard gas are probably badly degraded and as much of a threat to those holding them as to any potential targets."[14] According to Paula DeSutter, former Bush administration disarmament specialist, "Had the destruction process not started, we would be facing a far more dangerous situation— On the other hand, we would certainly feel more secure if all of the mustard gas had been eliminated."[15]

In spite of the fact that the recent political turmoil in Libya precipitated a large number of unsubstantiated allegations concerning Libya's remaining chemical weapons capabilities and intentions, as of today,

Gaddafi's regime seems to lack dedicated chemical weapon delivery system. The chemical weapon agents, due to their suboptimal manufacturing and poor maintenance, are apparently not very effective. Although political instability and deteriorating elations with the US and Britain have slowed down the elimination process of the chemical weapons, Libya's permanent representative to the OPCW Director-General recently reaffirmed his country's unwavering commitment towards CWC compliance.[16]

Endnotes:

1 "NTI: Research Library: Country Profiles: Libya Chemical Overview", April 2011, at http://www.nti.org/e_research/profiles/Libya/Chemical/index.html. (accessed on April 26, 2011).

2 Ibid.

3 Ibid.

4 Ibid.

5 "Stated Government Policy (Libya)-Jane's Chemical, Biological, Radiological and Nuclear Asses", Jane's, at http://articles.janes.com/articles/Janes-CBRN-Assessments/Stated-Government-Policy-Libya.html. (accessed on May 10, 2011).

6 "US worries Gaddafi may use poisonous gas as chaos deepens", Homeland Security Newswire, February 25, 2011, at http://homelandsecuritynewswire.com/us-worries-gaddafi-may-use-poisonous-gas-chaos-deepens. (Accessed on April 7, 2011).

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9 "Libya lacks means to use chemical arms: Watchdog", Reuters, February 27, 2011, at http://www.reuters.com/assets/print?aid=USTRE71Q1PS20110227. (accessed on April 26, 2011).

10 "Libya destroying chemical weapons, says watchdog", The Hindu, February 23, 2011, at http://www.thehindu.com/opinion/op-ed/article1483900.ece. (accessed on April 26, 2011).

11 "US worries Gaddafi may use poisonous gas as chaos deepens".

12 Ibid.

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14 "Doubts surround Gaddafi's chemical weapon arsenal", Reuters.com, March 2, 2011, at http://af.reuters.com/articlePrint?articleID=AFN0222994420110302. (accessed on April 27, 2011).

15 "US worried by remaining Libyan Chemical Arsenal", Global Security Newswire, February 24, 2011, at http://gsn.nti.org/siteservices/print_fiendly.php?ID=nw_20110224_8664. (accessed on April 27, 2011).

16 "NTI: Research Library: Country Profiles: Libya Chemical Overview".

Kaleidoscope

Chemical Weapons Convention Coalition

The total elimination of chemical weapons has been a matter of concern for the whole world. Recently in order to achieve this goal dozens of nongovernmental organizations from various parts of the world agreed to form a group which will work towards achieving this goal. They also hope to work towards preventing the use of Chemical weapons by terrorists' organizations.[1] The Chemical Weapons Convention Coalition is one such group.

This group has been under planning for years and is a part of a very small number of organizations which aim to achieve such target. Non governmental organizations from United States and Europe deliberated on this issue and discussed the 'founding document' for the organization.[2]

The aim of the organization is to compile data regarding all the countries whether they have joined the CWC and also the size of their chemical weapons arsenal and also to look at the industries which can be used for illegal activities. It is also targeted with the task of producing an annual report judging whether the member states are following the rules of the convention at their respective national levels.[3]

The various method undertaken by the groups to achieve its goal are public meetings, written commentaries, letter-writing campaigns, interviews, analyses and educational programs. The founding document states that the primary target audience of the group are officials at all levels of government.[4] In addition to this, the Hague based verification organization has also decided to support the group.[5]

The group identifies itself as "an independent, international body whose mission is to support" the global ban on chemical warfare materials "with focused civil society action aimed at achieving full membership of the Chemical Weapons Convention, the safe and timely elimination of all chemical weapons, preventing the misuse of chemicals for hostile purposes and promoting their peaceful use."[6]

Endnotes:

1 New Coalition Aims to Promote Chemical Weapons Disarmament, Nonproliferation, January 22, 2010, By Chris Schneidmiller, *Global Security Newswire at* http://www.globalsecuritynewswire.org/gsn/nw_20100122_8824.php

2 Ibid

3 Ibid

4 Ibid

5 Ibid

6 Ibid

DISARMAMENT

Mauritania Establishes CWC National Authority

May 11, 2011

The new Permanent Representative of Mauritania to the OPCW, Ambassador Mohamed Mahmoud Ould Brahim Khilil, has informed the Organisation that his country has established a National Authority to implement the Chemical Weapons Convention.

Ambassador Khilil made the announcement upon presenting his letter of credentials as Permanent Representative to Director-General Ahmet Üzümcü, on 9 May 2011. He also requested technical assistance from the OPCW to strengthen the capacity of the National Authority to fulfil its obligations, which the Director-General assured him will be forthcoming.

All States Parties are obliged to designate or establish a National Authority to implement the provisions of the Convention on their national territory, and to enact implementing legislation. Among their tasks, National Authorities are responsible for preparing declarations to the OPCW and escorting OPCW inspections of relevant industrial and military sites. They also act as focal points for interaction with other States Parties and with the Technical Secretariat.

Of the 188 States Parties to the Convention, 186 have now established National Authorities, leaving only two States Parties that have still to do so.

Source: *http://www.opcw.org/news/article/mauritania-establishes-cwc-national-authority/*

ARMS CONTROL

OPCW Expresses Concerns over Chemical Weapons Stockpiles in Libya

May 06, 2011

The Executive Council of the Organisation for the Prohibition of Chemical Weapons (OPCW), which met from 3 to 6 May 2011, expressed its concern over the chemical weapons stockpiles in the Libyan Arab Jamahiriya, particularly regarding their security and destruction within the established deadlines.

"I have reminded the Libyan Government of its international obligation to meet its destruction deadlines, and I have also reiterated to the National Authority that the responsibility for the physical security of those chemical weapons rests entirely with the Libyan Government," the Director-General, Ambassador Ahmet Üzümcü, said in his opening statement at the Executive Council.

The Council expressed their full support for the actions being undertaken by the Director-General in view of the situation, and encouraged him to continue his efforts.

The Executive Council, while noting the assurances given by the Libyan representative, urged Libya to ensure the security of the chemical weapons stockpiles and their destruction within the established deadlines.

Source: *http://www.opcw.org/news/article/opcw-expresses-concerns-over-chemical-weapons-stockpiles-in-libya/*

OPCW Graduates 13th Group of Inspectors

April 26, 2011

The OPCW held a ceremony at its Headquarters in The Hague Tuesday to mark the graduation of new trainee inspectors from a number of countries. The 15-week training was supported by the governments of Belgium, Czech Republic, Germany, Italy, Netherlands, Switzerland, and United States of America.

"I am most grateful to all of the States Parties that provided support to the training of OPCW inspectors," said the OPCW Director-General, Ambassador Ahmet Üzümcü, in his remarks at the ceremony. "The importance of inspector training for the implementation of the Chemical Weapons Convention is paramount, and your efforts have contributed significantly to assuring the quality of inspections over the coming years."

The trainees of Group L were from Australia, Brazil, Peru, Philippines, Republic of Korea, Russian Federation, Spain, United Kingdom and Zimbabwe, and the graduates will join an international team of more than 160 OPCW inspectors.

Since entry into force of the Chemical Weapons Convention in April 1997 the Organisation has devoted over 230,000 inspector-days to conducting some 4,450 inspections of mainly chemical weapons destruction facilities and industrial sites around the world that States Parties have declared to the OPCW in fulfillment of their obligations under the Convention.

For more information about the OPCW's inspection regime, please visit our website at www.opcw.

Source: http://www.opcw.org/news/article/opcw-graduates-13th-group-of-inspectors/

OPCW Completes 2000th Inspection

April 21, 2011

OPCW Director-General, Ambassador Ahmet Üzümcü with the Permanent Representative of the Republic of Korea, Ambassador Young-won Kim, OPCW Headquarters.

On 21 April 2011, the OPCW reached a significant milestone in the implementation of the Chemical Weapons Convention with the completion of the 2000th inspection of a declared chemical facility under Article VI of the treaty. The inspection was carried out at an industrial plant in the Republic of Korea.

Industry inspections have so far covered over 1,500 facilities in more than 80 countries. In all cases, the OPCW has been able to verify the activities declared by the States Parties.

"Industry inspections constitute a key element of the chemical weapons convention and an essential supplement to States Parties' own measures to monitor their chemical industries" said OPCW Director-General Ahmet Üzümcü. "This milestone achievement is a tribute to the dedication of our inspectors, and to the active collaboration of our States Parties and their chemical industries."

The Director-General added that "OPCW inspections are today accepted as a norm in the global chemical industry, and this contributes significantly to the confidence among States Parties in our verification regime. They also help raise awareness about the potential security risks involved."

The Permanent Representative of the Republic of Korea, Ambassador Young-won Kim, welcomed the announcement and underlined the value of the continuing

cooperation between the Republic of Korea and the OPCW.

Under Article VI, States Parties "shall adopt the necessary measures to ensure that toxic chemicals and their precursors are only developed, produced, otherwise acquired, retained, transferred, or used" for purposes not prohibited under the Convention. Trade of these chemicals is allowed among member states only.

Toxic chemicals are used for a variety of peaceful purposes from making ink to producing pharmaceuticals. To allow for verification, States Parties declare legitimate activities involving scheduled chemicals (chemicals that have been used as warfare agents or to make such agents in the past). The OPCW verifies such declarations through a combination of data monitoring and on-site inspections without "undue intrusion into the State Party's chemical activities".

Source: http://www.opcw.org/news/article/opcw-completes-2000th-inspection/

OPCW Director-General Meets Permanent Representative of the Libyan Arab Jamahiriya

March 11, 2011

The OPCW Director-General, Ambassador Ahmet Üzümcü, today asked the Permanent Representative of the Libyan Arab Jamahiriya to call on him at the OPCW Headquarters. The Director-General expressed the concerns of States Parties regarding the status of those chemical weapons possessed by Libya that remain to be destroyed, pursuant to its obligations under the Chemical Weapons Convention. He recalled that the responsibility for the physical security of those chemical weapons belongs entirely to Libya, and asked that every possible measure be taken to prevent their possible use.

The Permanent Representative reiterated to the Director-General the Libyan commitment to the implementation of the Convention, and that in accordance with the information he has received from Tripoli, the situation regarding the chemical weapons to be destroyed remains unchanged and under control.

Source: http://www.opcw.org/news/article/opcw-director-general-meets-permanent-representative-of-the-libyan-arab-jamahiriya/

NATIONAL AND INTERNATIONAL DEVELOPMENTS

E coli outbreak: Germany reports two more deaths

Health minister insists that new infections are dropping despite news of two deaths and 300 more E coli cases

Germany reported two more deaths and 300 more *E coli* cases, but its health minister insisted that new infections were dropping, giving some hope that the world's deadliest *E coli* outbreak was abating.

The health minister Daniel Bahr spoke before an emergency meeting in Berlin with health officials from the EU, which is concerned about Germany's handling of the crisis.

"I cannot yet give an all-clear, but after an analysis of the numbers there's reason for hope," Bahr told ARD television. "The numbers are continuously falling – which nonetheless means that there can still be new cases and that one unfortunately has to expect new deaths too – but overall new infections are clearly going down."

Bahr said the death toll had risen to 26 – 25 in Germany plus one in Sweden.

Germany's national disease control centre, the Robert Koch Institute, said the number of reported cases in Germany had risen by more than 300 to 2,648. Nearly 700 of those affected have been taken to hospital with a serious complication that can cause kidney failure. Another 100 *E coli* cases are in other European countries and the US.

The Koch Institute did not fully back Bahr's optimism. It said there was a declining trend in new cases but added that it was not clear whether this was because the outbreak was truly waning or because consumers were staying away from the raw vegetables believed to be the source of the *E coli*.

The EU's health chief, John Dalli, meanwhile, demanded that German health authorities work more closely with international experts in fighting the deadly epidemic, saying they should use "the experience and expertise in all of Europe and even outside of Europe", according to Die Welt newspaper.

"The focus of this meeting is to ensure that all the steps are being taken to get to ... the final elimination of this contamination as soon as possible and to see whether any more resources and efforts should be made," Dalli told reporters as he went into the Berlin meeting.

Outside health experts and even German MPs have strongly criticised the German investigation, saying the infections should have been spotted much sooner.

Weeks after the outbreak began on 2 May, German officials are still looking for its cause. Spanish cucumbers were initially blamed, then ruled out after tests showed they had a different strain of *E coli*. On Sunday, investigators pointed the finger at German bean sprouts, only to backtrack a day later when initial tests were negative.

On Wednesday, the agriculture minister of Lower Saxony, who had first warned against eating bean sprouts on Sunday, said authorities were still expecting new lab results from an organic farm that had been the focus of their investigation.

Gert Lindemann said authorities were still considering the farm in Bienenbüttel in northern Germany a possible source for the *E coli* outbreak.

Bahr reiterated that the source of the infection might never been found, a stance US experts have called a cop-out.

A warning against eating cucumbers, tomatoes, lettuce and bean sprouts is still in place.

Consumers across Europe are shunning fruit and vegetables, with EU farmers claiming losses up to •417m (£372m) as ripe produce rots in fields and warehouses.

Source: http://www.guardian.co.uk/world/2011/jun/08/e-coli-germany-more-deaths/print

E. Coli Outbreak Tied to Deadly New Strain

The new bacteria is a hybrid of two existing ones that have combined to form a super-virulent strain.

June 2, 2011

The outbreak of a deadly form of *E. coli* bacteria in Germany has medical experts racing to pinpoint its source — perhaps on a Spanish vegetable farm — as well as how this new strain could have evolved.

Researchers now say the new bacteria is a hybrid of two existing ones that have combined to form a super-virulent strain.

The World Health Organization reports the bacteria has killed 18 people and sickened more than 1,500 people in six nations, with the highest number of patients from Germany. U.S. authorities report two travelers returning from Germany contracted the disease and remain seriously ill, but have not spread the infection to others.

"You have an *E. coli* that's quite nasty and then it got genes from another toxic *E. coli* and it's become even nastier," said Paul Wigley, professor of food-borne diseases at the University of Liverpool.

Wigley said that the new strain is a combination of entero-aggregative *E. coli* (EAEC), which is an emerging microbe associated with diarrhea in developing nations, and entero-hemorrhagic e.coli (EHEC), which is similar to the one that caused the deadly hamburger outbreak of *E. coli* O157.

"It can hang around for a long time in the gut, invade pretty well and produce a toxin that damages the kidneys and can lead to bloody diarrhea," Wigley said.

The bacteria likely came from human or animal waste that came in contact with food. A Beijing lab that sequenced the genome of the bacteria with the help of German health officials said Wednesday that it appears to be resistant to many antibiotics. In fact, using antibiotics, which break apart the bacteria's cells, can release more toxins into the body, Wigley said.

"All you can do is supportive therapy, give patients fluid replacement, blood transfusions, and if kidney failure, then kidney dialysis." Officials with the Centers for Disease Control in Atlanta caution against panic and are careful not to call it a "super-bug" that can jump borders at will.

"We are talking about a food-borne outbreak," said Christopher Braden, director of CDC's division of food-borne, water-borne and environmental diseases. "There's a potential for this to be transmitted person to person, but no indication that it's happened."

Braden noted that so far, the disease has not affected children as much as adults, and that women are suffering more than men.

"Maybe it's coming from something kids don't normally eat, or something about this organism that doesn't affect kids as adults," Braden said. "We still don't know."

European health officials initially said they believed the source of the outbreak was contaminated vegetables grown in Spain, but have since backed off that claim. There are also reports that organically-grown vegetables like cucumbers were to blame since they rely on manure fertilizers.

In the meantime, several nations have banned food grown in Spain, while Russia has stopped all European produce imports.

Source:http://news.discovery.com/human/ecoli-outbreak-bacteria-strain-110602.html?print=true

Organic food linked to E. coli outbreak?

June 12, 2011

If you are a health food freak who lives on salads and swears by the benefits of organically grown raw vegetables, it's time for a reality check. In 16 countries across the globe, nearly 3,000 people have been sickened and 29 have died after eating raw

vegetables contaminated by a group of bacteria collectively called Escherichia coli (E. coli).

Authorities first cited contaminated Spanish cucumbers as the culprit and now organically grown sprouts from Germany are being seen as the most likely cause. The source of the infection still remains a mystery. Experts believe organic sprouts, cucumbers, tomatoes or lettuce contaminated somewhere between farm and fork have caused the disease.

Source: http://articles.timesofindia.indiatimes.com/2011-06-12/india/29649866_1_german-outbreak-coli-outbreak-organic-foods

'Terrorists may be spreading killer E.Coli'

June 7, 2011

The deadly E. Coli outbreak could have been spread by terrorists, say doctors, who add that rogue groups may have deliberately implanted the killer germ into fresh produce. Though Germany has been the centre of the outbreak, Britain could also be hit as our fruit and vegetable supply is also vulnerable to attack, reports the Daily Star.

The chilling warning comes as German health officials said a toxic batch of bean sprouts are probably behind the latest deadly outbreak. Scientists have warned people to avoid vegetables which are a popular ingredient in Chinese stir fry dishes.

Klaus-Dieter Zastrow, chief doctor for hygiene at Germany's Vivantes Hospital in Berlin, was quoted, as saying: "It is quite possible there's a crazy person out there who thinks: 'I'll kill a few people or make 10,000 ill.' "It is a mistake not to investigate in that direction," he added.

Source: http://articles.timesofindia.indiatimes.com/2011-06-07/uk/29628799_1_killer-outbreak-ecoli

Book Review

Chemical Weapons and Warfare by Brig. (Retd.) K R Padmanabhan, Surendra Publications (Delhi) 2010, ISBN: 978- 93-80014-50-0

Dr. Shamshad Ahmad Khan,

The author is a Research Assistant at IDSA, New Delhi.

Summary

This book presents detailed accounts of Chemical and Biological weapons program undertaken by different countries from the ancient time to the present day. It also traces the debate on banning these unseen weapons which caused 85,000 fatalities and resulted in 1,176,500 non-fatal casualties since its full scale usage in World War I.

Brig (retd) Padmanabhan's book, *Chemical Weapons and Warfare,* sheds light on diverse aspects of chemical weapons and chemical weapons programs undertaken by different countries during the First World War and thereafter. In the introduction, the author argues that although chemical warfare agents were deployed during the World War I for the first time in the second battle of Yepres in 1915, its use can be traced back to the ancient period. He writes, "Older Chinese writings dating back to about 1000 BC contain hundreds of recipes for the production of poisonous irritating smokes for use in war along with numerous accounts of their use" (p. 5) and it was in the 178 AD that China used arsenic containing "soul hunting fog" to suppress a peasant revolt. Elsewhere in the world, the author notes, Chemical warfare was applied in the 5th Century BC in Peloponnesian War between Athens and Sparta. The Spartans used "a lighted mixture of wood, pitch, and Sulfur" to incapacitate the Athenians. Athenians also used "hellebore roots to poison the water of Pleistrus River" (p.6).

The author's accounts suggest that in the ancient times too there were demands, akin to the present day conventions on chemical and biological weapons, not to use chemical agents during the wars. When the Germanic tribes used chemical agents to poison the wells of their enemies during their resistance to the Roman legions, the Roman jurists in reaction to the incident declared *"armis bella non venis geri"* (War is fought with weapons not with poisons) (p.2). This declaration by the Roman jurists seems to have left a deep impact on the debates regarding the deployment of chemical agents in wars. In 1854, when a British chemist proposed using cyanide filled artillery shell against enemy ships during the Crimean War, the British Ordnance Department rejected the proposal noting that was "as bad a mode of warfare

as poisoning the wells of the enemy"(p.6). The statement by the British Ordnance department suggests that they were referring to Roman jurists' declaration. Brig (retd) Padmanabhan mentions yet another agreement reached between Germany and France in 1672 when both the countries concluded the Strasbourg Agreement that included an article banning use of "perfidious and odious toxic agents" (p. 6).

So the author's account suggests that before the World War I, responsible authorities had been rejecting the proposals of initiating large scale implementation of chemical warfare on ethical grounds. However, during the World War I, many countries set aside these norms of not using chemical weapons and embarked on chemical weapons development program. For the first time in the World War I, the Germans deployed chemical warfare agents. They attacked French and Algerians with Chlorine gas in the Second battle of Ypress in April 1915, writes the author. After the World War I and during the inter war period many colonial powers used chemical warfare agents in an attempt to strengthen their hold on colonies and suppress the rebellions. The author notes that Winston Churchil authorized the use of Chemical weapons in 1920 when Kurdish and Arabs revolted against the British occupation in Iraq. Authorising the use of Chemical weapons, Churchil said, "I do not understand this squeamishness about the use of gas. I am strongly in favour of using poison gas against uncivilized tribes" (p. 8).

The Chemical warfare deployed during the World War I caused so many atrocities that at multiple international forums, the demand to ban the use of Chemical weapons grew stronger. Subsequently, in 1925 world's major nations signed the Geneva Protocol pledging never to use chemical and biological warfare agents. This pledge implied ban on the first use but not on the possession of Chemical weapons. This treaty preserved the right to use such weapons in retaliatory capacity. Thus, the pledge could not discourage the use of the chemical weapons and Italy, a signatory of Geneva Protocol, used mustard gas during the invasion of Ethiopia, killing 15,000 people. The author gives a detailed account of contravention of Geneva Protocol during the Second World War by the Axis Powers including Japan and Germany (p.8-9). He also notes that in the post-war period, chemical warfare development programs were undertaken by non-western nations as well, ignoring the ban imposed by the Geneva Protocol. Iraq used chemical weapons against Iran during the Iran Iraq War and thereafter against its own ethnic Kurdish citizens, killing almost 5000 people (p.12).

Chapter 5, could be interesting to the readers as the author gives detailed accounts of chemical agents and their variants that have been developed so far including their chemical components and its effects. The author also offers suggestions as to what to do in case the victims identifies that he/she has been affected by the chemical agents. This account would be helpful for those treating soldiers in battlefield.

In chapter six, the author writes that many countries including the US and the Soviet Union had also initiated other secret biological weapons development programs. The US military developed a large infrastructure of laboratories, test facilities and production of plants related biological weapons. By the end of 1960, the US has stockpiles of at least ten different biological and toxin weapons (p. 148). Similarly, USSR has been developing biological weapons; the 1979 outbreak of pulmonary anthrax in the Soviet Union is believed to have been caused by accidental release of anthrax spores from a Soviet biological weapons factory in Servedlovsk, writes the author.

In the same chapter, the author discusses medical aspects of biological and chemical weapons development and the ethical dilemma that confronts the scientists. To curb the chemical and biological development programs he suggests that the individual scientists should pledge not to engage knowingly in research and teaching that will further development of chemical and biological warfare agents. He argues that "Physicians and medical scientists should support methods for international epidemiologic surveillance ...and should support the vaccine for Peace Programs for control of 'dual threat' agents" (p. 153).

Barring typos that could have been completely avoided, the book is an informative source to understand Chemical and biological warfare undertaken by different countries from the ancient times to the present day.