

CHEMICAL WEAPONS CONVENTION AND ITS APPLICATION AGAINST THE USE OF CHEMICAL WARFARE AGENTS

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ABSTRACT

The history of the serious efforts to achieve chemical disarmament that culminated in the conclusion of the Chemical Weapons Convention (CWC) began more than a century ago. Although toxic chemicals have been used as a method of warfare throughout the ages, it is clear from some of the earliest recorded incidents that such weapons have always been viewed as particularly abhorrent. In this article a special attention will be paid to each part of the Convention itself, the main aim of the Convention which is the destruction of chemical weapons owned by the signatory states and the control of production, stockpiling and use of chemical for civil use as well. Any violation of the obligations, even inside a state territory, is punished with sanctions provided for in the Convention. The purpose of the article is to understand the obligations that the signatory states are required to observe, the inspection mechanism of specialized organizations, the possible sanctions in case of violations of the obligations verified after the inspections and the future perspectives after the global changes. In this paper the authors will analyze the creation and the evolution of CWC.

Keywords: *Chemical Weapons Convention (CWC), Organisation for the Prohibition of Chemical Weapons (OPCW), Chemical Warfare Agents (CWA)*

1. INTRODUCTION

Before this article can be discussed in greater details, it is necessary to distinguish between warfare means and methods. Warfare means are the weapons or the systems that fighters use on opponents to perform materially violence. Warfare methods are the strategies and tactical procedures used during military operations to overwhelm the opponents using information and weapons effects in addition to surprise. This explanation is important because during the last century, until the adoption of Protocol I in 1977, relating to the Protection of Victims of International Armed Conflicts, fighting interpretations were used to justify the indiscriminate use of weapons of mass destruction with prohibited warfare means and methods. Technical research group like the Quantum Electronics and Plasma Physics Research Group of University of Rome Tor Vergata are working on the problems of non-conventional events by developing new Decision Support System (DSS) (Gaudio *et al.*, 2011, 2013, 2014; Gelfusa *et al.*, 2014; Gallo, 2012; Benedetti *et al.*, 2011; Cacciotti *et al.*, 2014; Di Giovanni, 2014; Lupelli *et al.*, 2014; Malizia *et al.*, 2014; Carestia, 2014, 2015; Cenciarelli, 2015a; Ciparisse, 2015) and analyzing particular events using state of the art techniques and technologies in order to understand and address the problems (Malizia *et al.*, 2010; Malizia, 2016; Pinna *et al.*, 2011; Paziienza *et al.*, 2013, 2014; Cenciarelli, 2014, 2015b; Ludovici *et al.*, 2015).

The legal and moral prohibition of these weapons was successful in order to stop the race to chemical war. Industrial innovations and new technology developments brought the International Community to start a new process to improve law of war to conform it to military technology innovations. The aim of this work is to analyze the Chemical weapons convention from its origin and until its development and application during the years, showing how it has changed to protect humankind from possible criminal uses of chemical agents from new threats like international terrorism.

2. GENESIS AND HISTORICAL DEVELOPMENT OF CWC

2.1 1899 to WWII

An international peace conference held in The Hague in 1899 led to the signing of an agreement that prohibited the use of projectiles filled with poison gas. The efforts of the twentieth century were rooted in the 1899 Hague Peace Conference. The contracting parties to the 1899 Hague Conventions declared their agreement to abstain from the 'use of projectiles, the sole object of which is the diffusion of asphyxiating or deleterious gases'. Their intentions unfortunately proved futile. The rules of warfare agreed at the Hague Conference and its successor (the 1899 and 1907 Hague Regulations) prohibited the use of poisoned weapons. Nonetheless, chemical weapons were used on a massive scale during World War I, resulting in more than 100,000 fatalities and a million casualties (Zanders, 2002).

The result of this renewed global commitment was the 1925 Geneva Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare. However, the Geneva Protocol does not prohibit the development, production or possession of chemical weapons. It only bans the use of chemical and bacteriological (biological) weapons in war. Furthermore, many countries signed the Protocol with reservations permitting them to use chemical weapons against countries that had not joined the Protocol or to respond in kind if attacked with chemical weapons. Since the Geneva Protocol has been in force, some of these States Parties have dropped their reservations and accepted an absolute ban on the use of chemical and biological weapons (Thakur& Ere, 2006).

During the first half of the twentieth century, many developed countries spent considerable resources on the development of chemical weapons, particularly after the discovery of powerful nerve gases which renewed interest in the field. A number of countries used chemical weapons in the inter-war period, and all the major powers involved in World War II anticipated that large-scale chemical warfare would take place. Contrary to expectations, however, chemical weapons were never used in Europe in World War II. The reasons are uncertain, and historians still debate whether it was fear of retaliation in kind, the level of protection of enemy troops, or moral reasons that deterred their use (Bassiouni, 2008).

2.2 WWII to 1990

The fate of some of the stockpiles built up in anticipation of World War II is also uncertain. Many chemical weapons were abandoned, buried or simply dumped at sea. In any event, following World War II, and with the advent of the nuclear debate, several countries gradually came to the realization that the marginal value of having chemical weapons in their arsenals was limited, while the threat posed by the availability and proliferation of such weapons made a comprehensive ban desirable. At that time, the issues of chemical and biological weapons disarmament were linked to each other. Both issues became the subject of active consideration when, in 1968, Sweden was able to include them on the agenda of the multilateral Geneva disarmament conference. At that time, the conference was called the Eighteen Nations Disarmament Committee (ENDC) (Kellman, 2015).

Shortly thereafter, the negotiations on biological and chemical weapons issues diverged. In 1969, the United Kingdom tabled a draft biological weapons disarmament treaty. After several modifications

that reduced its effectiveness, the draft Biological Weapons Convention was agreed upon in the disarmament conference, and was endorsed by the United Nations General Assembly. The treaty opened for signature in 1972 and entered into force in 1975. The Biological Weapons Convention was an incremental step forward in the commitment to achieving a chemical weapons ban. Each State Party to this Convention affirms the recognized objective of effective prohibition of chemical weapons and, to this end, undertakes to continue negotiations in good faith with a view to reaching early agreement on effective measures for the prohibition of their development, production and stockpiling, and destruction. In addition, appropriate measures concerning equipment and means of delivery specifically designed for the production or use of chemical agents for weapons purposes are necessary (Graham, 1992).

The issue of chemical weapons was therefore retained on the agenda of the Geneva Conference, and various states tabled drafts during the 1970s. This era also saw the announcement of a joint US–Soviet initiative on chemical weapons, which was to be submitted to the Geneva Conference. A US–Soviet working group set up during this period began discussing some key ideas, which eventually formed the building blocks of the CWC. These included the need to control the precursors of chemical weapons, to establish mechanisms such as a conference or committee of all states parties and a secretariat to oversee the implementation of the treaty, and to use routine and challenge inspections as part of the verification regime (Raicevic, 2001).

In 1978, the Geneva conference –it was renamed the Conference on Disarmament in 1980– was restructured. Its membership increased to 40, and the chairmanship was to rotate among the members. The Conference decided in March of that year to establish an ad hoc working group on chemical weapons, which was required to 'define, through substantive examination, issues to be dealt with in the negotiations' on the Convention. During 1984, significant developments in the elaboration of the draft Convention have been made. The United States submitted a new draft text, which proposed intrusive verification measures, including mandatory challenge inspections. The negotiations received a new impetus when the Secretary-General of the United Nations announced that chemical weapons had been used by Iraq in its war against Iran. The Conference then agreed to begin elaborating a ban on chemical weapons, and mandated the ad hoc working group accordingly. The group worked based on a 'rolling text' of the Convention on which areas of consensus and disagreement were reflected (Stock *et al.*, 1996).

Beginning in 1986, the global chemical industry actively participated in these negotiations. Unlike the BWC, the negotiators of a chemical weapons ban reached an understanding that this ban would be subjected to international verification. To this end, trial inspections of both industrial and military facilities were undertaken, starting in late 1988. With the thawing of relations between the United States and the Soviet Union, there were a number of major breakthroughs in the negotiations on the Convention. In August 1987, the USSR indicated its willingness to accept, and even extend, the proposals for an intrusive verification regime contained in the 1984 US draft treaty. In the meantime, photographs of a chemical attack on civilians in Northern Iraq in March 1988 were widely published in the media. The international community reacted with repugnance against this use of Chemical Weapons, and within the Conference on Disarmament, the momentum for the conclusion of negotiations increased. In September 1989, President George Bush announced the new US position to the UN General Assembly: instead of total verifiability, the United States would seek 'a level of verification that gives us confidence to go forward'. In 1990, the United States and the Soviet Union also signed a bilateral agreement on chemical weapons, under which the two countries agreed not to produce chemical weapons, to reduce their stocks of chemical weapons to 20% of current holdings; and to begin destruction in 1992. It was also agreed that neither country would have more than 5000 tons of chemical agents by 2002. This agreement never entered into force; it nevertheless marked a willingness on the part of the two major possessors of chemical weapons to work together to eliminate this class of weaponry (Marauhn, 2016).

While the differences between the Americans and Soviets appeared to be diminishing, other issues gained prominence. Several Arab countries, for example, linked chemical disarmament to progress on

nuclear disarmament. Developing countries were generally concerned about whether the Convention would carry any benefits for them. Various new provisions were therefore developed for inclusion in the text of the Convention during the final years of the negotiations, such as:

1. assistance to victims of chemical weapons use,
2. the exemption of some sectors of the chemical industry from routine inspections,
3. the imposition of obligations on States Parties in relation to abandoned chemical weapons,
4. promise on the part of several developed countries -known collectively as the 'Australia Group'- to review export controls and other barriers to trade in chemicals (Üzümçü, 2016).

2.3 1992 to Present

On the whole, the last 'concession' from the industrialized countries, embodied in Article XI on economic and technological development, was probably the key to obtaining broad support for the Convention, since for a number of developing countries free trade in chemicals for purposes not prohibited under the Convention was the only important issue. The solution that was found is perhaps best captured in the statement of the Australian representative to the plenary session of the Conference on Disarmament on August 6, 1992. "*The members of the Australia Group undertook to review, in the light of the implementation of the Convention, the measures that they will take to prevent the spread of chemical substances and equipment for purposes contrary to the objectives of the Convention*". The aim was removing such measures for the benefit of States Parties to the Convention acting in full compliance with their obligations under the Convention (Paragraph 40 of the Report of the Ad Hoc Committee on Chemical Weapons to the Conference on Disarmament, CD/1170, dated August 26, 1992(OPCW, 2016).

In 1992, another obstacle to agreement on the Convention was removed when the United States renounced its previous insistence on retaining the option of retaliation in kind, and accordingly dropped its demand for the right to retain security stockpiles. There was a strong push to conclude the CWC. This was affirmed when President George Bush called for, and obtained agreement on, a one-year deadline for the completion of negotiations. It was clear to everyone involved that 1992 offered a window of opportunity for agreeing on a text for the treaty. The Chairman of the ad hoc Committee on chemical weapons moved quickly and tabled a draft Convention which incorporated the latest 'rolling text' and possible compromise solutions. After two more revisions, the draft convention was approved by most delegations, and was transmitted to the Conference in the summer of 1992. The Conference on Disarmament adopted the draft text on September 3, 1992 and transmitted it in its Report to the UN General Assembly. The text of the Convention was commended by the General Assembly in December 1992, with the request to the UN Secretary-General, as Depositary of the Convention, that it be opened for signature in Paris on January 13, 1993. A total number of 130 States signed the Convention within the first two days and it was subsequently deposited with the United Nations Secretary-General in New York (Üzümçü, 2016).

Recognizing that considerable preparations were required, and that a number of outstanding issues still remained to be resolved before the Convention could enter into force, the signatory states in Paris approved a resolution -the 'Paris Resolution'- to set up a 'Preparatory Commission' for the future Organization for the Prohibition of Chemical Weapons. Under the General Assembly resolution commending the text of the Convention, the UN Secretary-General was also requested to provide the services required by the signatory states to initiate the work of the Preparatory Commission. Accordingly, the Paris Resolution mandated the UN Secretary-General to convene the Preparatory Commission for its first session within 30 days of the fiftieth signature of the Convention. Since this threshold, number was easily exceeded at the signing ceremony in Paris, the inaugural session of the Preparatory Commission was held shortly thereafter, on February 8, 1993, in The Hague, the Netherlands, and the seat of the future Organization. As mandated in the Paris Resolution, the Preparatory Commission immediately established a Provisional Technical Secretariat to assist its work, and to prepare for the eventual Secretariat of the OPCW. The Preparatory Commission stayed in existence from 1993 until shortly after the Convention entered into force on April 29, 1997.

According to the terms of the Convention, the CWC would enter into force 180 days after the 65th country ratified the treaty. To prepare for the treaty's entry into force and the implementation of the verification regime, a Preparatory Commission was established in 1993 (Herbach, 2016).

The work of the Preparatory Commission, as described in the Paris Resolution, was to prepare the 1st Session of the Conference of the States Parties after Entry into Force, to make all necessary practical preparations for the implementation, and to finalize the work and the necessary procedures and guidelines needed for its implementation. These activities can be broadly categorized as developing the operational procedures for the Chemical Weapons' (CW) Verification regime and other operations; drafting the program and budget of the OPCW; and establishing the infrastructure and internal functional rules for the OPCW Secretariat. The Preparatory Commission functioned primarily through two working groups, one of which was tasked with considering administrative and organizational matters, while the other was assigned the responsibility for issues relating to verification and technical cooperation and assistance. Other bodies were also created to assist the work of the Preparatory Commission on specific issues such as relations with the host Country and preparations for the First Session of the Conference of The States Parties. The Preparatory Commission was successful in resolving a number of tasks within its mandate, the results of which were reflected in its Final Report. Among its major achievements were solutions to several substantive verification issues as well as the setting up of the OPCW Laboratory and Equipment Store, the development of a general training scheme for inspectors and the recruitment of inspector trainees, arrangements relating to the new OPCW headquarters building, and the development of draft documents such as the Headquarters Agreement. In addition, there are also an OPCW Staff and Financial Regulations, OPCW Health and Safety Policy and Regulations, OPCW Confidentiality Policy, and the OPCW Media and Public Affairs Policy. The Preparatory Commission was also responsible for the orderly transfer of its property, functions and recommendations to the OPCW. Despite its considerable efforts, however, the Preparatory Commission was unable to reach an agreement on a number of issues deriving from the Paris Resolution. These issues were therefore carried over to the OPCW as 'unresolved issues'. Many of these issues have been resolved since then, but others are still under discussion by the Member States of the OPCW (Herbach, 2016; OPCW, 2016).

Hungary was the 65th country to ratify the Convention, in late 1996, and on April 29, 1997, the Chemical Weapons Convention entered into force with 87 States Parties—becoming binding international law. An additional 22 countries had ratified the treaty in the 180 days between Hungary's ratification and entry into force. With the entry into force of the Convention, the OPCW immediately began its work to implement the Convention. Both, the Convention and its implementing body, are intended to adapt not only to shifts in the international environment and the changing needs of State Parties, but also to respond to the rapid pace of scientific and technological developments. Every five years, the Convention foresees that the State Parties should undertake a review of the implementation process. These review conferences serve as fora for the assessment and evaluation of the CWC's implementation, and the identification of areas where change is needed. A particular focus is given to the verification regime and the changing context within which it is implemented as well as scientific and technological advances in chemistry, engineering and biotechnology. The first review conference was held from April 28 to May 9, 2003. The second review conference was held from April 7 to 18, 2008.

3. STRUCTURE OF CWC AND ITS USE AGAINST TERRORISM

The Convention on Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction is an international treaty under which prohibition of chemical weapons is fully regulated. It took over 25 years to complete all the negotiations. The Convention consists of a Preamble, 24 articles and 3 annexes (Iannotti *et al.*, 2016).

3.1. Basic Obligations and Rights of Contracting Parties

The basic obligations and rights of the contracting parties may be classified as (Boulden, 2014):

1. *Obligations related to chemical weapons*: basically the contracting parties are prohibited to develop, produce, acquire, stockpile or keep chemical weapons or transfer them to whomsoever, directly or indirectly;
2. *Obligations related to chemical weapon production facilities*: the contracting parties must officially provide all the data on them to allow the inspectors to complete the phase of inspection and get final decisions;
3. *Obligations related to old and abandoned chemical weapons*: the obligations related to old CWA are not strict as the ones for other CWA.
4. *Obligations related to activities not prohibited under the Convention*: States can use toxic chemicals for purposes different from war or terrorism but they have to provide detailed information about these activities.
5. *Right to support and protection from chemical weapons*: The state contracting party that is under attack with chemical weapons is protected in such situation by this right (the details are in Article X of the Convention).
6. *Right to unfettered economic and technological development and protection of confidential information*: The chemical industry under the CWC has to respect the limitation on production and transfer of certain chemicals, the submission of data on production and the permission to effect inspection on spot.

3.2. Measures Implemented in the Convention

The measures implemented in the convention at (Üzümçü, 2014):

1. *National level*: the provisions to implement these measures are in Article VII of the Convention. These are general provisions that have to be analyzed and used by each state to examine concrete measures in case of CW possession or production. There is not a general model that can be applied for each state.
2. *International level*: the CWC has been established to guarantee an international control on chemical weapons that has to follow different protocols compared to other threats like nuclear weapon production. In order to achieve this, the OPCW -Organization for the Prohibition of Chemical Weapons- has been established together with sanctions, limitations or suspensions of right that can be imposed against the states that violate the provisions of the convention.

3.3. CWC Against Terrorism

There is a large number of CWC provisions that can be used as effective tools to prevent terrorist purposes. Here the important ones are analyzed (Dewing, 2014):

1. *“The Convention requires states to enact laws criminalizing the production of or attempted production of chemical weapons”*: Many states still do not have laws criminalizing the production of chemical weapons. Japan, for instance, did not have such a law before the terrorist incident in 1995. The CWC specifically requires states to enact laws criminalizing the production, stockpiling, transfer, and use of chemical weapons by any persons or corporations on their territory or subject to their jurisdiction. -including persons holding their citizenship, worldwide.
2. *“The Convention requires states to control the production of chemical weapons”*: The CWC requires governments to collect data on a substantial number of chemical weapons and precursors (listed in the CWC's Schedules of Chemicals), providing a ready-made source of data for national anti-terrorist efforts.
3. *“Chemical industries will be alerted to the danger that their products may be misused”*: Some, but not all, chemical industries in some developed countries are already aware of the

need to be cautious in selling chemicals that can be used to produce chemical weapons. The CWC's reporting requirements, combined with national programs of industry outreach, will help to alert firms to the need to use caution in selling precursor chemicals.

4. *“National and international agencies will be created that can serve as resources in the fight against terrorism”*: The creation of the OPCW helps all the states with chemical terrorism potential problems. CWC also requires that the states create a national agency that has to communicate with OPCW all the information about chemical weapons or chemical weapon precursors.
5. *“States will be discouraged from assisting or protecting chemical terrorists”*: The CWC will make it more difficult for states to aid chemical terrorists and their supporters. First, the treaty will reinforce the international norm against the possession or use of chemical weapons, and so expose states that assist terrorists to severe international criticism. Second, it will require states to enact legislation criminalizing attempts to produce chemical weapons. This will remove the excuse that a person who is being sought for crimes elsewhere cannot be extradited if he or she has not committed a crime under the laws of the state in which he or she has taken shelter.
6. *“The CWC will assist states that are the victims of actual or threatened chemical terrorist attacks”*: The CWC provides for humanitarian and technical assistance to states that have been the victims of actual or threatened use of chemical weapons.
7. *“National stockpiles of chemical weapons that might otherwise fall into the hands of terrorists will be eliminated”*: The Convention requires that these stockpiles be destroyed; until this process is complete, they will be under international supervision, reducing the danger of diversion.
8. *“The CWC provides a forum for discussing chemical terrorism-related problems”*: The OPCW's components will include an executive council that can address problems on an emergency basis, as well as annual meetings of the Conference of Parties at which the treaty's operation can be reviewed and adjusted.

4. THE INSPECTION SYSTEM OF THE CWC: PROBLEMS AND PROSPECTS

The CWC has been the first treaty that totally prohibited and eliminated a whole category of weapons of mass destruction with an extremely extensive and intrusive verification system. The Convention has also become a model for subsequent disarmament treaties. In this section the inspections system will be deeply analysed to understand how it applies the control and disarmament treaties of CWC.

4.1 The Significance of a Challenge Inspection System

The CWC provides for two sets of mechanisms to deal with possible concerns about non-compliance:

1. The clarification procedure that clarifies questions concerning possible non-compliance, either bilaterally or through the Executive Council of the Organization for the Prohibition of Chemical Weapons -CWC, Article IX, paragraphs 1–7.
2. The challenge inspection system that allows for inspectors of the Technical Secretariat of the OPCW to conduct an on-site inspection on the territory or any other place under the jurisdiction or control of a State Party when another State Party has raised a concern about non-compliance. If a challenge inspection could establish that there had been no breach of the Convention in all the dubious cases, it would help enhance confidence among States Parties that obligations under the Convention had actually been complied with by others. Even if that were not the case, a strong possibility of detecting breaches could still in itself assure States Parties that obligations under the Convention have generally been met.

It seems that, for the deterrent function to work effectively (ie. have a challenge inspection system), certain conditions should be met:

- a) there ought to be the possibility that inspections can be in fact be conducted at any time - conditions for effective decision-making-
- b) there ought to be the possibility of actually detecting non-compliance -conditions for effective detection-
- c) In assessing whether and, if so, to what extent these requirements are fulfilled, the following elements seem to be relevant:
 - 1) the kind of information that would be required;
 - 2) how a decision on such a request would be made;
 - 3) whether there is a right of refusal on the part of the challenged state;
 - 4) whether there is any quota or limit to the request or receiving of inspections;
 - 5) whether there are any restrictions in terms of specifying inspection sites; the timeline between the decision to conduct an inspection and its actual implementation; and the intrusiveness of inspection activities.

4.2 The Challenge Inspection System Under the CWC

The basic provision of the CWC concerning challenge inspections – Article IX, paragraph 8 – is as follows: “Each State Party has the right to request an on-site challenge inspection of any facility or location in the territory or in any other place under the jurisdiction or control of any other State Party for the sole purpose of clarifying and resolving any questions concerning possible non-compliance with the provisions of this Convention, and to have this inspection conducted anywhere without delay by an inspection team designated by the Director-General [of the Technical Secretariat] and in accordance with the Verification Annex.”

The above-cited paragraph states that the inspections are to be conducted “in accordance with the Verification Annex” of the Convention so an analysis on the provisions of the Annex is necessary to understand the power of this inspection system.

1. *Decision-making on conducting an inspection:* The requesting State Party is first required to submit an “inspection request” to the Executive Council of the OPCW -where the decision on the challenge inspection would be made- as well as to the Director-General of the Technical Secretariat with all the requested information. The inspection request can be refused -with the so-called red-light formula- but it is a rare case and it happens when the request is based on ridiculous motivations. The inspection request is accepted with the three-quarter blocking majority of all members of the Executive Council -the votes of absent persons are counted as “favourable to the inspection”-. There is no quota or limit system applicable to the number of inspections that a State Party or a facility may receive (Cooper, 1992).
2. *Inspection procedures:* The inspected State Party is allowed to take measures to protect sensitive installations and to prevent the disclosure of confidential information and data “not related to this Convention” -Article IX, paragraph 11(c).
3. *Timeline:* The inspection team, once it has arrived, shall assess the “inspection perimeter” proposed by the State Party and evaluate whether to accept it or not. The access to the “requested perimeter” by the inspection team has to be given within 108 hours of their arrival. It should be noted, however, that the inspected State Party must be provided with information regarding the location of the requested inspection site at least 12 hours before the inspection team’s arrival at the point of entry -Verification Annex, Part X, paragraph 6-. Thus, the inspected State Party would have at maximum roughly 120 hours -five days- to prepare for the inspection. The inspection team is also allowed to commence such activities as taking wipes, air, soil or effluent samples within a 50 meters band around the outside of the perimeter upon the team’s arrival at the final/alternative perimeter -“perimeter activities”: Verification Annex, Part X, paragraphs 35– 37-. Both perimeter activities and exit monitoring may be continued until the completion of the inspection -Verification Annex, Part X, paragraphs 31, 35.

4. *Intrusiveness*: The inspection team availability to access in the “requested perimeter” does not mean that the inspection team members are authorized to access all the facilities and areas of the perimeter in order to protect the sensitive installations of the State Party preventing the disclosure of sensitive information. The inspected State Party is obliged to make “every reasonable effort” to demonstrate that any object, building, structure, container or vehicle that has been protected is not used for purposes related to the possible non-compliance concerns raised in the inspection request. (OPCW, 2016).
5. *Assessment*: The Executive Council can allow a semi-automatic decision to conduct an inspection, by the way the inspection modalities present constrains. In terms of timeline, the inspection team might have to wait up to five days before being permitted to enter the requested inspection site. Theoretically, unlimited access would be the best possible way to ensure the effective verification of an arms control agreement but it is not possible: that is why the five days and the access have as a consequence that there is not a 100 per cent verification in a real arms control and disarmament world. The key criterion that is sometimes mentioned in this respect is the ability “to detect militarily significant violations in sufficient time to make an effective response” (Krepon, 1992). However, the concept of the timely detection of militarily significant violation would have different meanings for different arms control agreements. In the CWC context, “one ton of chemical” was once mentioned in the US Senate as a criterion for “militarily significant violation” but it is important to clarify that the concept of “militarily significant violation” or the “one ton” threshold for an effective verification has nothing to do with the definition of chemical weapons themselves in the CWC. Therefore, if a State Party develops or produces a toxic chemical or its precursor beyond the quantity that could be justified in the light of a designated purpose not prohibited under the Convention, it is in breach of the Convention, even if it does not reach a quantity of military significance. Military significance is a concept that could be applied in the context of verification and not in the context of prohibition.

4.3 General Constraints on Conducting Challenge Inspections

The above restrictions are strictly related to the CWC but there are general restrictions that have to be considered. They concern the external and internal functions of state sovereignty: one is related to the territorial jurisdiction or control of a state and the other to the human rights of individuals.

1. *Limitations related to the territorial jurisdiction or control of a state*. Article IX, paragraph 8, of the CWC states that each State Party can request an inspection on another non-State Party. However, normally it is not possible to conduct an on-site inspection on the territory of a non-State Party even if the place is under the jurisdiction or control of a State Party and it might entail a risk of undermining the whole verification system of the CWC. The CWC has introduced the following paragraph in its Verification Annex, Part II to avoid the above-mentioned problem: “In cases where facilities or areas of an inspected State Party are located on the territory of a State not Party to this Convention, the inspected State Party shall take all necessary measures to ensure that inspections of those facilities or areas can be carried out in accordance with the provisions of this Annex. A State Party that has one or more facilities or areas on the territory of a State not Party to this Convention shall take all necessary measures to ensure acceptance by the Host State of inspectors and inspection assistants designated to that State Party. If an inspected State Party is unable to ensure access, it shall demonstrate that it took all necessary measures to ensure access.” The first provision obligates the State Party having facilities or areas on the territory of a non-State Party to take all necessary measures to ensure that inspections of those facilities or areas can be carried out when they are requested. On the other hand, the last provision obliges the State Party concerned to demonstrate that it took all necessary measures if it is unable to ensure access. This latter provision implies that a State Party shall take all measures to satisfy the CWC even if the inspectors cannot have access to the suspected areas. In order to face this problem the CWC has introduced another paragraph that is analogous to paragraph 20 quoted above. Paragraph 21 of the Verification Annex, Part II, stipulates as follows: “In cases where the facilities or areas sought to be

inspected are located on the territory of a State Party, but in a place under the jurisdiction or control of a State not Party to this Convention, the State Party shall take all necessary measures as would be required of an inspected State Party and a Host State Party to ensure that inspections of such facilities or areas can be carried out in accordance with the provisions of this Annex. If the State Party is unable to ensure access to those facilities or areas, it shall demonstrate that it took all necessary measures to ensure access. This paragraph shall not apply where the facilities or areas sought to be inspected are those of the State Party". The last sentence of this paragraph does not appear in paragraph 20. This sentence, in fact, means that the possible exemption from ensuring access stipulated in the paragraph would not apply where the facilities or areas sought to be inspected belong to the hosting State Party.

2. *Limitations related to the human rights of private persons.* The on-site inspections have to take into account constitutional provisions on human rights regarding privacy (Bothe *et al.*, 1998). In order to reduce the possibilities to have a negative answer in term of access in some particular facility, the CWC stipulates in paragraph 41 of the Verification Annex, Part X that: "the inspected State Party shall be under the obligation to allow the greatest degree of access taking into account any constitutional obligations it may have with regard to proprietary rights or searches and seizures" This means that the inspected State Party is required to give the inspectors access only to the extent that this is in conformity with its constitution. Therefore, even if the inspected State Party cannot obtain a warrant and give full access -in time-, it would not be held to be in breach of the Convention for failing to give such access (Duncan *et al.*, 1995).

4.4 Practical Problems of the Challenge Inspection System

The non-use of the challenge inspection system and its background, arguably the most challenging problem of the CWC's challenge inspection system, has been that it has been neither used nor requested since the last years causing a negative effect on the credibility of CWC. It was due to the difficulties to prove the presence of chemical weapons that still exists, even if the technologies and methods to detect chemicals have been improved in the last decade. The second problem is that a non-detection does not mean a "non presence" of chemical weapons or chemical weapons precursors, so that an innocence declaration can be affected by errors. Developed States Parties, on the other hand, put emphasis on the difference between the clarification procedure and the challenge inspection system, and maintain that the clarification procedure is not something that is legally required to be followed as a precondition before a challenge inspection request is filed. They point out that the provision in Article IX, paragraph 2, itself makes that point clear by stating that "States Parties should, whenever possible, first make every effort". This is to clarify and resolve non-compliance concerns through consultations and that the clarification procedure is to be utilized "without prejudice to the right of any State Party to request a challenge inspection". Legally speaking, the point of view of developed States Parties reflects the correct interpretation of the relevant provision. Nonetheless, the argument of developing States Parties is not necessarily a complete reinterpretation of the above provision and seems to contain some legitimacy. At any rate, the difference of opinion between the two groups appears to be rather profound and it does not seem that it will be settled anytime soon. Perhaps there therefore needs to be a fresh approach to accomplishing the goal.

4.5 Towards Resolving the Problem

A mechanism developed that was proposed to overcome the above mentioned problems affirm that "there seems to be a need to create another level of mechanism which falls between the routine industry inspection and the politically loaded challenge inspection. A mechanism which is a purely technical exercise but which serves to clarify questions and uncertainties which delegations and the Organization may have. Such a mechanism, denuded of a political character, could serve a useful role as a confidence building measure that goes beyond the provisions of the regular inspection" (OPCW, 2000).

The fact that the challenge inspection might not work as expected had been anticipated even during the CWC negotiations. In 1989, to counter such an occurrence, the United Kingdom had proposed an “ad hoc inspection” system with rather limited purposes and scope. These ad hoc inspections have to follow these lines:

1. Each State Party would have the right to initiate inspections by the Technical Secretariat in civil and military facilities and elsewhere on the territory of any other State Party.
2. These requests would not be linked to any allegation of breach of the Convention.
3. The purpose of the inspection would be to check whether any activity in the facility concerned was subject to declaration or prohibition under the terms of the Convention.
4. Procedures for the conduct of the inspection (i.e. its format) would differ from those for routine inspections and for challenge inspection. This proposal was not accepted during the CWC negotiations because developing countries saw it as being too similar to the challenge inspection and, in addition, they did not wish to receive further inspections at their industrial sites (OPCW, 2016).

However, a similar system was proposed and agreed upon in the nuclear field. In May 1997, the Board of Governors of the International Atomic Energy Agency –IAEA- adopted a model Additional Protocol (INFCIRC/540) to the model Comprehensive Safeguards Agreement (INFCIRC/153). The latter Agreement has provided a basic mechanism for monitoring the nuclear activities of non-nuclear-weapon States Party to the Treaty on the Non-Proliferation of Nuclear Weapons –NPT-. It is called “routine inspection” based on reports prepared by those States. In 1991, the IAEA revealed the problems connected to this system because clandestine nuclear weapon programs have been found in States like Iraq (Albright & Hibbs, 1992). Faced with this reality, the IAEA decided to formulate a new set of rules to monitor nuclear activities.

If the CWC had been able to adopt an “ad hoc inspection” system, the problem that the CWC is now facing with regard to its challenge inspection system might not have come about. Put differently, the problem might well be resolved, at least partially, if the OPCW could adopt, and States Parties could accept, a document comparable to the Additional Protocol of the IAEA. Thus, the idea contained in the Protocol’s “complementary access” system seems worth exploring in the CWC verification context. The difficult part is how to achieve the goal. From a methodological perspective, there appears to be two ways to introduce such a system into the CWC. One is to utilize the existing framework; the other is to create a new framework. The first option might draw on the precedent of confidence- and security-building measures –CSBMs- in Europe. The CSBMs in Europe, a mechanism designed mainly to promote transparency by providing information on military activities, are equipped with a challenge-type inspection, called “inspection”. According to the Stockholm CSBM Document of 1986, an “inspection” may be requested when compliance with CSBMs is in “doubt”; and an inspection request needs to be accompanied by a statement of “reasons” for the request (Bloed, 1993). However, these conditions and requirements were later dropped in the Vienna CSBM Document of 1994 (Bloed, 1993), probably owing to the routine of inspection requests in practice. It would be tempting to follow this example of European CSBMs and drop the sensitive part of the information requirement in requesting a challenge inspection in the CWC context -i.e. concern regarding possible non-compliance-. Yet the reality would not be so simple. First, unlike the European CSBMs, which are based on a series of evolving political documents, the CWC is a legally binding treaty. As such, it is impossible to drop an important requirement for an inspection request without formally amending the Convention, which is far more difficult than modifying CSBM Documents. Secondly, the modification of the European CSBM Documents became possible because the participating states routinely made requests for inspection, which is something completely lacking in the OPCW. A second method to achieve the goal would be to negotiate a new document on complementary access-type inspections in the Additional Protocol of the IAEA. However, it would be equally difficult to pursue this path. One needs to remember that States Parties to the CWC have already assumed a considerable burden in receiving industry inspections every year, depending on the scale of the respective States Parties’ chemical industry. It is inconceivable that they would assume a

new burden without being offered any new carrot. The same factor seems to have led to the dismissal of the “ad hoc inspection” proposal during the CWC negotiations. To agree on any new measures, the minimum requirement would be a general agreement among participants to promote the shared idea, which is again lacking in the OPCW at present. This train of thought brings us back to the method of utilizing the existing framework. It is possible to envisage a State Party requesting a challenge inspection of the facilities of another State Party that has friendly relations with the requesting State Party, thus breaking the ice. Admittedly, this could be seen as an irregular, if not abusive, request, but it might still be regarded as falling within the scope of the CWC challenge inspection scheme, as long as the request is for the purpose of “clarifying and resolving any questions concerning possible noncompliance with the provisions of this Convention” -Article IX, paragraph 8, emphasis added-, no matter how technical the questions may be. In other words, the language of the CWC concerning challenge inspection seems broad enough to cover not only challenge inspections proper but also the “complementary access” type of inspections. It is to be hoped that such an “evaluative” interpretation would promote a practice that could be followed by other interested States Parties and gradually constitute a basis on which to build a system similar to the “complementary access” of the IAEA.

5. THE THIRD REVIEW OF THE CWC

The OPCW area and goals have changed during its history and among the traditional goals of the regime are the complete, irreversible and verified destruction of existing CW stockpiles, which still needs to be accomplished, and the continued oversight of the regime’s non-proliferation dimension—or, as it is increasingly called, the prevention of the re-emergence of chemical weapons. These two areas have been characterized as the ‘fundamental goals’ of the CWC by the US Under Secretary of State for Arms Control and International Security, during the UN high-level meeting. The interventions by Iranian and other representatives at the same meeting on behalf of the Non-Aligned Movement –NAM- have highlighted and reasserted a wider set of goals and different priorities, focusing on international cooperation, assistance and protection. These new goals together with the experience of the first two CWC Review Conferences in 2003 and 2008 have been the base to implement the third revision of the CWC as it is a mistake to think that the CW problem has been solved with the establishment of the CWC (Lachowski, 1994; Robinson, 2008).

The main focus of the CWC implementation has been the destruction of existing CW stockpiles by possessor states, which has led to approximately 75 per cent of declared CW having been destroyed under international verification by 30 June 2012. The six CW possessor states — Russia, the United States, India, South Korea, Albania and Libya — have declared a total of nearly 70,000 tons of chemical warfare agents and about 8.6 million munitions and containers. Of these, Russia declared some 40,000 tons, the United States 28,575 tons, India around 1,000 tons and South Korea around 600 tons. Both the Albanian and the Libyan declarations—some 16 tons of CW agents in the case of the former and 23.62 tons in the case of the latter—did not substantially change the overall size of declared CW stockpiles. The OPCW fixed in the past a ten-year deadline – April 29, 2007-to complete destruction of declared CW stockpiles, with a five-year extension option (OPCW, 2016). However, it has not been respected, considering that the US in 2006 had destroyed less than 50% of its CW arsenal, India around 70%, South Korea more than 80%, and the Russian Federation around 16%.

These delays resulted in the extension of the final destruction deadline for five of the CW possessor states, which was combined with a requirement to report to the Executive Council every 90 days on the progress made in the destruction process, as well as to continue to submit annual plans of destruction and annual reports on their CW destruction activities. It has been decided to set visits intended as ‘additional transparency and confidence building measure’. After these measures, positive results have been achieved: in summer 2012, the US had destroyed approximately 90 per cent and the Russian Federation 65 per cent of their respective declared CW arsenals, raising the potentially thorny

issue of how the Review Conference will deal with the delay in CW demilitarization (Lachowski, 1994).

5.1 Non-Proliferation and Preventing

After the above-mentioned results, the budget agreed at the end of 2012 allocates fewer resources to the inspection of CW destruction activities and to implement a higher number of inspections of so-called ‘other chemical production facilities’ –OCPF (Kelle, 2012).

The majority of the chemistry substances used to produce chemical weapons have dual use application to rules and procedures for toxic chemicals that may pose a risk to the CWC’s object and purpose, but are not listed on one of the three CWC schedules, they are called DOC -Discrete Organic Chemicals-. The verification of these OCPFs has been a cause of disagreement among CWC states parties during the past 2 decades. Since the CWC entered into force, more than 5000 inspected States Parties have declared DOC-producing OCPFs. The United States during the years stressed the need to increase the number of OCPF facilities ‘that are inspected annually’ and to focus more on ‘specific facilities that should be inspected’. Some of these facilities incorporate technologies and features that are highly relevant to the Convention (Kelle, 2012).

There are several diverging views on OCPF inspections so in accordance with CWC the OPCW had to start the implementation of a verification system for OCPFs. In the first stage, the site selection for inspections was carried out through a two-stage process in which first the country and then the plant site for inspection were selected. An interim algorithm introduced by the Technical Secretariat in May 2007, which allowed for the selection of plant sites in a single step and sought to direct the process towards relevant facilities, replaced this temporary mechanism (Kelle, 2012). The improved algorithm allows the Technical Secretariat to focus on facilities of greater relevance but does not satisfy the part: ‘proposals by states parties’. A mechanism for how such proposals could be integrated into the OCPF site selection methodology still needs to be agreed upon more than a decade after OCPF inspections were begun.

5.2 Protection and Assistance

The protection against the CW is legitimate according to article X. Such protection can be realized through research, development, production and use of protective measures against CW. In order to improve the protection capabilities, many exercises and training courses have been conducted. The first major OPCW exercise on the delivery of assistance, named ASSISTEX¹, took place in September 2002 in Zadar, Croatia. Its aim was to assess the preparedness of both states parties and Technical Secretariat for processing and responding to a request for assistance. The underlying scenario involved a fictitious state party discovering a terrorist group first producing and then using CW in an attack on a major airport. Over 900 individuals from eight states parties participated in the exercise. It has been followed by several exercises that help the implementation of CWC provisions on protection, assistance thanks to the multitude of activities by both the OPCW’s Technical Secretariat and a small number of dedicated states parties, which have funded, conducted and provided logistical support for a large number of assistance- and protection related courses. It has clearly improved the capabilities to conduct an investigation of alleged use and to provide assistance if the national capabilities of a CWC state party are unable to cope with the situation.

5.3 International Cooperation for Peaceful Uses of Chemical Substances

In order to attract those states that have never produced CW or do not feel threatened by them, the CWC contains provisions -in article XI- for fostering international cooperation in the peaceful uses of

¹<https://www.opcw.org/our-work/assistance-protection/>

chemistry. The OPCW's Technical Secretariat has developed and implemented a range of activities in this area, annual sessions of the Conference of the State Parties and the first two review conferences have seen members of the NAM criticizing the export controls of states participating in the Australia Group –AG-, which they regard as contravening the CWC cooperation provisions. The number of states participating in the AG has grown and the scope of its export controls has widened since then, while criticism has recently become restricted to a few NAM states (Robinson, 1992).

Some of these States strongly criticize the existence and operations of AG so the members of the Western European and Others Group –WEOG-, by contrast, defended the need for the Australia Group's continued existence. Given the entrenched positions of participants in this debate, it is not surprising that much of the Review Conference report simply reproduced text contained in the CWC or agreed upon during earlier conferences of the state's parties. The Review Conference also 'urged the Council to continue its facilitation efforts to reach early agreement on the issue of the full implementation of Article XI' (Robinson, 1992).

6. CONCLUSION

The aim of this work has been to analyse the CWC starting from its origin, its development and application during the years, showing how it has changed to protect humankind from possible criminal uses of chemical agents coming from new threats like international terrorism. The study has focused on an historical analysis on the evolution of chemical weapon production and use in different countries and how, year by year and case by case, new procedures, laws and approaches have been developed and used to face these problems and increase the safety of people and security of countries till the preparation of CWC.

REFERENCES

- Albright, D. & Hibbs, M. (1992). *Iraq's Quest for the Nuclear Grail: What Can We Learn?* Arms Control Today, **22**: 3-12.
- Bassiouni, M.C. (2008). The new wars and the crisis of compliance with the law of armed conflict by non-state actors. *J. Criminal Law Criminology*, **98**: 711-810.
- Benedetti, M., Gaudio, P., Lupelli, I., Malizia, A., Porfiri, M.T., and Richetta, M. (2011). Scaled experiment for Loss of Vacuum Accidents in nuclear fusion devices: Experimental methodology for fluid-dynamics analysis in STARDUST facility. *Proc. 2nd Int. Conf. Fluid Mech. Heat Mass Transfer*, pp. 142-147.
- Bloed, A. (1993). *The Conference on Security and Co-operation in Europe: Analysis and Basic Documents, 1972-1993*. Martinus Nijhoff Publishers, Leiden, The Netherlands.
- Bothe, N., Ronzitti, N. & Rosas, A. (1998). National implementation of the CWC: Some legal considerations. *The New Chemical Weapons Convention: Implementation and Prospects*, Kluwer, The Hague, pp. 545-546.
- Boulden, J. (2014). Multilateral institutions/regimes and the dissemination of WMD. *Globalisation, Multilateralism, Europe: Towards a Better Global Governance?*, pp. 361-372.
- Cacciotti, I., Aspetti, P.C., Cenciarelli, O., Carestia, M., Di Giovanni, D., Malizia, A., D'Amico, F., Sassolini, A., Bellecci, C., Gaudio, P. (2014). *Simulation of Caesium-137 (¹³⁷Cs) local diffusion as a consequence of the Chernobyl accident using Hotspot*. *Defence S&T Tech. Bull.*, **7**: 18-26.
- Carestia, M., Pizzoferrato, R., Gelfusa, M., Cenciarelli, O., D'Amico, F., Malizia, A., Scarpellini, D., Murari, A., Vega, J. & Gaudio, P. (2014). Towards the implementation of a spectral data base for the detection of biological warfare agents. *SPIE Security+ Defence - International Society for Optics and Photonics*, 92510I.
- Carestia, M., Pizzoferrato, R., Gelfusa, M., Cenciarelli, O., Ludovici, G.M., Gabriele, J., Malizia, A., Murari, A., Vega, J. & Gaudio P. (2015). Development of a rapid method for the automatic classification of biological agents' fluorescence spectral signatures. *Optical Eng.*, **54**: 114105.

- Cenciarelli, O. Pietropaoli, S. Malizia, A. Carestia, M. D'Amico, F. Sassolini, A. Di Giovanni, D. Rea S., Gabbarini, V. Tamburrini, A. Palombi, L. Bellecci, C. & Gaudio, P. (2015a). Ebola virus disease 2013-2014 outbreak in West Africa: An analysis of the epidemic spread and response. *Int. J. Microbiol.*, **Vol. 2015**, 769121.
- Cenciarelli, O., Gabbarini, V., Pietropaoli, S., Malizia, A., Tamburrini, A., Ludovici, G., Carestia, M., Di Giovanni, D., Sassolini, A., Palombi, L., Bellecci, C., Gaudio, P. (2015b). Viral bioterrorism: Learning the lesson of Ebola virus in West Africa 2013–2015. *Virus Res.*, **210**: 318-326.
- Cenciarelli, O. (2014). Biological emergency management: the case of Ebola 2014 and the air transportation involvement. *J. Microb. Biochem. Technol.*, **6**: 247-253.
- Ciparisse, J.F., Malizia, A., Poggi, L.A., Gelfusa, M., Murari, A., Mancini, A. & Gaudio, P. (2015). First 3D numerical simulations validated with experimental measurements during a LOVA reproduction inside the new facility STARDUST-Upgrade. *Fusion Eng. Design*, **101**: 204-208.
- Cooper, G.H. (1992). The Chemical Weapons Convention verification regime. *UNIDIR Newslett.*, **20**: 11.
- Dewing, M. (2014). Terrorism and chemical security: Small quantities of chemicals of interest. *J. Appl. Secur. Res.*, **9**: 81-96.
- Di Giovanni, D., Luttazzi, E., Marchi, F., Latini, G., Carestia, M., Malizia, A., Gelfusa et al. (2014). Two realistic scenarios of intentional release of radionuclides (Cs-137, Sr-90) - the use of the HotSpot code to forecast contamination extent. *WSEAS T. Environ. Dev.*, **10**: 106-122.
- Duncan, A.S., Krutzsch, W. & Trapp, R. (1995). A Commentary on the Chemical Weapons Convention. *Int. Comparative Law Quarterly*, **44** : 961-962.
- Gallo, R., De Angelis, P., Malizia, A., Conetta, F., Di Giovanni, D., Antonelli, L., Gallo, N., Fiduccia, A., D'Amico, F., Fiorito, R. et al. (2012) *Development of a georeferencing software for radiological diffusion in order to improve the safety and security of first responders*. Defence S&T Technical Bulletin **6** (1): 21-32.
- Gaudio, P., Gelfusa, M., Lupelli, I., Malizia, A., Moretti, A., Richetta, M., Serafini, C., & Bellecci, C. (2011). First open field measurements with a portable CO₂ lidar/dial system for early forest fires detection. *SPIE Remote Sensing - International Society for Optics and Photonics*, 818213.
- Gaudio, P. Gelfusa, M., Malizia, A., Richetta, M., Serafini, C., Ventura, P., Bellecci, C., De Leo, L., Lo Feudo, T. & Murari A. (2013). *New frontiers of forest fire protection: A portable laser system (FfED)*. *WSEAS Tran. Environ. Dev.*, **9**: 195-205.
- Gaudio, P., Gelfusa, M., Malizia, A., Parracino, S., Richetta, M., Murari, A., Vega, J. (2014). Automatic localization of backscattering events due to particulate in urban areas. *SPIE Remote Sensing - International Society for Optics and Photonics*, 924413.
- Gelfusa, M., Gaudio, P., Malizia, A., Murari, A., Vega, J., Richetta, M. & Gonzalez, S. (2014) UMEL: A new regression tool to identify measurement peaks in LIDAR/DIAL systems for environmental physics applications. *Rev. Sci. Instrum.*, **85**: 063112.
- Graham, H.C. (1992). *The Chemical Weapons Convention verification regime*. *UNIDIR Newslett.*, **20**: 11.
- Herbach, J. (2016). The evolution of legal approaches to controlling nuclear and radiological weapons and combating the threat of nuclear terrorism. *Yearbook of International Humanitarian Law*, **17**: 45-66.
- Iannotti, A., Schraffl, I., Bellecci, C., Malizia, A., Cenciarelli, O., Di Giovanni, D., Palombi, L., Gaudio, P. (2016). Weapons of mass destruction: A review of its use in history to perpetrate chemical offenses. Defence. *S&T Tech. Bull.*, **9**: 39-52
- Kelle, A. (2012). Non-proliferation and preventing the re-emergence of chemical weapons. *Disarmament Forum University of Bath*, **1**: 55-64.
- Kellman, B. (2015). The Advent of International Chemical Regulation: The Chemical Weapons Convention Implementation. *Act. J. Legislation*, **25**: 117-139
- Krepon, M. (1992). Verification of a Chemical Weapons Convention. In Brad Roberts (Ed.) *Chemical Disarmament and U.S. Security*, Boulder, Colorado.
- Lachowski, Z. (1994). Conventional arms control and security dialogue in Europe. *SIPRI Yearbook*, **1**: 761-761.

- Ludovici, G.M., Cenciarelli, O., Carestia, M., Malizia, A., Tamburrini, A., Gabbarini, V., Sassolini, A., Di Giovanni, D., Mancinelli, S., Palombi, L., Gaudio, P., Bellecci, C. & Rinaldi, T. (2015). *The importance of forensic microbiology in CBRNe investigations. Defence S&T Tech. Bull.*, **8**: 153-161.
- Lupelli, I., Gaudio, P., Gelfusa, M., Malizia, A., Belluzzo, I. & Richetta, M. (2014). *Numerical study of air jet flow field during a loss of vacuum. Fusion Eng. Design*, **89**: 2048-2052.
- Malizia, A., Quaranta, R. & Mugavero, R. (2010). CBRN events in the subway system of Rome: Technical-managerial solutions for risk reduction. *Defence S&T Tech. Bull.*, **3**: 140-157.
- Malizia, A., Carestia, M., Cafarelli, C., Milanese, L., Pagannone, S., Pappalardo, A., Pedemonte, M., Latini, G., Barlascini, O., Fiorini, E., Soave, P.M., Di Giovanni, D., Cenciarelli, O., Antonelli, L., D'Amico, F., Palombi, L., Bellecci, C. & Gaudio, P. (2014). *The free license codes as Decision Support System (DSS) for the emergency planning to simulate radioactive releases in case of accidents in the new generation energy plants. WSEAS Tran. Environ.Dev.*, **10**: 453-464.
- Malizia, A. (2016). Disaster management in case of CBRNe events: an innovative methodology to improve the safety knowledge of advisors and first responders. *Defense Secur. Anal.*, **32**: 79-90
- Maruhn, T. (2016) The prohibition to use chemical weapons. *Yearbook of International Humanitarian Law*, **17**: 25-44.
- Organisation for the Prohibition of Chemical Weapons (OPCW) (2000). Challenge Inspection: The South African View. *OPCW Synthesis*, Cape Town, pp. 26-27.
- Organisation for the Prohibition of Chemical Weapons (OPCW) (2016). Available online at: <https://www.opcw.org> (Last access date: 18 January 2016).
- Pazienza, M., Britti, M.S., Carestia, M., Cenciarelli, O., D'Amico, F., Malizia, A., Bellecci, C., Gaudio, P., Gucciardino, A., Bellino, M., Lancia, C., Tamburrini, A., Fiorito, R. (2013). Application of real-time PCR to identify residual bio-decontamination of confined environments after hydrogen peroxide vapor treatment: Preliminary results. *J. Microb. Biochem. Technol.*, **6**: 24-28.
- Pazienza, M., Britti, M.S., Carestia, M., Cenciarelli, O., D'Amico, F., Malizia, A., Bellecci, C., Fiorito, R., Gucciardino, A., Bellino, M., Lancia, C., Tamburrini, A., Gaudio, P. (2014). Use of particle counter system for the optimization of sampling, identification and decontamination procedures for biological aerosols dispersion in confined environment. *J. Microb. Biochem. Technol.*, **6**: 43-48.
- Pinna, T, Cadwallader, L.C., Cambi, G., Ciattaglia, S., Knipe, S., Leutererh, F., Malizia, A., Petersen, P., Porfiri, M.T., Sagot, F., Scales, S., Stober, J., Vallet, J.C., Yamanishij, T. (2011). Operating experiences from existing fusion facilities in view of ITER safety and reliability. *Fusion Eng. Design*, **85**: 1410-1415.
- Raicevic, N. (2001). The history of prohibition of the use of chemical weapons in international humanitarian law. *Law Politics*, **1**: 613-631.
- Robinson, J.P. (1992). *The Australia Group: A Description and Assessment. Controlling the Development and Spread of Military Technology: Lessons from the Past and Challenges for the 1990s*. VU University Press, Amsterdam, The Netherlands.
- Robinson, J.P. (2008). Difficulties facing the chemical weapons convention. *Int. Affairs*, **84**: 223-239.
- Stock, T., Haug, M. & Radler P. (1996). Chemical and biological weapon development and arms control. *SIPRI Yearbook: Armaments, Disarmament and International Security*, Stockholm International Peace Research Institute (SIPRI), Stockholm.
- Thakur, R., Ere, H. (2006). *The chemical weapon convention. Implementation Challenges and Opportunities*. United Nations University Press, Hong Kong.
- Üzümcü, A. (2014). The Chemical Weapons Convention-disarmament, science and technology. *Anal. Bioanal. Chem.*, **406**: 5071-5073
- Üzümcü, A. (2016). One hundred years of chemical warfare and disarmament: Then and now. *Yearbook of International Humanitarian Law*, **17**: 9-12
- Zanders, J.P. (2002). *The Chemical Weapons Convention and Universality: A Question of Quality Over Quantity?* Available online at: http://kms2.isn.ethz.ch/serviceengine/Files/EINIRAS/55138/ichaptersection_singledocument/1cb1ffae-61ef-464f-8e6c-a9412a6cc157/en/04_The+CWC+and+Universality.pdf (Last access date: 13 September 2016).