Annex

Overview of the chemical weapon programme of Iraq

1. Chemical weapons were the first area of weapons of mass destruction explored by Iraq. In 1971, the Iraqi Chemical Corps established a laboratory-scale facility at Al-Rashad, in the Baghdad area, to gain practical experience in the synthesis of chemical warfare agents and to evaluate their effects. Although production of laboratory (gram to kilogram) quantities of chemical warfare agents could have been justified for defensive purposes, such as the calibration of detection instruments and the testing of protective equipment, the work of the laboratory also constituted a necessary step in the training of a national cadre for future dedicated chemical weapon research and production. In addition, it contributed to the creation of relevant support infrastructure and a system for the acquisition of equipment and materials.

2. The functioning of a laboratory in the period from 1971 to 1973 can be considered to be a preparatory stage of Iraqi familiarization with chemical weapon technology, although there is no clear evidence concerning the intentions of Iraq at that time. In 1974, the laboratory came under the auspices of a newly created organization, the Al-Hazen ibn al-Haitham Institute, which was subordinated to the Iraqi security and intelligence agencies.

3. By the end of 1974, the chemical weapon work at the Al-Hazen ibn al-Haitham Institute was expanded in an attempt to produce chemical warfare agents on a larger (tens of kilograms) scale. Following the progress in the scaling-up of the synthesis of chemical warfare agents, the Al-Hazen ibn al-Haitham Institute decided to expand its chemical laboratory complex inherited from the Chemical Corps and to place larger-scale production units at a new site located in a remote desert area south of the town of Samarra. In 1975, the construction of four production plants commenced. These included a plant for the production of the chemical warfare agent mustard gas, a plant to manufacture the nerve agents tabun and sarin, and two multipurpose plants for the production of precursor chemicals. The construction work stopped however after the closure of the Al-Hazen ibn al-Haitham Institute in 1978.

4. A large-scale chemical weapons programme was established by Iraq in 1981, after the beginning of the Iran-Iraq war, when Iraq faced defeat in the face of the overwhelming manpower advantage of the Islamic Republic of Iran. The goal was to produce and supply the armed forces with significant quantities of chemical weapons that could be quickly deployed.

5. The Iraqi military chemical weapon programme progressed rapidly. From 1981 to 1983, Iraq expanded production at the Al-Rashad facility and developed the complex at the Samarra site started by the Al-Hazen ibn al-Haitham Institute. Iraq constructed several chemical weapon production plants and assembled other critical elements of infrastructure at the site. By the end of 1984, Iraq had produced hundreds of tons of chemical warfare agents and supplied several thousand filled chemical weapon munitions to the armed forces. Iraq was not able to transcend some critical technological barriers, such as the quality of some of the chemical warfare agents produced. Despite those flaws, however, according to Iraq, the use of chemical weapons achieved its major purpose and made a significant impact on the outcome of the Iran-Iraq war.

6. The chemical weapon programme required access to foreign technology, equipment and raw materials because, in the early 1980s, Iraq did not have indigenous capabilities to manufacture chemical process equipment and precursors for the production of chemical warfare agents. A convincing legitimate cover story was needed to engage outside contractors and suppliers. Therefore, the chemical weapon programme began to operate under the facade of the State Establishment for Pesticide Production (SEPP).

7. In the 1970s and 1980s, the production of a second generation of agricultural pesticides, in terms of technology, equipment and raw materials, most closely corresponded to the requirements for the production of chemical warfare agents. In addition, Iraq had legitimate needs for pesticides for its growing agricultural sector.

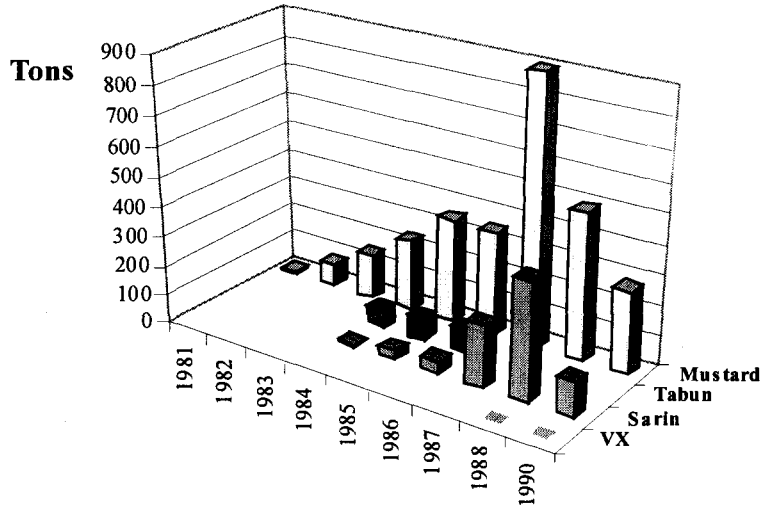
8. In general, Iraq did not develop its own methods for the production of chemical warfare agents. At the beginning of the programme, its main concept was to replicate, at an industrial scale, known foreign methods and techniques of the production of chemical warfare agents using commercially available technology, equipment and raw materials. Later, however, for some agents, such as VX, Iraq applied modified processes to suit its own capabilities.

9. Training in foreign institutions, open publications, foreign patents, international conferences and forums were major sources of information on basic chemical weapon production technology for Iraq. The information was first tested by Iraq at laboratory level to identify and adjust unknown parameters of the synthesis of chemical warfare agents that could not be found in open sources, such as the kinetics of chemical reactions, combinations of catalysts, equipment specifications and scaling-up procedures.

10. During the Iran-Iraq war, the Iraqi chemical weapon programme was not able to produce weapons of sufficient quality that could be stored as operational and strategic reserves. To overcome this limitation, after the end of the war, the chemical weapon programme was focused on the improvement of previously produced agents and on the development of more powerful agents and better quality agents suitable for long-term storage. Those activities included efforts to produce binary weapons and the chemical warfare agent VX. Iraq also initiated several projects to build indigenous capabilities for the production of critical chemical warfare agent precursors after 1988. These efforts were interrupted by the 1991 Gulf war.

11. According to declarations made by Iraq, in the period from 1981 to 1991 the chemical weapon programme produced approximately 3,850 tons of the chemical warfare agents mustard, tabun, sarin and VX, as shown in figure I.

Figure I: Production of lethal chemical warfare agents as declared by Iraq*



	1981	1982	1983	1984	1985	1986	1987	1988	1990
VX								2.4	1.5
Sarin				5	30	40	209	394	117
Tabun				60	70	80			
Mustard	10	75	150	240	350	350	899	494	280

* Iraq declared no large-scale production or weaponization for 1989.

Weaponization of chemical warfare agents

12. The chemical warfare agent weaponization efforts conducted by SEPP and the Muthanna State Establishment (MSE) relied mainly on the adaptation of conventional munitions for the dispersion of chemical warfare agents. In most cases, the adaptations were performed by or coordinated with other Iraqi military industrial establishments. The critical components that made those munitions technically suitable for chemical weapon applications were optimized burster charges of specific size and shape and other minor components, such as sealing rings, filling ports and agent containers.

13. In order to achieve self-reliance in munitions, the Iraqi chemical weapon programme also indigenously produced munitions casings, including a variety of aerial bombs, using raw materials for the production of conventional munitions and manufacturing equipment procured from foreign suppliers. The production of chemical weapon munitions was directly linked to the design and production of conventional munitions by Iraq.

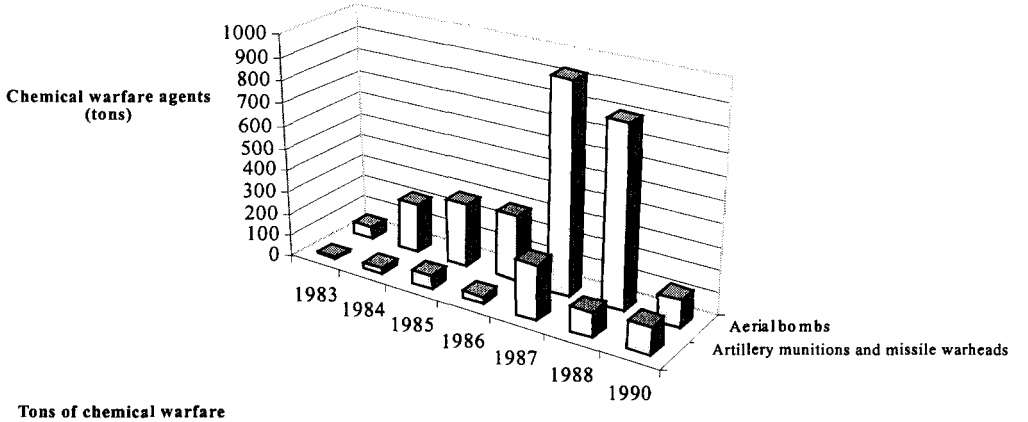
14. Sustainable means of delivery and munitions capable of fulfilling operational goals was the prime determining factor in the selection of munitions for the Iraqi chemical weapon programme. The efficiency of dissemination of chemical warfare agents for munitions was considered by Iraq in relation to operational goals. However, the optimal efficiency of munitions was not in itself the prime criterion for the selection of munitions for use with a chemical warfare agent.

15. In the methods and "rules" of chemical weapon use, Iraq followed known principles. Battle scenarios prepared by the Iraqi armed forces envisaged both defensive and offensive operations and therefore comprised requirements for different types of chemical munitions to assure operational flexibility. Thus, in general, artillery projectiles and aerial bombs filled with the persistent chemical warfare agent mustard gas were to be used for area denial, to prevent the movement of attacking enemy troops in the course of defensive operations. Chemical 122-mm rockets filled with the non-persistent chemical warfare agent sarin were to be deployed against enemy positions on the front line, and used to break the enemy defences in preparation for offensive operations and counter-attacks. After chemical attacks, areas fired upon with chemical rockets containing non-persistent agent could be crossed by attacking Iraqi troops. Aerial bombs with both persistent and non-persistent agents could be used against multiple targets beyond the front line. Chemical warheads for ballistic missiles developed at the very end of the programme were considered to be strategic weapons.

16. Iraq did not have special military units dedicated for the use of chemical weapons. Regular military combat units were to receive and use chemical weapons if necessary, under special directives. It is probable that such directives were issued during the Iran-Iraq war under the name of the President of Iraq.

17. Of the total of some 3,850 tons of chemical warfare agents produced, approximately 3,300 tons of agents were weaponized in different types of aerial bombs, artillery munitions and missile warheads, as detailed in figure II.

Figure II: Weaponization of lethal chemical warfare agents as declared by Iraq*



Tons of chemical warfare agents weaponized

	1983	1984	1985	1986	1987	1988	1990
Artillery munitions and missile warheads	10	27	61	32	243	110	123
Aerial bombs	53	220	284	292	931	807	126

* Iraq declared no large-scale production or weaponization for 1989. It produced an unknown (probably small) number of weapons in 1981 and 1982.

18. In the period from 1981 to 1991, Iraq weaponized some 130,000 chemical munitions in total. Of these, over 101,000 munitions were used in combat, according to Iraq, in the period from 1981 to 1988.

19. Iraq declared that some 28,500 chemical munitions remained unused in Iraq as of January 1991. According to Iraq, of these, about 5,500 filled munitions were destroyed by coalition forces during the war in 1991. Another 500 filled munitions were declared destroyed unilaterally by Iraq. These last two figures were partially verified by United Nations inspectors. The bulk of the destruction of some 22,000 filled munitions however occurred under the supervision of the United Nations inspectors in accordance with Security Council resolution 687 (1991) in the period from 1991 to 1994. During the collection of chemical weapons for destruction after the 1991 war, Iraq stated that it was not able to locate some 500 chemical munitions.

Destruction of Iraqi chemical weapons and related items

20. In accordance with Security Council resolution 687 (1991), large quantities of chemical weapons and related items and materials declared by Iraq were destroyed under United Nations supervision in a relatively short period, from 1991 to 1994, mainly at the Muthanna State Establishment, the former chemical weapon complex. The destruction included 22,000 filled and more than 16,000 unfilled chemical munitions, 690 tons of chemical warfare agents (both bulk and weaponized), more

than 3,000 tons of precursor chemicals and over 100 major items of chemical weapon production equipment.

21. The supervision of the destruction by Iraq of its chemical weapons was one of the main achievements of the United Nations verification agency. It was the first chemical weapon destruction operation supervised by an international organization. It demonstrates the fact that, by using the best expertise available and developing optimal operating procedures, the Special Commission was able to ensure that this dangerous operation was conducted as rapidly as possible.

22. The United Nations supervision of the destruction operations was not limited to the presence of the United Nations inspectors at a destruction site and the observation of destruction operations. It also included the evaluation and assessment of the destruction methods proposed by Iraq to meet the requirements of Security Council resolution 687 (1991) regarding public safety during the destruction, as well as technical expertise, guidance and actual support to Iraqi personnel involved in the destruction. To accomplish this, the Special Commission assembled a Destruction Advisory Panel comprising prominent international experts in the area of chemical weapons to consult on all aspects of the destruction. The intended destruction methods were also coordinated with the United Nations Environment Programme.

23. The following methods were used for the destruction of Iraqi chemical weapons and precursor chemicals:

(a) Destruction of the chemical warfare agent mustard gas and flammable precursors using an incinerator built by Iraq from items of equipment procured and used in the past by the chemical weapon programme. The incinerator, at MSE, was commissioned by the United Nations Special Commission;

(b) Destruction of the chemical warfare nerve agents sarin and tabun, and some of their precursors, through hydrolysis using MSE facilities, under the guidance of the Special Commission;

(c) Destruction on an ad hoc basis through explosive venting and simultaneous burning of chemical munitions damaged during the 1991 Gulf war. Those munitions represented immediate health and environmental hazards and for safety considerations could not be transported to the designated destruction site at the former chemical weapon complex.

24. A dedicated Special Commission team, the Chemical Destruction Group, was deployed to Iraq, where it was stationed from 1992 to 1994, to supervise and monitor destruction operations carried out by Iraq, including regular environmental monitoring. It also provided decontamination and medical support to Iraqi personnel involved in the destruction operations. Over 100 experts from 25 countries served with the Group during the period of its work in Iraq. Owing to the dangerous nature of the work and the hazard inherent in the destruction area, utmost attention was given to minimizing the health and environmental impacts of the destruction of chemical weapons and their components. The Group personnel suffered no serious injuries during destruction operations. The final sampling and analysis conducted by the Special Commission upon the completion of the destruction showed that no significant chemical weapons-related environmental hazards existed at MSE.

25. All hazardous waste resulting from the destruction of chemical weapons was safely sealed at several structures and areas of MSE with reinforced concrete and

brick walls covered with earth. These included two bunkers, one of which was damaged by aerial bombardment in 1991 and contained 122-mm artillery rockets and munition remnants that had been filled with nerve agent sarin. To maintain security and safety, in a signed protocol with the Special Commission, Iraq undertook to inspect the sealed structures at least once a month to ensure that the seals were intact and that warning signs are not removed, damaged or defaced as long as Security Council resolution 715 (1991) remains in force.

26. The United Nations-supervised destruction of chemical weapons by Iraq shows the importance of long-term continuity in site security and safety arrangements and hazardous materials disposal. The implementation of the protocol after the withdrawal of the United Nations inspectors from Iraq, in March 2003, cannot be verified.

United Nations verification

27. Although a number of issues relating to the Iraqi chemical weapon programme remain unresolved, the United Nations inspectors were able to identify the major parameters of the programme, its scope and the results achieved. This included elements of the programme that Iraq tried to conceal from the inspectors, such as its efforts to produce the chemical warfare agent VX and retain a portion of the equipment, instruments and materials procured in the past by the chemical weapon programme.

28. The experience of the verification of the Iraqi chemical weapon programme shows that only an advanced verification system comprising various verification tools and techniques is capable of uncovering undeclared activities. The analysis of procurement data revealed the acquisition of specific items and materials by Iraq; document searches resulted in the discovery of records of undeclared activities; interviews with Iraqi scientists and technicians helped to identify gaps in the Iraqi declarations on specific issues; debriefings of defectors produced additional information that was not declared by Iraq; information from former suppliers to Iraq helped to corroborate procurement data; and sampling and analysis identified residues of undeclared materials, which, in combination with on-site inspections, revealed the indisputable existence of undeclared activities. Combined expertise within the United Nations verification body was also critical for credible verification and assessment. In addition, the system of ongoing monitoring and verification provided assurance that chemical weapon production had ended in 1991 and was a strong deterrent to the resumption of proscribed activities thereafter.

29. The primary chemical weapon development and production complex in Iraq was dismantled and closed under the supervision of the United Nations Special Commission. Inspectors identified other facilities with dual-use capabilities that were put under monitoring. Considerable progress was made in the verification of undeclared chemical weapon-related activities, such as the VX production activities of Iraq and its efforts to retain a portion of the chemical process equipment and precursors procured in the past by its chemical weapon programme.

30. On the issue of VX, Iraq initially declared that it had carried out only laboratory research on this chemical warfare agent. By 1995, the Special Commission uncovered evidence that the scope of Iraqi activities on VX was much broader. Consequently, in 1996 Iraq declared the production of 3.9 tons of VX, the production of 60 tons of crucial VX precursors and the acquisition of some 650 tons

of other precursors for the production of VX. Iraq also acknowledged that it had decided to conceal various aspects of its VX activities from the Special Commission and declared that, in 1991, it had unilaterally destroyed all VX and its main precursors as well as documents and records relevant to VX.

31. Concerning Iraqi efforts to retain chemical weapon-related equipment and materials, in 1997 the United Nations inspectors identified 325 additional items of production equipment, 125 analytical instruments and 275 tons of precursor chemicals procured by the former chemical weapon programme and retained by Iraq. The identification of the materials was made on the basis of multiple pieces of evidence gathered by the inspectors.

32. The verification experience of the Special Commission and UNMOVIC shows that a country's documentation of its chemical weapon programmes is critical for verification, since physical evidence may no longer exist. The intentional elimination or concealment of documentary evidence dramatically decreases confidence in the inspected party and leads to ambiguities that may never be resolved satisfactorily.

33. Given the absence of complete production, storage and deployment records, which according to Iraq were destroyed unilaterally, it was not possible for United Nations inspectors to verify fully the Iraqi declarations regarding overall quantities of chemical weapons produced, used or retained. Verification of the declarations was made more difficult since the major part of the bulk chemical warfare agents produced and chemical munitions filled over the period of 10 years had been used in combat. With regard to chemical agents and munitions remaining in Iraq as of 1991, there is a high degree of confidence that the vast majority of these have been declared by Iraq, identified by the inspectors and destroyed under international supervision. However, unilateral destruction by Iraq prolonged the verification process and left uncertainties regarding types and quantities of weapons it had destroyed.

34. A residue of uncertainty also remains with respect to chemical munitions that were lost, according to Iraq, after the 1991 Gulf war. The Iraq Survey Group quoted conflicting statements of former Iraqi officials, one individual suggesting that some 500 155-mm munitions were retained by Iraq and other officials insisting that they were actually destroyed.

35. Iraqi regular military units in theatres of operation received and used both conventional and chemical weapons. Because of the rapid relocation of many of those units and the dozens of facilities involved in the handling of the weapons, there is a possibility that chemical munitions have been inadvertently mixed with conventional weapons. Moreover, some chemical munitions filled with chemical warfare agents were marked as standard conventional weapons, which made their identification as chemical munitions problematic, not only for United Nations inspectors and later personnel of the Iraq Survey Group, but also for Iraq.

36. From information collected by the inspectors in Iraq, UNMOVIC assessed that, depending on the munitions models, types of chemical warfare agents, dates of production and filling and storage conditions, some chemical munitions, if remaining in Iraq, may still retain relatively high-purity chemical warfare agent, like mustard gas. Other munitions would contain degraded chemical warfare agents, binary components or only their residues.

37. The experience of verification of Iraqi chemical munitions also showed that to recognize the subtle modification used to convert conventional munitions into chemical munitions a detailed understanding of the original munition materials, design and manufacturing process was required. Understanding all conventional delivery means available to Iraq is another area essential for the recognition of Iraqi chemical weapon munitions, their distinctive parts and components.

38. Iraq is rich in natural resources such as oil, natural gas and minerals, including phosphate rock and sulphur. By-products from processing those reserves may be used for some chemical warfare agent precursors. Taking into account the pre-1991 efforts of Iraq to achieve self-reliance in the production of critical chemical warfare agent precursors from materials available in Iraq, it was critical for the monitoring system to also cover a portion of the Iraqi petrochemical and mining complex to prevent the conversion of commercial chemicals and capabilities for proscribed purposes.