

**Annex****Overview of the chemical munitions recently found in Iraq**

1. The Iraqi chemical weapons stockpile consisted of chemical warfare agents filled into munitions and bulk containers. Iraq declared an overall production of some 3,850 tons of chemical agents during the past chemical weapons programme. Approximately 3,300 tons of mustard gas and the nerve agents tabun and sarin or a sarin/cyclosarin mixture were weaponized into about 130,000 munitions, out of which over 101,000 munitions were used during the Iran-Iraq war. The Iraqi chemical arsenal, produced before 1991, included the following delivery systems: 155-mm artillery projectiles, 122-mm rockets, missile warheads and a variety of aerial bombs. While most of the agents weaponized were filled into aerial bombs, the 122-mm rockets and 155-mm artillery projectiles were the most numerous munitions of the Iraqi chemical weapons arsenal. Iraq declared and inspectors confirmed that the 155-mm projectiles had been filled with mustard gas, while the 122-mm rockets were weaponized with sarin or a sarin/cyclosarin mixture. Iraq also declared that it had successfully developed and tested a limited number of binary artillery systems, including 155-mm and 152-mm shells for sarin but did not enter into serial production of such systems.

2. According to Iraq, during the Iran-Iraq war, munitions were filled with chemical agents days or weeks before their intended use and, after temporary storage at the Muthanna State Establishment, the primary Iraqi chemical weapons facility, they were delivered directly to designated military units. The chemical munitions were dispersed to dozens of locations throughout the territory of Iraq, where they could have been mixed with conventional munitions, abandoned, buried, lost or damaged. Iraq declared that the chemical munitions produced after the Iran-Iraq war (in 1990 and January 1991) had been distributed to 17 locations, including airbases and ammunition depots, throughout the country. Normally, artillery shells, aerial bombs and warheads filled with chemical agents were stored without their associated explosives. The explosive burster charge and fuse were inserted prior to use. The 122-mm rockets filled with nerve agents, however, were frequently stored complete with their explosive burster charge, fuse and with rocket motors attached.

**Quality of Iraqi chemical warfare agents**

3. According to Iraq, it carried out bulk production and weaponization of chemical warfare agents during the period from 1983 to January 1991 at the Muthanna State Establishment. The production capabilities of the Establishment consisted of both industrial-scale and pilot-scale plants, where chemical agents and their immediate precursors were manufactured. The chemical agents produced at the pilot plants were sometimes of better quality than the agents produced at the large-scale plants, as the pilot-scale processes were easier to control.

4. According to Iraq, the majority of mustard gas that it produced throughout the period of its chemical weapons programme was of high purity (90-95 per cent), although some of it formed a viscous tar (polymerized material) while in storage. Iraq was unable, however, to produce high-purity, stable nerve agents in bulk quantities. For example, the average purity of tabun produced was within the range of 50 to 60 per cent. Iraq stated that it abandoned the tabun programme in 1986 because it had decided to concentrate on the production of the more toxic agent,

sarin. On average, the purity of sarin and sarin-type agents produced by different methods both during and after the Iran-Iraq war was within the range of 45 to 60 per cent. Besides failing to achieve the production of high-purity nerve agents, the level of purity varied from batch to batch. Iraq explained that this variation and the failure to achieve production of high-purity tabun, sarin, cyclosarin and a sarin/cyclosarin mixture was due to both the poor quality of the immediate precursors used and to technical problems associated with the production steps. Iraq furthermore explained that the overall technological problems included its inability to remove solvents and impurities during the final stage of chemical agent production, and difficulties with the optimization of the configuration of production equipment and process parameters for agents and their immediate precursors.

5. Iraq monitored the quality of both bulk and weaponized chemical warfare agent. However, Iraq provided only a small part of its quality control records to inspectors, stating that the rest had been destroyed. Fragmentary information provided in those records indicates that the mustard filled in munitions or stored in bulk containers had a very low rate of degradation and was therefore suitable for long-term storage. The records for nerve agents show that sarin had a tendency to degrade to varying degrees over a few months of storage because of the presence of large quantities of impurities. The Iraqi data indicate that while sarin with an initial purity of 45 to 60 per cent degraded rapidly during the first two months of storage (by 25 to 30 per cent), it degraded further by only 3 to 5 per cent during the third and fourth months of storage. In the absence of more comprehensive quality control records, however, it is not possible to extrapolate degradation rates for Iraqi nerve agents over longer periods of time.

6. While the purity of nerve agents produced were effective enough for immediate use on the battlefield during the Iran-Iraq war, they were not suitable for long-term storage. Following the war with the Islamic Republic of Iran, Iraq focused on the improvement of the purity of agents (which in itself would improve their shelf life) as well as on the development of more powerful agents that were also suitable for longer-term storage, including binary sarin and the chemical nerve agent VX. Iraq declared that its VX programme had been unsuccessful and limited only to an experimental phase. It furthermore declared that, in total, 3.9 tons of VX had been manufactured. According to Iraq, the VX produced with a purity of between 18 and 41 per cent degraded rapidly and therefore had never been considered for stabilization or weaponization. The progress achieved by Iraq with its nerve agent programme after the Iran-Iraq war, including the extent of VX-related activities, cannot be fully evaluated due to the absence of evidence, such as the original production records for the period 1989-1990. No additional or new information on this aspect of the Iraqi chemical weapons programme was provided in the September 2004 report of the Iraq Survey Group led by the United States.

#### **Findings of the United Nations**

7. A survey by the United Nations Special Commission of the Iraqi chemical weapons arsenal remaining in 1991 revealed that the overall conditions of filled munitions remaining after the Gulf war varied from site to site. While some locations had well-preserved chemical munitions, at other places they were corroded and leaking. The survey also indicated that many of the 122-mm rockets were leaking, and at some locations severely damaged.

8. The screening of samples of chemical agents taken by the Special Commission from various types of munitions and storage containers during the period 1991-1994 showed that the nerve agents had degraded to various levels and that the agent content was generally below 10 per cent and sometimes below 1 per cent. In a few cases, the purity of nerve agents remained around 20 to 30 per cent, and in one case inspectors identified tabun with a purity of 44 per cent.

9. The destruction process for most of the nerve agent-filled rockets was complicated due to the combined hazard of leaking agent and the presence of explosives. It was also observed that, whether 122-mm rockets had been filled with agents directly into their metal casing or filled into special containers inside the rockets, high internal pressure was created as the sarin and cyclosarin degraded. In 1998, an inspection team involved in the excavation and destruction of more than 200 122-mm rockets formerly filled with sarin/cyclosarin still detected the presence of nerve agents in the rockets.

10. The Special Commission found that most of the 155-mm mustard shells that had survived bombardment during the 1991 Gulf war were in relatively good condition. Samples of chemical agent from various types of munitions and storage containers taken during the period 1991-1994 confirmed the presence of high-purity mustard (typically around 90 per cent). While conducting chemical weapons destruction operations at Muthanna, inspectors also observed that many mustard-filled munitions (bombs and artillery projectiles) contained both good quality agent and polymerized material, in varying proportions. In February 2003, UNMOVIC safely destroyed 10 mustard-filled projectiles and a few litres of mustard agent. The destruction of this material had been scheduled for late 1998 by the Special Commission, but had not been completed before its withdrawal from Iraq in December 1998. Laboratory analysis of samples taken from those projectiles confirmed the contents as high-purity mustard (above 90 per cent).

11. During its inspection activities in Iraq, UNMOVIC identified 18 122-mm rocket warheads designed for use with chemical agent, 14 of which were empty, while the others contained liquid residues, mainly water. No chemical agents nor their respective degradation products were identified. All of the empty warheads were well preserved and suitable for filling with the chemical agent.

12. According to the report of the Iraq Survey Group, in addition to the munitions identified by UNMOVIC, during the period from March 2003 to September 2004, a further 53 chemical munitions (11 155-mm, 41 122-mm and one 152-mm binary) had been found by the Group. They were identified as part of the Iraqi pre-1991 stock, and analysis of the liquid residue in the munitions indicated the presence of degraded chemical agents (mustard, sarin/cyclosarin and binary sarin), their degradation products and impurities. The key parts of a National Ground Intelligence Center report, declassified by the Director of National Intelligence for the Permanent Select Committee on Intelligence of the House of Representatives, mentioned the recovery of approximately 500 chemical munitions in Iraq since 2003, which contained degraded mustard or sarin nerve agent. However, the declassified parts gave no details regarding the purity of the agents.