United Nations

Distr.

GENERAL

S/1999/94

29 January 1999

LETTER DATED 27 JANUARY 1999 FROM THE PERMANENT REPRESENTATIVES OF THE NETHERLANDS AND SLOVENIA TO THE UNITED NATIONS ADDRESSED TO THE PRESIDENT OF THE SECURITY COUNCIL

For the sake of greater transparency and for the benefit of all Members of the United Nations, we should be grateful if you would have the text of the reports drawn up by the Special Commission on the current state of affairs with respect to the disarmament of Iraq's proscribed weapons and on ongoing monitoring and verification in Iraq, dated 25 January 1999, circulated as a document of the Security Council.

(Signed) Danilo TURK (Signed) Peter van WALSUM

Ambassador Ambassador

Permanent Representative of Permanent Representative of

the Republic of Slovenia to the Kingdom of the Netherlands

the United Nations to the United Nations

Annex

Letter dated 25 January 1999 from the Executive Chairman of the Special Commission established by the Secretary-General pursuant to paragraph 9 (b) (i) of Security Council resolution 687 (1991) addressed to the President of the Security Council

With this note, I have the honour to forward to you two reports drawn up by the Special Commission one on the current state of affairs with respect to the disarmament of Iraq's proscribed weapons; the other on ongoing monitoring and verification in Iraq. It is thought that these materials may be useful to members of the Council

Signed) Richard BUTLER

(Pages 3-280 are offset

Enclosure 1

REPORT : DISARMAMENT

1. The present report is intended to address those disarmament issues under relevant Security Council resolutions for which the Special Commission is responsible. It comprises four main parts:

record and methodology;

priority issues in disarmament;

three annexes providing the status of verification of Iraq's proscribed weapons programmes; and

an annex on actions by Iraq to obstruct disarmament;

Record and methodology

2. Paragraphs 8 and 9, in section C of resolution 687 (1991), provide that Iraq shall agree to the "destruction, removal, or rendering harmless, under international supervision of" the following:

Missiles:

all ballistic missiles with a range greater than 150 kilometres;

all related major parts;

all repair and production facilities;

For both chemical weapons and biological weapons:

all weapons;

all stocks of agents;

all related subsystems;

all related components;

all research, development, support and manufacturing facilities.

3. For the conduct of this work, the resolutions of the Council established a three-step system: full disclosure by Iraq; verification of those disclosures by the Commission; destruction, removal, or rendering harmless, under international supervision, of all proscribed weapons, materials and facilities.

4. From the inception of the relevant work, in 1991, Iraq's compliance has been limited. Iraq acknowledges that, in that year, it decided to limit its disclosures for the purpose of retaining substantial prohibited weapons and capabilities.

5. Actions by Iraq in three main respects have had a significant negative impact upon the Commission’s disarmament work:

Iraq’s disclosure statements have never been complete;

contrary to the requirement that destruction be conducted under international supervision, Iraq undertook extensive, unilateral and secret destruction of large quantities of proscribed weapons and items;

it also pursued a practice of concealment of proscribed items, including weapons, and a cover up of its activities in contravention of Council resolutions.

6. Historical references made in this report to the relationship between the Commission and Iraq are for the sole purpose of describing the environment in which the Commission’s disarmament work took place and its impact on the accounting for proscribed weapons.

7. The Commission's work has taken five main forms:

evaluation and analysis of Iraq’s declarations;

inspections of relevant sites in Iraq;

interviews of Iraqi personnel connected to proscribed weapons programmes;

seeking access to and study of relevant Iraqi documentation;

seeking assistance from Member States, particularly through the provision of relevant information, as required of them by the Security Council.

8. As has been reported to the Council, over the years, and as has been widely recognized, notwithstanding the very considerable obstacles placed by Iraq in the way of the Commission's work, a great deal has been achieved in: verifying Iraq's frequently revised declarations; accounting for its proscribed weapons capabilities; and in destroying, removing or rendering harmless substantial portions of that capability. A complete and detailed record of the

Commission’s disarmament work in Iraq would be considerably more voluminous than the three weapons related Annexes to this report.

9. Those Annexes focus on the material balances of proscribed weapons, major components and agents - and in some cases production equipment and facilities - as defined in paragraphs 8 and 9 of resolution 687 (1991). It must be pointed out that in many instances the data given in the Annexes rests on an acceptance of Iraq’s basic declarations. The Annexes provide a material balance and an accounting of the totals declared by Iraq. This does not imply that the accuracy of the declared total has itself been verified, in all cases.

10. The Annexes do not cover in depth other obligations of Iraq under the relevant resolutions, such as with respect to full disclosure of research, development, know-how and procurement in the respective weapons areas. Although progress has been made in the verification of these obligations, many have not been resolved. For example, the Commission awaits responses from a number of Governments in order to be able to verify Iraq’s declarations on its foreign procurement for its proscribed weapons programmes.

11. In the BW area, the report has to cover all elements of Iraq’s biological warfare programme as Iraq’s declaration in this area cannot, in its totality, be verified by the Commission as being full, final and complete. For this reason it is not possible to present a material balance in this area when there is no firm basis for either side of such a balance.

12. Three basic points about this disarmament record need to be made. First, the overall period of the Commission's disarmament work must be divided into two parts, separated by the events following the departure from Iraq, in August 1995, of Lt. General Hussein Kamal. This which resulted in the provision to the Commission of an extensive cache of documents on Iraq’s prohibited programmes. These documents and subsequent disclosures by Iraq indicated that, during the first four years of its activities, the Commission had been very substantially misled by Iraq both in terms of its understanding of Iraq’s proscribed weapons programmes and the continuation of prohibited activities, even under the Commission’s monitoring. Positive conclusions on Iraq’s compliance reported to the Council previously by the Commission had to be revised. They were conclusions generally based on accepting Iraq’s declarations at face value. Analysis of the new material shaped the direction of the Commission’s subsequent work including the emphasis on: obtaining verifiable evidence including physical materials or documents; investigation of the successful concealment activities by Iraq; and, the thorough verification of the unilateral destruction events.

13. Secondly, the Commission has been obliged to undertake a degree of forensic work which was never intended to be the case. This was derived, virtually exclusively, from Iraq's inadequate disclosures, unilateral destruction and concealment activities. These actions, all of which were contrary to the resolutions, made the Commission’s work more difficult and, in many cases, continued even after 1995. Had this behaviour not occurred, a far less searching inquiry by the Commission would have been necessary. The work of verification of Iraq's declarations would have and should have been far easier and should have been able to be undertaken far more quickly than has proven to be the case. Such concerted obstructions naturally raise the question of why Iraq has carried out these activities.

14. Thirdly, these overall circumstances have meant that, in spite of the years that have passed and the extensive work that has been undertaken, it has not been possible to verify, fully, Iraq's statements with respect to the nature and magnitude of its proscribed weapons programmes and their current disposition.

15. With respect to this latter point, two comments are apposite. First, Iraq's current claims that; it has fulfilled all of its disarmament obligations in each weapons area; ceased concealment policies and actions; and, that it has neither proscribed weapons nor the ability to make them are not able to be verified.

16. Secondly, documents or records available in Iraq in which relevant details of its proscribed programmes and actions are set out: production and acquisition records; records of disposition of weapons; and, records of claimed destruction, relevant policy decisions and decisions on termination of concealment, would be invaluable in helping to close remaining gaps and achieve acceptable confidence in Iraq’s declarations. The Security Council recognised these two aspects in resolution 707 (1991) when it demanded Iraq provide immediate and unconditional access to, inter alia, records, and, demanded that Iraq cease attempts to conceal prohibited materials.

17. In response to the Commission's requests for relevant documents, Iraq has repeatedly claimed that they no longer exist or cannot be located, a claim which often has been shown to be false, either because inspection activities have in fact located precisely such documents or because Iraq has reversed its stated position and then produced relevant documents. The Commission briefed the Council on its assessment of the existence and importance of documents in June 1998. The Commission has assessed that the documents provided in August 1995 were only selected categories of documents were provided and that other categories were retained by Iraq. It remains the Commission’s strong view that, under the present circumstances, relevant documentation exists in Iraq and that provision of such documentation is the best hope for revealing the full picture, as required by the relevant resolutions.

18. On certain other occasions, Iraq has not claimed that documents sought by the Commission do not exist but has stated instead that they are not relevant to the Commission. The judgement of relevance of any given document is for the Commission, not Iraq, to make, as has been recognized by the Security Council.

19. In August 1998, Iraq declared that unless the Commission could demonstrate that Iraq retained prohibited items, then it must declare that Iraq had fully implemented its obligations under section C of resolution 687. This is contrary to the system established by the Council which imposed upon Iraq the obligation of full disclosure and upon the Commission the duty to verify those disclosures. Were a reversal of these obligations to be accepted, the possibility of serious error would be high as it is Iraq which controls access to the most fundamental information. The Commission remains convinced that Iraq has the capacity to provide credible information thus allowing the Commission to have confidence in an accurate declaration, when it is provided.

20. Notwithstanding the fundamental sources of difficulty described above, and building on both its past achievements and the substantial body of knowledge of Iraq's proscribed programmes the

Commission assembled, in June of 1998, and indicated, first to the Security Council and then to Iraq, what it believed to be the remaining priority issues in disarmament, in particular as regards proscribed weapons. This reflected the Commission's understanding of the desire of the Council to focus on selected important parts of the requirements of its resolutions. The methodology used in drawing up this list was to focus on unaccounted proscribed weapons and to set aside other aspects such as fully verifying production capacities, research activities, etc. Satisfactory resolution of the specific "priority issues" would make it easier to conclude that other unverified elements were of lesser substantive importance. Conversely, the inability of Iraq to satisfy these issues would point to more ominous explanations for other unverified parts of Iraq's declarations. Whether these other parts will ultimately be addressed is an open question, but one which has a direct bearing upon confidence in future monitoring.

PRIORITY ISSUES

21. In the view of the Commission, a correct understanding of the nature of the list of priority issues is essential. It should rest on the following considerations.

22. First, these remaining issues must be resolved as they are the necessary conditions for an acceptable material balance in each of the three weapons areas for which the Commission is responsible.

23. Secondly, it should be noted that, even if full resolution was able to be made of these priority issues, this would not mean that there had been a full accounting of all of the proscribed materials and activities listed in paragraphs 8 and 9 of section C of resolution 687 (1991), as summarized in paragraph 2 of this report. However, their full accounting would considerably increase the level of confidence of the Commission's overall verification.

24. Thirdly, if the priority issues are not able to be satisfactorily resolved, then it is likely that the settlement of so-called non-priority outstanding issues will assume a greater importance in achieving confident verification.

25. Finally, the implications of not achieving a credible resolution of the priority disarmament issues needs to be considered, both with respect to the assessment of Iraq's compliance, as well as its implications for the system of ongoing monitoring and verification.

Priority issues in the missile area

Proscribed Missile Warheads

Special Warheads

26. Analysis at the laboratories designated by the Commission has detected the presence of degradation products of nerve agents, in particular VX, on a number of warhead remnants which had been excavated at the sites of the unilateral destruction. The October 1998 meeting of international experts convened by the Commission concluded that "the existence of VX degradation products conflicts with Iraq's declarations that the unilaterally destroyed special warheads had never been filled with any chemical warfare agents. The findings by all three

laboratories of chemicals known to be degradation products of decontamination compounds also do not support Iraq's declarations that those warhead containers had only been in contact with alcohols." Clarification by Iraq of these issues as recommended by the meeting would allow the Commission to make a determination whether or not the current assessment of the quantity of special warheads identified amongst the remnants excavated, accounts for all special warheads declared to have been produced by Iraq and provides for the verification of their unilateral destruction.

27. The Commission found that Iraq's explanations on procedures and methods of unilateral destruction of the special warheads were, in general, plausible. In one aspect related to the destruction of BW warheads, the Commission, after consulting a group of international experts, assessed that Iraq's declaration that 15 warheads had been destroyed simultaneously conflicted with physical evidence collected at the declared location of their unilateral destruction. This finding indicated that not all BW warheads had been destroyed at the same time as claimed by Iraq and that Iraq had retained some BW warheads after the date of the declared July 1991 unilateral destruction. Obviously, any retained warheads after the declared destruction date would be an indication that not all proscribed missiles for such warheads were destroyed as claimed by Iraq. The discrepancies between Iraq's declarations and the physical evidence collected need to be resolved. In addition, the Commission's investigations showed that, despite repeated attempts, Iraq had not provided the true locations of the hiding, immediately prior to the declared unilateral destruction, of at least half of the special warheads including abovementioned 15 BW warheads. Iraq's continuous inability to disclose hide sites of the special warheads has also prevented the Commission from verification of the declared unilateral destruction of the special warheads.

Conventional warheads

28. The full and verifiable accounting for proscribed missile conventional warheads remains outstanding in the verification of the premise that Iraq has not retained any holding of proscribed missiles and that all proscribed missiles and their warheads indeed had been destroyed. Issues related to remnants of warheads that have not been recovered, but which have been declared by Iraq as unilaterally destroyed (some 25 imported warheads and some 25 Iraqi manufactured warheads), remain unresolved in the accounting of proscribed warheads that Iraq claimed to have destroyed unilaterally. Iraq has not provided a definite explanatory statement for the Commission to be able to determine the reasons why no remnants to account for some 50 warheads declared as unilaterally destroyed, were recovered.

Proscribed Single-Use Liquid Missile Propellant

29. The full accounting for imported proscribed missile propellants is outstanding. Any retention of such propellants would be an indication that not all proscribed missiles were destroyed as claimed by Iraq. The propellants at issue are used exclusively for such proscribed missiles only. Documents, including an inventory list on their declared unilateral destruction, requested by the Commission, have not been made available by Iraq to support its declaration on the quantities (over 500 tonnes) of proscribed propellants it claims to have destroyed unilaterally.

Proscribed Indigenous Missile Production

Complete missiles

30. An inventory of proscribed missiles that Iraq declared as destroyed unilaterally contained a reference to seven indigenously produced missiles which were in possession of the Army in 1991. No remnants which could prove such destruction, have been recovered. The Commission has not been able to verify the nature and destruction of these missiles and repeatedly requested Iraq to confirm, through physical evidence, the declared unilateral destruction of these seven missiles. The verification in this area is considered essential as it might involve operational missiles produced indigenously by Iraq. The November 1997 Emergency Session of the Commission determined that the accounting for these seven missiles was one of the priority requirements.

Major components

31. It should be noted that due to the methods used by Iraq for the declared unilateral destruction and lack of supporting documentation made available by Iraq, the verifiable material balance of major proscribed components for indigenous missile production could not be established, or that this work would take a prolonged period of time. Iraq is required to provide, inter alia, unambiguous physical evidence of the unilateral destruction of combustion chamber/nozzle assemblies for indigenously produced missiles and documentary evidence sufficient for complete accounting of all indigenously produced major missile parts and for verification of their unilateral destruction.

-

Priority issues in the chemical weapons area

Material Balance of Chemical Munitions

Expenditure of chemical munitions in the 1980s

32. In July 1998 during an inspection the Commission found a document which detailed the consumption of special munitions by Iraq in the 1980s. Iraq took the document from the Chief Inspector and did not return it to the Commission despite demands by Security Council that it do so. The figures in this document indicate serious discrepancies with Iraq's declarations on the expenditure of CW-munitions in the 1980s. According to this document, Iraq consumed about 6,000 chemical aerial bombs less than it is stated in its declarations. This invalidates the starting point of the Commission's accounting for chemical weapons which remained in 1991. The provision by Iraq of this document together with clarifications of the discrepancies is required to increase the degree of confidence with respect to Iraq's declarations of chemical weapons which remained in Iraq in 1991 and their disposition.

550 Artillery shells filled with Mustard

33. Iraq declared that 550 shells filled with mustard had been "lost" shortly after the Gulf War. To date, no evidence of the missing munitions has been found. Iraq claimed that the chemical warfare agents filled into these weapons would be degraded a long time ago and, therefore, there would be no need for their accounting. However, a dozen mustard-filled shells were recovered at a former CW storage facility in the period 1997-1998. The chemical sampling of these munitions, in April 1998, revealed that the mustard was still of the highest quality. After seven years, the purity of mustard ranged between 94 and 97%. Thus, Iraq has to account for these munitions which would be ready for combat use. The resolution of this specific issue would also increase confidence in accepting Iraq's other declarations on losses of chemical weapons which it has not been possible to verify.

R-400 Aerial Bombs

34. Among 1,550 R-400 bombs produced by Iraq, more than 1,000 bombs were declared as destroyed unilaterally by Iraq, including 157 bombs stated as having been filled with biological warfare agents. The accounting for about 500 bombs unilaterally destroyed has not been possible due to the state and extent of their destruction. In order to bridge the gap, the Commission asked Iraq to provide documentation on the disposition of the parachute tail sections of R-400 bombs. The accounting for these components would enable the Commission to verify the maximum number of R-400 bombs, which Iraq could have produced. Though this would not solve the specific issue of the quantity and composition of BW bombs, including allocation of BW agents, it may facilitate the final accounting for the chemical R-400 bombs. Iraq presented the information sought on the disposition of tail sections but field inspection activities are still required to verify the full accounting for these weapons.

Accounting for the Production of the Chemical Warfare Agent VX

35. The degree of verification achieved is not satisfactory. Iraq declared that it had produced a total of 3.9 tonnes of VX. Iraq provided documents on production in 1988, but failed to provide verifiable evidence for its activities in 1990. Iraq also denies that it weaponized VX. Sampling by the Commission of special warheads has thrown significant doubt upon this claim. Iraq needs to provide verifiable evidence and clarifications to support its declarations on the production and weaponization of VX. Technical meetings with the Iraqi specialists and field verification are required.

Material Balance of CW-Production Equipment

36. One hundred and ninety-seven pieces of glass CW production equipment were removed by Iraq from its prime CW facility prior to the Commission's arrival in 1991 and were repeatedly moved in shipping containers between several facilities throughout Baghdad until 1996. This production equipment from two of 20 shipping containers was destroyed under the Commission's supervision in 1997. To ensure that all CW production equipment removed from the CW facility has been accounted for, the Commission requested Iraq to provide its clarifications on their movement. Iraq presented such clarifications in July 1998. Field verification is still required to increase the degree of confidence that all equipment has been

accounted for.

Priority issues in the biological weapons area

37. Since the adoption of Security Council resolution 687 (1991) in April 1991 and until July 1995, Iraq denied that it had had any proscribed biological warfare (BW) activities. Based on the results of its inspection and verification activities, the Commission assessed and reported to the Council in its report of April 1995, that Iraq had not provided an account of its proscribed biological programme nor accounted for materials and items that may have been used or acquired for such a programme. The Commission stated that with Iraq's failure to account for the use of these items and materials for legitimate purposes, the only conclusion that can be drawn is that there is a high risk that they had been purchased and used for a proscribed purpose - acquisition of biological warfare agent. Iraq was provided with evidence collected by the Commission. On 1 July 1995, Iraq, for the first time, acknowledged that it had had an offensive BW programme but still denied any weaponization. Subsequently, in August 1995, after the departure form Iraq of Lt. Gen. Hussein Kamel Hassan, Iraq admitted that it had weaponized BW agents and deployed biological weapons for combat use.

38. Since August 1995, Iraq has submitted a number of "Full, Final and Complete Disclosures" (FFCD) of its declared BW programme. These declarations have been assessed by the Commission and by international experts as incomplete, inadequate and containing substantial deficiencies. They were not accepted as a full account of the scale and the scope of Iraq's BW programme. This refers in particular to weaponization of produced BW agents, bulk BW agent production and acquisitions for the BW programme.

39. In the Commission's view, Iraq has not complied with requirements of the relevant Security Council resolutions on the disclosure of its biological warfare programme. A full, complete and verifiable disclosure of all its biological weapons activities needs to be presented by Iraq.

40. Because Iraq has failed to disclose fully, the scope and nature of its BW programme, the priority issue in this weapons area involves the whole scope of the BW programme. This means that Iraq must furnish a complete and verifiable disclosure as a matter of absolute first priority. The Commission would then need to assess and verify that disclosure.

41. Finally, it needs to be recognised that Iraq possesses an industrial capability and knowledge base, through which biological warfare agents could be produced quickly and in volume, if the Government of Iraq decided to do so.

Appendix 1

STATUS OF THE MATERIAL BALANCES IN THE MISSILE AREA

Introduction

1. In its resolution 687 (1991) of 3 April 1991, the Security Council required Iraq to unconditionally accept the destruction, removal or rendering harmless, under international supervision, of all ballistic missiles with a range greater than 150 kilometres and related major parts, and repair and production facilities. To that end, Iraq was specifically required:

> to submit to the Secretary-General, within 15 days of the adoption of the resolution, a declaration of the locations, amounts and types of all such items in the missile area;
>
> to agree to urgent, on-site inspection by the Special Commission of its missile capabilities, based on Iraq's declarations and the designation of any additional locations by the Special Commission itself;
>
> to destroy, under supervision of the Special Commission, all its missile capabilities, including launchers.

2. The inadequacy of Iraq's initial declarations was one of the elements leading to the adoption of Security Council resolution 707 (1991) of 15 August 1991, in which the Council, inter alia, demanded that Iraq provide full, final and complete disclosure (FFCD), as required by resolution 687 (1991), of all aspects of its programmes to develop weapons of mass destruction and ballistic missiles with a range greater than 150 kilometres, and of all holdings of such weapons, their components and production facilities and locations.

3. With Iraq’s full cooperation and its commitment to the implementation of its obligations under the Security Council resolutions, these tasks in the missile area could have been accomplished in a relatively short period of time. Instead Iraq has chosen a course of withholding its proscribed missile capabilities and obstruction of the Commission’s work. Examples of this policy were Iraq’s decision, immediately after the adoption of resolution 687 (1991) in April 1991, to retain two-thirds of its operational force of proscribed missiles and the concealment of its capabilities to indigenously manufacture proscribed missiles with liquid propellant engines.

4. By the end of 1991, the Commission had completed the task of the destruction of proscribed missile weapons and materials that Iraq had chosen to declare immediately after the adoption of resolution 687 (1991). At that time, the Commission came to the conclusion that Iraq had not declared all its holding of such weapons nor disclosed all its proscribed capabilities and programmes. In March 1992, Iraq admitted that it had withheld from the Commission a considerable amount of proscribed weapons and their component, and declared that it had destroyed them unilaterally in Summer 1991 without the Commission’s supervision. This unilateral destruction by Iraq was in direct violations of Security Council resolution 687 (1991).

5. The Commission's verification has subsequently focussed on the following main tasks:

> the accounting of all proscribed missiles and related operational missile assets, including missile launchers, warheads and propellants in particular those declared as destroyed unilaterally;

the accounting of indigenous production of proscribed missiles and related major parts;

obtaining a full understanding of other issues related to Iraq's missile activities and capabilities proscribed by the Security Council.

6. Through its verification process, the Commission has been accumulating evidence that Iraq's initial and subsequent disclosures of proscribed weapons holdings and missile capabilities were inadequate. This required additional actions by the Commission to dispose of proscribed items, identified through the verification process, as well as new declarations to be presented by Iraq. In August 1995, Iraq admitted that important information on its proscribed programmes had been hidden from the Commission including a considerable amount of documentation. As a consequence, Iraq agreed to prepare a new Full, Final and Complete Disclosure (FFCD) in the missile area. Such an official declaration was provided by Iraq in November 1995. The Commission did not accept this declaration as either a full or complete disclosure. Iraq submitted another FFCD in June 1996. The latter document, supplemented subsequently by numerous Iraqi explanations and clarifications, has been the basis for the Commission's verification activities.

7. In June 1996, Iraq and the Commission established a Joint Programme of Action and agreed to concentrate work on certain fundamental areas. The first priority among them was the material balance of proscribed weapons and their major components. The other established priorities were: the unilateral destruction of proscribed items; further provision of documentation, when available, related to proscribed weapons programmes; and the identification of measures taken in 1991 and the measures used by certain individuals to retain some proscribed items until August 1995. Subsequently, the June 1996 Joint Programme of Work was elaborated through discussions between the Deputy Prime Minister of Iraq and the Executive Chairman.

8. This paper provides, in broad terms, information on the current status of the material balances of proscribed operational weapons and capabilities in the missile area. The material balance approach has been the cornerstone of the Commission's verification effort. This approach has been designed to allow the Commission to reconcile, in a reasonable but verifiable manner, the quantities and the types of proscribed weapons and their major parts, acquired by Iraq either through production or importation, with the quantities of these items disposed of through consumption or destruction or rendering harmless. Throughout this process, it has been Iraq's responsibility alone to provide sufficient evidence to support its own data and declarations on both sides of this equation.

9. The methodology adopted in this paper, is to indicate, based on the most recent declarations from Iraq, quantities of proscribed items available to Iraq, and then provide factual statements as to how the declared quantities have been accounted for. Where feasible, the data is presented in a tabular format for ease of comprehension.

10. The paper's focus is on proscribed missile systems that either had been made operational by Iraq or had been close to an operational status. The paper also provides a report on the status of missile repair and production facilities which were required to be destroyed or rendered harmless

under resolution 687 (1991). Iraq's other proscribed missile capabilities are dealt with only to the extent required for the paper's main focus.

11. Beyond the material balances related to proscribed missiles and the status of relevant facilities, the paper does not address other issues that were investigated by the Commission and which may or may not have reached a satisfactory resolution. This includes Iraq's efforts related to the development of missiles or their sub-systems which have been assessed by the Commission as not having achieved operational status or which would not contribute substantially to proscribed operational capabilities already available to Iraq. Examples of such issues are missile delivery means for nuclear weapons, parachute retarded missile warheads "Meteo 1", separating missile warheads, undisclosed warhead designs, Iraq's efforts to develop missiles with ranges from 1000 to 3000 kilometers and Iraq's space launch vehicle, Al-Abid. Issues related to retention by Iraq of expertise in the proscribed missile area, and design/production/assembly documentation as well as military infrastructure of the proscribed missile operational force have not been addressed in this paper. The paper does not describe the Commission's investigations of Iraq's foreign procurement in support of its proscribed missile activities.

12. Section 1 of the paper provides a status report of the material balances of proscribed missiles and related operational assets. Section 2 describes the status of the material balances of proscribed indigenous missiles, their related major parts, production equipment, and the status of missile repair and production facilities. Section 3 summarises missile activities in Iraq after the adoption of resolution 687 (1991) relevant to the verification of its proscribed activities.

Section 1: "Status of the material balance of proscribed missiles and related operational assets"

13. For the purpose of the verification of the material balance of proscribed missiles and related operational assets, the Commission has focussed on the following key items: the missiles as well as their launchers, warheads and single-use propellants for proscribed missiles. The Commission has also investigated the accounting for other elements of operational assets such as key missile guidance and control instruments and auxiliary vehicles for missile fuelling, transportation and testing. The Commission has determined that the full accounting of these latter elements, despite remaining ambiguities, could be considered secondary in importance, provided a solid and verifiable accounting of the selected key items is established.

Missiles

14. Iraq declared that it imported 819 long-range combat missiles that fall under prohibitions established by resolution 687 (1991). Over half of them were modified by Iraq, since 1987, into missiles known in Iraq as Al Hussein class missiles. Al Hussein missiles used by Iraq during recent wars had a range of some 650 kilometres.

15. The Commission does not have evidence to confirm reports of Iraq's importation of SCUD-B class missiles from any but a single supplier. The data on the missile deliveries, serial numbers of missile engines and other components that was provided to the Commission by the supplier, was essential in establishing the material balance in this area. Table 1 provides a summary of the material balance of the 819 proscribed combat missiles imported by Iraq.

Table 1

Expenditure/disposal event	Declared quantity	Accounting status
Pre-1980 expenditures, such as in training	8	Accounting is based on documentation provided by Iraq.
Expenditure during the Iran-Iraq war (1980-1988), including the War of the Cities in February-April 1988	516	Accounting is based on documentation provided by Iraq. Iraq's data on some of these missile firings, in particular during the War of the Cities, was corroborated by independent sources.
Testing activities for development of Iraq's modifications of imported missiles and other experimental activities (1985-1990)	69	Accounting is based on documentation provided by Iraq. Iraq's data on a number of these test firings was corroborated by independent sources.
Expenditures during the Gulf War (January-March 1991)	93	Accounting is based on documentation provided by Iraq. Iraq's data on nearly all of these firings was corroborated by independent sources. A discrepancy in the accounting of a small number of fired missiles exists between Iraq's data and data provided by other sources.
Destruction pursuant to Security Council resolution 687 (early July 1991)	48	UNSCOM verification during the destruction.
Unilateral destruction by Iraq (mid July and October 1991)	85	Accounting is based on documentation provided by Iraq. The Commission carried out laboratory analysis of remnants of the unilaterally destroyed missiles excavated in 1996-1997. The Commission identified remnants of engines from 83 out of the 85 missiles declared.

16. As a result of the emergency session of the Special Commission on 21 November 1997, the members of the Commission stated that they were "satisfied that 817 of the 819 proscribed missiles imported by Iraq have been effectively accounted for".

17. In late 1995, Iraq provided to the Commission an inventory of missiles destroyed unilaterally. This inventory contained a reference to seven indigenously produced missiles, in addition to the 85 imported missiles. The November 1997 emergency session determined that accounting for these seven missiles was one of the priority requirements. The Commission has not been able to verify the nature and destruction of these missiles. (For more details, see Section 2, below)

18. In July 1991, the Commission supervised the destruction of 9 Fahad missiles. Fahad missiles were Volga/SA2 surface-to-air missiles that Iraq modified for a surface-to-surface application, with ranges over 150 kilometres. Twenty-one flight tests of Fahad missiles were declared to have been conducted by Iraq before the Gulf War. No supporting documentation has been provided by Iraq to ascertain how many such missiles were modified. Unmodified Volga missiles declared by Iraq in 1996 are currently under the Commission's monitoring in order to ensure their non-modification for a surface-to-surface application or for delivery of non-conventional warheads.

Missile Launchers

19. Iraq declared that, during the Gulf War, it had 14 combat mobile launchers for Al Hussein class missiles, including ten which had been imported and four which were indigenously produced. It also imported one launcher of this type for training purposes. Iraq declared that it had indigenously constructed two mobile launchers that had not been made operational, and that it had three experimental prototype mobile launchers.

20. The quantity of imported launchers has been confirmed by the supplier. The Commission does not have evidence to confirm reports of Iraq’s importation of this class of proscribed missiles launcher from any but this supplier.

21. Iraq declared that it had acquired from a foreign supplier ten 50-tonne flatbed trailers suitable for the construction of indigenous mobile launchers. This information has been confirmed by the supplier. Six of these trailers were converted to the abovementioned indigenously produced mobile launchers, called Al Nida. The Commission verified the destruction of the launching equipment erected on these six trailers, and allowed Iraq to use, for non-proscribed purposes, these and the four other, unused trailers that had been imported.

22. Iraq declared that 28 operational fixed launchers for Al Hussein class missiles had been deployed. In addition, 28 "stand-by", training, testing or decoy fixed launchers were constructed or were under construction.

23. Table 2 provides a summary of the material balance of mobile and fixed missile launchers.

Table 2

Launchers	Declared quantity	Accounting status
Imported combat mobile launchers	10	5 launchers destroyed under UNSCOM supervision in 1991. 5 launchers destroyed unilaterally by Iraq. Remnants of all 10 launcher vehicle chassis, launching arms and stools were identified in August 1997. It was not possible to identify remnants of all launching and support equipment from these launchers.
Imported training mobile launcher	1	Destroyed under UNSCOM supervision in 1991.
Indigenous combat operational mobile launchers (Al Nida)	4	Launching equipment and two associated launch control vehicles were destroyed unilaterally by Iraq. Accounting is based on documentation provided by Iraq and the identification of some remnants of destruction. The trailers of the launchers were released by the Commission for use in non-proscribed activities.
Indigenous non-operational mobile launchers (Al Nida)	2	Launching equipment and two associated launch control vehicles were destroyed under UNSCOM supervision. The trailers of the launchers were released by the Commission for use in non-proscribed activities.
50-tonne trailers suitable for Al Nida launchers	4	Released by UNSCOM for use in non-proscribed activities. 3 of these trailers have been seen by UNSCOM. In November 1997, Iraq declared that the fourth, missing trailer had been stolen and could not be located.
Indigenous prototype launchers	3	Destroyed under UNSCOM supervision.
Fixed launch sites (completed or under construction)	56	Destroyed under UNSCOM supervision or their destruction certified by UNSCOM.

Completed control panels for indigenous launchers	24	2 sets were destroyed under UNSCOM supervision. 22 sets were declared to have been destroyed by Iraq unilaterally. Some remnants of destroyed panels have been seen by UNSCOM.

24. The Commission's verification efforts, with respect to Iraq's declarations on combat missile launchers, have been frustrated by Iraq's misleading statements. Prior to March 1992, Iraq claimed that several imported mobile launchers had been destroyed during the Iran-Iraq war. In March 1992, it declared that those launchers had been unilaterally destroyed by Iraq in the summer of 1991. This statement was repeated in Iraq's June 1996 FFCD. In the course of its follow-up verification, the Commission established that Iraq's statement on the unilateral destruction of mobile missile launchers was wrong. This finding was presented to Iraq by the Commission in July 1997. Iraq then made a new statement, in August 1997, that five imported launcher chassis had in fact been destroyed in October 1991, and not in July 1991, as had previously been declared by Iraq. A fuller explanation of Iraq's actions to retain mobile launchers after the adoption of resolution 687 (1991) and to conceal the events and timing of their unilateral destruction was requested. In September 1997, the Commission asked Iraq to explain the operational requirements for the retained proscribed missile assets that Iraq had concealed after April 1991. In response, the Deputy Prime Minister of Iraq gave an explicit order, in the presence of the Executive Chairman, to the Iraqi experts not to discuss such issues with the Commission.

Missile Warheads

25. Iraq declared that it had imported 819 combat warheads for proscribed missiles of SCUD/Al Hussein class and that 121 combat warheads of the same type had been produced indigenously or had been under production at the time of adoption of resolution 687 (1991). Iraq's declarations on the material balance in this area have changed several times. Table 3 provides a summary of the material balance of declared warheads based on Iraq's most recent declarations of 1998.

Table 3

Expenditure/ disposal event	Declared quantity		Accounting status
	imported	indigenous	
Pre-1980 expenditures	8	0	Accounting is based on documentation provided by Iraq.

Expenditure during the Iran-Iraq war (1980-1988), including the War of the Cities in February-April 1988	515	0	Accounting is based on documentation provided by Iraq.
Activities for the development of Iraq's modifications of imported missiles, establishing indigenous production of warheads and other experimental activities (1985-1990)	52	12	In most cases, the accounting is based on documentation provided by Iraq. In a number cases, particularly in relation to indigenous warheads, no documentation has been provided.
Expenditures during the Gulf War (January-March 1991)	87	6	No documentation on the expenditure of the warheads was provided by Iraq. Iraq's data on nearly all missile firings was corroborated by independent sources. The origin of warheads fired with these missiles could not be established.
Destruction pursuant to Security Council resolution 687	37 (15 conventional and 22 special)	13 (5 conventional and 8 special)	UNSCOM verification during the destruction.
Unilateral destruction by Iraq (mid July and	120	90	Accounting is based on documentation

October 1991)	(92 conventional and 28 special)	(73 conventional and 17 special)	provided by Iraq. The Commission carried out excavation of warheads unilaterally destroyed. The results of the assessment of excavated remnants are presented below.

26. Pursuant to the programme of work established in July 1997, survey and excavation work started August 1997 at the declared sites of the unilateral destruction and the burial sites of warhead remnants. By June 1998, all sites declared by Iraq, where warhead remnants could be found, were surveyed and excavated. Thus, a strong presumption is that all remnants have been collected. Table 4 provides a summary of the assessment of recovered warheads remnants relevant to the material balance.

Table 4

Category of warheads destroyed	Declared quantity	Recovered or otherwise accepted as accounted for
Special warheads destroyed unilaterally (modified imported and indigenously produced)	45	43 - 45
Imported conventional warheads (Iraq's unilateral and UNSCOM - supervised destruction)	107	83
Indigenous warheads of all types (accounting method is by imported rings, as key elements in a warhead structure)	196-200	170 -180

27. Issues related to remnants of warheads that have not been recovered, but which have been declared by Iraq as unilaterally destroyed (some 25 imported warheads and some 25 Iraqi manufactured warheads), remain outstanding in the accounting of proscribed warheads that Iraq claimed to have destroyed unilaterally. The full and verifiable accounting for proscribed missile conventional warheads remains essential for the verification of the premise that Iraq has not

retained any proscribed missiles and that all proscribed missiles and their warheads indeed have been destroyed.

28. As a result of the Technical Evaluation Meeting on the proscribed missile warheads held in February 1998 in Baghdad, the Commission's team of international experts determined that Iraq's warhead production and acquisition records were the best way to obtain the full picture of Iraq's warhead production. No documents have been provided by Iraq in response to this request. According to the team, issues related to the warhead material balance and accounting such as duplicate counting, warhead destruction activities and warhead markings, need to be fully resolved to enable the establishment of a solid and verifiable material balance in the warhead area. In July and November 1998, the Commission again asked Iraq for clarifications to be provided to facilitate the completion of the verification. The Commission has not received answers from Iraq that would allow to achieve this goal.

Warheads with chemical and biological warfare agents

29. A priority aspect of the accounting for proscribed missile warheads relates to the missile warheads that were filled or were designed to be filled with chemical or biological warfare agents (special warheads). Iraq's declarations on the acquisition and disposal of the special warheads, for both CW and BW delivery, have changed several times. The current Iraqi declarations could be summarised as follows:

> Iraq stated that it had produced 25 combat special warheads for BW (16 warheads filled with botulinum toxin, 5 warheads with anthrax and 4 warheads with aflatoxin) and 50 combat special warheads for CW (16 warheads filled with sarin and 34 warheads with the alcohol component of the binary system). Out of 75 declared combat special warheads, 25 warheads were declared as indigenously produced (15 CW and 10 BW warheads) and 50 warheads were modified from imported warheads (35 CW and 15 BW warheads). In addition, Iraq declared that it had produced 3 special warheads for training purposes, and that 3 additional special warheads had been used in static tests and 2 special warheads had been used in flight tests.
>
> The 30 CW combat warheads (16 filled with sarin and 14 with the alcohol component) were destroyed under UNSCOM supervision in 1991-1993. Iraq's declarations on the disposal of the remaining 45 combat special warheads out of the 75 declared as produced, stated that they had been unilaterally destroyed in early July 1991. The assessment of the warhead remnants excavated since August 1997 allows for the identification of 43-45 special warheads coming from the sites of the declared unilateral destruction.

30. Iraq's declarations and supporting documents include a specific distribution, by their type and warfare agent filling, of the 45 special warheads unilaterally destroyed in July 1991. According to Iraq's declarations, 20 of them were chemical weapons and contained only the alcohol component of the CW binary system. Analysis at the laboratories designated by the Commission has detected the presence of degradation products of nerve agents, in particular VX, on a number of warhead remnants which were excavated. A meeting of international experts,

including representatives of the three laboratories, which was held on 22-23 October 1998 concluded that "the existence of VX degradation products conflicts with Iraq's declarations that the unilaterally destroyed special warheads had never been filled with any chemical warfare agents. The findings by all three laboratories of chemicals known to be degradation products of decontamination compounds also do not support Iraq's declarations that those warhead containers had only been in contact with alcohols." Clarification by Iraq of these issues as recommended by the meeting would allow the Commission to make a determination whether or not the current assessment of the quantity of special warheads identified amongst the remnants excavated, accounts for all special warheads declared to have been produced by Iraq and provides for the verification of their unilateral destruction.

31. Iraq described in detail the procedures and methods of unilateral destruction of the special warheads by explosive demolition. After examination of the relevant destruction sites and the special warhead remnants recovered from them, the Commission found that Iraq's explanations were, in general, plausible. However, in one aspect dealing with the destruction of BW warheads, the Commission, after consulting a group of international experts, assessed that Iraq's declaration that 15 warheads had been destroyed simultaneously conflicted with physical evidence collected at the declared location of their unilateral destruction. This finding indicated that not all BW warheads had been destroyed at the same time as declared by Iraq and that Iraq had retained some BW warheads after the declared July 1991 unilateral destruction date. The discrepancies between Iraq's current declarations on its unilateral destruction of the special warheads and the physical evidence collected at the destruction site need to be clarified. In addition, the Commission's investigations showed that Iraq had not provided the true locations of the hiding, prior to the declared unilateral destruction, of at least half of the special warheads including the abovementioned 15 BW warheads. In December 1998, Iraq again identified new locations of storage pits from where the warheads had been moved to the unilateral destruction sites. The Commission could not again confirm that the newly identified locations had been used for hiding warheads. Iraq's continuous inability to disclose hide sites of the special warheads has also prevented the Commission's verification of declared unilateral destruction of the special warheads.

32. Evidence has been recovered pointing to Iraq's attempts to design and produce non-conventional warheads for missiles other than Al Hussein. Despite available documentary evidence of work on non-conventional warheads for so called FROG short-range missiles in 1990, Iraq insisted that all such work was done only in 1988 without any success or follow-up attempts. Iraq denied any activities related to non-conventional warheads for Volga/SA 2 surface-to-air missiles that it was modifying for surface-to-surface application.

Missile Propellants

33. Iraq declared that it acquired missile propellants together with imported long-range missiles in quantities required for the proper operation of these missiles. Two of these propellants (main fuel and oxidizer) are unique for use with proscribed missiles of SCUD/Al Hussein class and thus, are subject to destruction and full accounting. The third propellant (starting fuel) is also used in non-proscribed missiles in Iraq and thus, has been excluded by the Commission from the accounting.

34. Iraq declared that, in the late 1980's, it had also imported specific components for the indigenous production of the same type of main fuel for proscribed missiles. Iraq declared that it had never produced indigenously proscribed missile propellants from basic raw materials. (For more details, see Section 2, below)

35. A summary of the material balance of imported main fuel and oxidizer unique for proscribed missiles is provided below.

36. Imported missile main fuel (TM185): Iraq declared the importation of 818 tonnes of main fuel. No supporting documents were provided by Iraq to substantiate this declaration. Table 5 provides a summary of the material balance of the main fuel.

Table 5

Expenditure/ disposal event	Declared quantity (tonnes)	Accounting status
Consumed with missiles launched and used for static tests of missile engines	661	Accounting is based on technical requirements for missile operations. Most of the launching and testing events are supported by documentation provided by Iraq.
Destruction pursuant to Security Council resolution 687 (early July 1991)	20	UNSCOM verification during the destruction.
Unilateral destruction by Iraq (August-September 1991)	137	No supporting documentation has been provided by Iraq.

37. Imported missile oxidizer (AK 27I): Iraq declared the importation of 2,895 tonnes of this oxidizer. No supporting documents were provided by Iraq to substantiate this declaration. Table 6 provides a summary of the material balance of missile oxidizer.

Table 6

Expenditure/disposal event	Declared quantity (tonnes)	Accounting status
Consumed during missile launch and used for static	2,436	Accounting is based on technical requirements for missile operations. Most

tests of missile engines		of the launching and testing events are supported by documentation provided by Iraq.
Destruction pursuant to Security Council resolution 687 (early July 1991)	52	UNSCOM verification during the destruction.
Unilateral destruction by Iraq (August -September 1991)	407	No supporting documentation was provided by Iraq.

38. The full accounting for imported single-use proscribed missile propellants is outstanding. Documents, including an inventory list on the declared unilateral destruction, specifically requested by the Commission, have not been made available by Iraq to support its declaration on the quantities (over 500 tonnes) of proscribed propellants it claims to have destroyed unilaterally.

Section 2: "Status of the material balances of proscribed indigenous missiles and related major parts, production equipment, and status of repair and production facilities"

39. In addition to importation of missiles and related operational assets that fall under prohibitions established by Security Council resolution 687 (1991), Iraq undertook major efforts to indigenously produce proscribed missiles. For this purpose, a number of projects were established and numerous facilities were involved.

40. Iraq's indigenous missile production depended greatly on parts, components, materials and equipment that it procured through foreign sources. The Commission has sought information from Governments on the supply of such items. Responses from a number of Governments were of great assistance in the Commission's verification work.

Al Hussein Missile System

41. Iraq sought to manufacture indigenously a complete missile system called Al Hussein. As with the imported missile system of SCUD-B class, the indigenous system was composed of missiles, warheads, launchers, guidance and control instruments, liquid propellants and support equipment required for the operational use of these missiles.

42. In practically all cases, indigenously produced assets and originally imported ones could have been used interchangeably by Iraq. For example, the Al Hussein missiles, whether modified from imported SCUD-B missiles or indigenously produced, could be launched from either imported launchers or indigenously produced launchers, both mobile and fixed. The same was true for missile warheads. For these reasons, issues related to launchers and warheads both imported and indigenously produced, are covered in Section 1. Section 2 focuses on issues

related to indigenous production of missiles themselves, in particular their engines, guidance and control instruments and some items unique to the indigenously produced Al Hussein class missiles.

43. Iraq began the reverse engineering and production of Al Hussein class missiles in 1987. Its efforts included the acquisition and assembly/production of all airframe components (fuel and oxidizer tanks, engine covers, instrument compartments and warheads), guidance and control instruments and their components, and liquid propellant engines. By the time of the adoption of resolution 687 (1991), Iraq had achieved considerable progress, including successful testing of indigenously assembled engines, airframes, and some guidance and control instruments. In 1995, Iraq declared for the first time that it conducted four flight tests of missiles with indigenously manufactured engines, all of them in 1990. Iraq has declared that it was successful in the indigenous production of the whole missile airframe and warhead as well as missile launchers.

44. In April 1990, Iraq established a new military unit of Brigade size (Unit 223) to be equipped with operational missile assets. One of the available Iraqi documents of April 1990 referred to a task for different organizations in Iraq to secure the needs with respect to the brigade's combat supplies (missiles, launchers and ground support). Iraq has not responded positively to the Commission's requests to provide relevant decision level documentation on the equipping of Unit 223 with combat supplies. Such documentation could significantly clarify - Iraq's planned and actual capabilities to produce indigenously and deploy, with the Army, operational missiles and related missile equipment. In response to the Commission's request of 17 November 1998, Iraq provided some 64 pages of documents related to Unit 223. This documentation did not contain the information on combat supplies sought by the Commission. It dealt with personnel and non-combat equipment like radios and cars, to be assigned to the unit and did not discuss Iraq's capabilities and actions to equip this unit with missiles, launchers and other operational assets.

45. In its initial declarations in response to the requirements of resolution 687 (1991), Iraq did not disclose fully its efforts to manufacture indigenously Al Hussein class missiles or the progress it achieved. Iraq later admitted that it had a full scale programme to manufacture indigenously complete Al Hussein missiles and that it had established specialized factories for this purpose. The factories were directed, in early 1988, to plan for production of 1000 missiles. Iraq maintains that by January 1991, it had failed to produce a single operational missile.

46. After the adoption of resolution 687 (1991), Iraq sought to retain all available capabilities, components, materials, tooling and machines for its indigenous production of missile engines and guidance and control components, and attempted to conceal the true scope of its pre-Gulf War programme.

47. In the course of the Commission's verification activities, it became practically impossible to establish and verify material balances regarding airframes and related major parts due to the relative abundance of sources of their acquisition and methods of their unilateral destruction used by Iraq. Thus, missile engines and missile guidance and control systems, in particular their gyroscopic instruments, were selected as the focus for efforts to establish the material balance in

the area of indigenous missile production. The Commission believed that if solid material balances could be established in these two areas, gaps in other areas of the proscribed indigenous missile production could be assessed as of secondary importance.

Complete Al Hussein Missiles

48. In late 1995, Iraq provided to the Commission, an inventory of proscribed missiles that it destroyed unilaterally. In addition to imported missiles that it destroyed, the inventory contained a reference to seven indigenously produced missiles. Iraq explained that these were missiles or missile engines that had been given to the Army's Surface-to-Surface Missile Forces as "training" missiles. No documentation has been provided to confirm that these particular missiles were for training purposes. Although Iraq declared that these seven indigenous missiles were destroyed together with 85 imported combat missiles, remnants of the indigenous missiles or their engines, which could prove their unilateral destruction, have not been recovered by the Commission at the declared destruction sites.

49. The declared unilateral destruction of these missiles has not been verified. The verification in this area is considered as a priority issue as it might involve operational missiles produced indigenously by Iraq.

Missile Engines

50. In response to the requirements of resolution 687 (1991) of April 1991, Iraq did not disclose its programme to produce indigenously liquid propellant engines for proscribed missiles. In October 1991, Iraq stated that it had a limited, unsuccessful effort within its Project 1728 for the reverse engineering of proscribed missile engines and had imported some components and equipment for that purpose. For years, Iraq insisted that the main purpose of Project 1728 had not been missile production, but the development of welding and other technologies for manufacturing agricultural pumps.

51. In its first FFCD in May 1992, Iraq declared that all Project 1728 machines and equipment had been totally destroyed during the Gulf war. Following an intense effort to identify equipment procured for Project 1728, the Commission determined that Iraq's declared purpose for this programme was incorrect. The evidence obtained by the Commission indicated that the project had been established and operated specifically for the production of proscribed missiles, in particular their liquid propellant engines. Based on these findings, the Commission took the decision, in February 1995, on the disposal of Project 1728 equipment still available in Iraq at that time. Over a hundred machines and other major pieces of equipment were identified. Of these, the Commission requested the destruction of five machines, and established a prohibition on the use of eleven machines in any missile related production in Iraq. The remaining general purpose machines from Project 1728 were released since they could be used for non-proscribed activities and similar machines were readily available elsewhere in Iraq. Iraq protested the Commission's decision of February 1995. It agreed to implement it only in July 1995. In its November 1995 FFCD, Iraq finally acknowledged that the main purpose for Project 1728 had been the reverse-engineering and production of proscribed missile engines, and that the

equipment, identified by the Commission, had been used or acquired for use in proscribed activities. A summary of the material balance of Project 1728 machines and equipment is contained in Table 7:

Table 7

Machines/ Equipment	Declared Quantity	Purpose of use	Accounting status
Flow forming machines	2	Manufacture of combustion chamber and nozzle (CC/N) assemblies	Destroyed under UNSCOM supervision in July 1995
Vacuum furnaces	2	Brazing and annealing of CC/N assemblies	Destroyed under UNSCOM supervision in July 1995
Balancing machine	1	Balancing of turbo-pump components	Destroyed under UNSCOM supervision in July 1995
Speciality welding machines	7	Welding of various engine components	Banned from use in missile production since February 1995. Tagged and under UNSCOM monitoring
Laser cutting machine	1	Cutting preforms for CC/N assemblies	Banned from use by Iraq in missile production since February 1995. Tagged and placed under UNSCOM monitoring
Test equipment	2	Testing of electronic and mechanical components	Banned from use by Iraq in missile production since February 1995. Tagged and under UNSCOM monitoring
Numerically controlled rivetting machine	1	Assembly of injectors into injection head of missile engine	Banned from use by Iraq in missile production since February 1995. Tagged and under UNSCOM monitoring
Welding machines	16	General purpose machines, used by Project 1728 in the production of missile engine components	Released for use in non-proscribed activities

Press	9	General purpose machines, used by Project 1728 in the production of missile engine components.	Released for use in non-proscribed activities
Cutting machines	5	General purpose machines, used by Project 1728 in the production of missile engine components.	Released for use in non-proscribed activities
Turning and milling machines	54	General purpose machines, used by Project 1728 in production of missile engine components.	Released for use in non-proscribed activities
Brazing equipment	1	General purpose equipment, used by Project 1728 in the production of turbo pump components	Released for use in non-proscribed activities
Plasma coating machine	1	General purpose machines, used by Project 1728 in the production of missile engine components.	Released for use in non-proscribed activities
Spark erosion machines	2	General purpose machines, used by Project 1728 in the production of missile engine components.	Released for use in non-proscribed activities
Rolling, drilling, grinding, bending, and rivetting machines	8	General purpose machines, used by Project 1728 in the production of missile engine components.	Released for use in non-proscribed activities
Testing machines	2	General purpose quality control equipment, used by Project 1728 for testing missile engine components.	Released for use in non-proscribed activities

Turbo pump test stand	1	Testing of turbo pumps of missile engines.	Damaged during the Gulf War. Destroyed under UNSCOM supervision in 1996

52. Iraq declared that it could not indigenously produce most of the components of engines for Al Hussein class missiles. Thus, Iraq imported these components as well as some production or assembly tools/dies. Iraq provided supporting documentation for the foreign acquisition of many of these items. The Commission attempted to verify these declarations. Most, but not all, Governments of major suppliers of these items to Iraq provided the required support to this effort. At this stage, the Commission is not in a position to state that it has verified all supplies of missile engine components to Iraq. Some substantial problems remain as to the quantities and types of components sought by Iraq and the timing of their acquisition. The Commission believed that such issues might loose their significance if a verifiable material balance could be established for the most critical missile components that had been declared by Iraq as received and if these deliveries were fully verified. As described below, this objective has not been achieved.

53. No significant quantities of missile components for indigenous production of proscribed missiles were presented by Iraq for destruction in accordance with the requirements of resolution 687 (1991). Iraq declared that practically all of the imported missile engine components, which remained at the time of the adoption of resolution 687 (1991) in April 1991, had been secretly destroyed either by explosion in the desert or by melting in foundries. These unilateral destruction activities were claimed to have occurred from July to November 1991 and were declared by Iraq for the first time in March 1992. Based on the evidence presented by Iraq and the lack of supporting documentation at that time, the Commission was not able to verify the quantities of proscribed items declared as unilaterally destroyed. The Commission also assessed that not all items, declared by Iraq to have been unilaterally destroyed in 1991, had in fact been destroyed as declared.

54. In November 1995, Iraq provided inventory lists to account for the unilateral destruction of components in 1991. Iraq was unable to produce credible explanations of discrepancies between its official declarations and the data contained in the documents it provided. In 1996, Iraq admitted that most important components and tools for its missile engine production had been diverted from the declared unilateral destruction in 1991. Iraq stated that items thus concealed had been retained until March-May 1992, at which time they were secretly destroyed despite the fact that Iraq had already disclosed unilateral destruction of some other items from its proscribed missile activities. In July 1998, Iraq acknowledged that declarations provided to the Commission were not complete and that hiding of missile engine components prior to their unilateral destruction had occurred at an additional site undeclared until that time.

55. The Commission conducted a number of inspections to recover indigenous missile engine components from destruction and burial sites identified by Iraq. This was done in an attempt to verify declared material balances of these components. After a first round when far fewer items had been recovered than had been listed in the documents, Iraq stated that most of the missing

items had been re-excavated unilaterally by Iraq in April or May 1992 and taken to foundries for melting. The Commission, then, conducted an inspection to identify ingots and other remnants resulting from the unilateral destruction activities in an effort to establish at least a rough material balance by aggregate weight of melted materials. Again, when insufficient material was recovered to account for the declared destruction of missile engine components, Iraq provided new explanations that, in fact, it had dumped the items that were missing from the accounting, into various rivers. In July 1998, the Commission conducted an inspection to recover these items.

56. Due to the methods of the unilateral destruction and the lack of sufficient documentation, it has not been possible to establish, to a satisfactory level, material balances of major missile engine components. The status of the material balances of missile engine components achieved, could be illustrated using the two major components of proscribed missile engines. These are: (1) the missile engine combustion chamber and nozzle (CC/N) assembly, and (2) the missile engine turbo pump, which delivers liquid propellant into a missile engine combustion chamber.

57. In November 1995, Iraq declared that it had indigenously produced some 80 combustion chamber and nozzle (CC/N) assemblies for proscribed missile engines. Table 8 provides a summary of the material balance of the declared quantity of CC/N assemblies.

Table 8

Expenditure event	Quantity	Declared Disposal Status	Comments
Indigenously produced CC/N assemblies which were rejected for integration into complete engines	54 - 57	Unilaterally melted in foundries from August to October 1991	Iraq stated that this number is not necessarily factual. Rather it is an estimate based on expected production. The declaration is not supported by documentation or physical evidence.
Indigenously produced CC/N assemblies integrated into complete engines and used in flight tests	4	Not recovered after tests or, if recovered, unilaterally melted by Iraq in foundries from August to October 1991	Accounting of flight tests is based on documentation provided by Iraq.

Indigenously produced CC/N assemblies integrated into complete engines and used in static tests	12	Unilaterally melted in foundries from August to October 1991	Some of the static tests are accounted for based on documentation provided by Iraq.
Indigenously produced CC/N assemblies accepted for integration into complete engines and not used as of April 1991	7-10	Unilaterally melted in foundries from August to October 1991	Iraq provided documents to support the acceptance of some eight CC/N assemblies some of which would require additional work.
Summary	some 80	Practically all indigenously produced combustion chamber and nozzle assemblies were declared as unilaterally destroyed by melting.	Ingots presented by Iraq as evidence of the unilateral destruction do not show expected evidence of the destroyed combustion chamber and nozzle assemblies.

58. Iraq declared that it had not been able to produce indigenously turbo pumps for proscribed missile engines. Iraq attempted to acquire them by importing complete turbo pumps or by importing their components for final assembly in Iraq. Iraq declared that it had failed to assemble any complete turbo pumps from imported components. All turbo pump components were declared as unilaterally destroyed. Iraq stated that it had imported 34 turbo pumps from the specific foreign supplier. The importation was part of the implementation of an overall order for 305 turbo pumps from this supplier. The Commission has been able to obtain data on the quantity of the turbo pumps ordered and imported by Iraq directly from this supplier. Table 9 provides a summary of the material balance of imported turbo pumps declared by Iraq.

Table 9

Expenditure event	Quantity	Declared Disposal Status	Comments
Imported turbo pumps used in	4	None recovered after tests, or if recovered,	Accounting of the flight tests is based on

missile flight tests in 1990		unilaterally melted in foundries from August to October 1991	documents provided by Iraq. The documents did not specify the origin of turbo pumps used.
Imported turbo pumps used in missile engine static tests in 1989 -1991	10	Unilaterally melted in foundries from August to October 1991	The Commission has been unable to verify the declaration either by documentation or physical evidence. Contrary to Iraq's declarations, the Commission has documentary proof that the turbo pumps arrived in Iraq only six months after their first usage as claimed by Iraq.
Imported turbo pumps not used as of April 1991	9	Unilaterally destroyed by explosions and buried in the desert in July 1991. They were then unilaterally excavated by Iraq and melted in a foundry in April or May 1992.	Inventory records of the unilateral destruction of July 1991 list eight turbo pumps.
Imported turbo pumps not used as of April 1991	11	Unilaterally destroyed by melting in a foundry in July 1991	No documentary evidence was provided by Iraq to confirm this declaration.
Imported turbo pump consumed in acceptance test by foreign manufacturer in 1991	1	Retained by manufacturer and not delivered to Iraq	Documentary evidence shows that all 35 turbo pumps were received by Iraq. Iraq provided no evidence to confirm the declared consumption of the turbo pump.

Summary	35	Practically all turbo pumps were declared as unilaterally destroyed by melting.	Ingots presented by Iraq as evidence of the unilateral destruction showed evidence of only 3 destroyed turbo pumps. The origin of these turbo pumps could not be determined without laboratory analysis.

59. As its attempts to establish material balances of major engine components have not brought satisfactory results, the Commission was forced to switch from this approach to an attempt to establish a rough material balance, only by the aggregate weights, of all missile engine components declared to have been acquired or produced by Iraq and disposed of after the adoption of resolution 687 (1991). The application of the new method, by definition, could not result in accounting for individual components and had to mix, in the verification process, important key items with other items. In most cases, it turned out to be impossible to establish with any degree of certainty whether recovered materials represented missile related remnants or not. In this respect, the Commission relied solely on declarations and statements from Iraq.

60. Based on information provided by Iraq in July 1998, the aggregate weight of components and production tools/dies for missile engine production that were declared as having been unilaterally destroyed, were estimated to be around 108 tonnes. A rough material balance, by weight, of unilaterally destroyed components for indigenous missile engine production is presented in Table 10:

Table 10

Unilateral Destruction Event	Declared Quantity (tonnes)	Accounting Status
Destruction by explosives at Al Alam in 1991	35	11 tonnes recovered at the site in 1997 under UNSCOM supervision.
		2.2 tonnes recovered by Iraq without UNSCOM supervision in 1998 from areas around the destruction site. Quantities verified by UNSCOM.
		6 tonnes declared by Iraq as removed from the destruction site by local residents. No supporting evidence was provided by Iraq.

		15 tonnes declared by Iraq as unilaterally excavated by it in 1992 and then melted. See entry below.
Melted at foundries in 1991 and 1992	77	This includes 15 tonnes that Iraq declared it unilaterally excavated in 1992. 91 ingots weighing a total of 89 tonnes were presented by Iraq as being remnants of the destruction by melting. Ingots recovered cannot be associated, unambiguously, with the declared destruction activities.
Dumping in rivers in 1991	2	300-400 kg were recovered under UNSCOM supervision in 1998.
Destruction by explosives at Nibai in 1991	1	Small quantities were recovered under UNSCOM supervision.
Destruction by cutting in 1992	8	The damaged remnants were presented to UNSCOM.

61. It should be noted that ingots recovered can not be associated, unambiguously, with the material declared as melted by Iraq, as destruction of other materials was occurring at the same foundries at the same time. Only 24 of 91 ingots showed evidence of parts for the missile engine production.

62. As verifiable material balances of proscribed engine components can not be established, either component wise or by aggregate weight, additional inspections were conducted in 1997 and 1998 to assess Iraq's technical capabilities in missile engine production. International experts, invited by the Commission for a meeting in Baghdad in July 1998, came to an assessment that, by the end of 1990, Iraq had the capability to assemble a limited number of proscribed liquid propellant engines for Al Hussein class missiles but was still experiencing production related problems. The international experts also assessed that Iraq needed to account for the key components of its missile engine programme.

Missile Guidance and Control Instruments

63. In contravention of the requirements of resolution 687 (1991), Iraq did not declare its efforts to produce guidance and control (G&C) instruments for its Al Hussein class missiles. After the Commission discovered, in August 1991, a facility for the development and production of such components, Iraq declared reverse-engineering efforts in this area.

64. In early 1992, Iraq acknowledged the importation of some components for proscribed G&C systems. The Commission sought to obtain Iraq's full disclosure concerning these procurement

efforts. Iraq denied most of them until August 1995. The Commission also discovered that Iraq had been receiving such components from foreign suppliers up to November 1991 i.e. several months after the adoption of resolution 687 (1991).

65. In 1992, Iraq declared that it had unilaterally destroyed components and tooling from its guidance and control programme by disposing them in rivers or melting them in foundries. Based on the evidence presented by Iraq at that time and due to the lack of supporting documentation, the Commission was not able to verify the quantities of proscribed items declared as having been unilaterally destroyed. The Commission also assessed that not all items declared by Iraq to have been unilaterally destroyed in 1991, had in fact been destroyed at that time. In 1996, Iraq admitted that some items for its G&C production programme had been diverted from the previously declared unilateral destruction in 1991. Iraq stated that items thus concealed had been retained until March 1992, at which time they were secretly destroyed despite the fact that Iraq had already disclosed unilateral destruction of some other items from its proscribed missile activities. Iraq provided partial inventory lists to account for the unilateral destruction. The Commission sought to verify this information by interviews, discussions and inspections during 1996 and 1997. Iraq was unable to produce credible explanations or evidence of the complete destruction.

66. The Commission assessed that, due to the methods of unilateral destruction and the incomplete nature of the destruction inventories provided by Iraq, the establishment of even a rough material balance for proscribed guidance and control components could not be achieved. As with missile engine production, the Commission then had to resort instead to assessment of Iraq's technical capabilities for the indigenous production of guidance and control systems, specifically the gyroscopic instruments.

67. As a result of an expert meeting with Iraqi counterparts in July 1998, the international experts, who had been invited by the Commission, made an assessment that by the end of 1990, Iraq did not have the capability either to manufacture indigenously or assemble from foreign components, gyroscopes for its indigenous missiles.

68. Available evidence showed that Iraq continued to work on the indigenous production of proscribed missile gyroscopic instruments after April 1991. Iraq continued to receive parts for these instruments until November 1991. These items were critical to the assembly of such instruments. In 1993, a tasking to work on proscribed missile gyroscope instruments was given to a facility in Iraq that previously had been involved in their production. During the same period, Iraq also attempted to procure additional critical items for these instruments. Iraq stated that all these efforts had been very short lived. It provided no evidence or documentation to support this statement. Iraq also retained a number of original imported gyro instruments until late 1995. (For more information on these issues, see Section 3, below). All these facts could not but raise a legitimate question why it was neccessary to conduct such prohibited activities when, according to Iraq, all available proscribed imported missiles had been destroyed long ago.

Missile Propellants

69. Iraq declared that it had acquired from foreign suppliers some 410 tonnes of chemical components to be used to prepare the main fuel for Al Hussein missiles similar to the fuel that had been imported with SCUD-B missiles. Documents were provided by Iraq to support some of these acquisitions. Iraq declared that all chemicals had been disposed of unilaterally.

70. Iraq declared that it has not used its nitric acid production facility to manufacture oxidizer for Al Hussein class missiles. It had instead engaged in "refurbishment" of residues of the imported oxidizer (AK27I) remaining in storage tanks after the fuelling of missiles. According to Iraq, this "refurbishment" process was conducted during 1990 and some 55 tanks of oxidizer residues, i.e., over 150 tonnes of oxidizer, had been collected. Iraq stated that most of the "regenerated" oxidizer did not pass acceptance tests. No evidence has been provided by Iraq to substantiate its declarations. Iraq declared that "regenerated" oxidizer produced and "non-regenerated" oxidizer collected were destroyed unilaterally in August 1991 together with other propellants for SCUD-B/Al Hussein class missiles.

71. Iraq originally denied that it had any project to produce Al Hussein class missile propellants from raw material in Iraq. During its verification effort, the Commission learned that contrary to Iraq’s statements, there had been a project, prior to the Gulf War, to construct a dedicated facility in Iraq to produce proscribed missile propellants. Documents found in August 1995 confirmed the validity of this information. The documents also revealed that the implementation of the project had continued after the adoption of resolution 687 (1991) in April 1991. After the Commission presented its evidence to Iraq, Iraq admitted, in 1996, that such a project had existed and its construction had continued after April 1991. Iraq explained that the completion of the construction of the project’s buildings had been accomplished after April 1991 as a part of the "reconstruction campaign" and the project had not been fully implemented due to technical difficulties in the procurement of some equipment. The site is currently used by Iraq for the production of solvents and cleaning solutions and it is currently under the Commission’s monitoring.

72. In addition to efforts to acquire propellants for Al Hussein class missiles and as a part of its efforts to develop a next generation of long-range missile systems with increased ranges, Iraq procured a more advanced missile fuel - hydrazine based UDMH. It also established a plan to construct a factory in Iraq for the production of 500 tonnes/year of UDMH. Iraq initially denied plans to design a missile engine using UDMH. In 1995, it admitted that it had had such plans and had actually carried out a static test of a SCUD-B engine modified for use with UDMH. Iraq declared that it had imported 10 tonnes of UDMH and ordered, but did not receive, more. Except for fuel used in the static test, the remaining quantity of imported UDMH had been declared by Iraq as unilaterally destroyed in 1991. No evidence or documentation were presented by Iraq to support this declaration.

BADR-2000 Missile System

73. In 1984, Iraq signed contracts for the importation of 115 surface-to-surface missiles called BADR 2000 and for the establishment in Iraq of the infrastructure for the production of the first stage solid propellant rocket motors for missiles of this class. The construction of the

infrastructure, including a facility for the final integration and testing of the complete missile, started in 1985. Iraq declared that it had experienced difficulties with the supplier Government with regard to the provision of the missiles as well as support and production equipment. After contract delays and in an effort to receive some of the contracted items, Iraq signed another contract, in 1987, for the provision of only 17 complete BADR 2000 missiles and missile ground support equipment. Iraq declared that it soon realized that it would not receive any of the contracted missiles, nor most of the contracted infrastructure. Iraq terminated the contracts with this supplier Government in late 1988. Iraq declared that, in the beginning of 1989, it attempted to complete the BADR 2000 project by itself, in particular the production of solid propellant motors. This time it decided to deal directly with the supplier companies or their middlemen, as well as to rely on indigenous capabilities. Some additional materials, equipment and technologies were received by Iraq in 1989 and 1990. In late 1995 and early 1996, Iraq provided to the Commission substantial documentation, including contracts with suppliers, to support its declarations on the BADR 2000 project. The Commission has so far been unable to verify Iraq's declarations with the original supplier Government.

74. Iraq declared that it had never been successful in commissioning the production or integration facilities it had been building, nor in manufacturing any complete BADR 2000 missiles, nor had it received from abroad any operational missiles of this system.

75. In response to resolution 687 (1991), Iraq declared three facilities which had been under construction in Iraq as part of the BADR 2000 infrastructure as well as some of the equipment and materials procured for the programme. The Commission supervised the destruction of all declared items. In February 1992, the Commission also identified, for destruction in accordance with resolution 687 (1991), additional critical equipment and buildings at these facilities. Initially, Iraq refused to comply with this decision. Following Iraq's disclosure of the unilateral destruction in March 1992, Iraq relented and the equipment and buildings at the BADR 2000 facilities were destroyed under the Commission's supervision. In 1996, Iraq declared that it had diverted critical tools and materials from the BADR 200 programme and buried them in a hide site. These items had been declared unilaterally destroyed and were shown to the Commission in May 1992. Table 11 summarizes the destruction completed at all three BADR 2000 facilities:

Table 11

Item	Quantity	Purpose of use	Accounting status
Buildings	11	Production and testing of proscribed solid propellant rocket motors	Destroyed under UNSCOM supervision. The remaining buildings at the facilities were released by the Commission for use in non-proscribed activities and are currently under UNSCOM monitoring.

Tools	12	Casting of proscribed solid propellant rocket motors	Destroyed under UNSCOM supervision
Missile mockup	1	Weight and balance simulation	Destroyed under UNSCOM supervision
Handling equipment	12	Movement and processing of proscribed solid propellant motors	Destroyed under UNSCOM supervision
Mixing equipment	7	Manufacture of solid propellants for proscribed solid propellant motors	Destroyed under UNSCOM supervision
Casting and curing equipment	2	Preparation of proscribed solid propellant motors	Destroyed under UNSCOM supervision
Motor case preparation equipment	10	Preparation and lining of proscribed solid propellant motors	Destroyed under UNSCOM supervision
Ammonium Perchlorate (APC) processing equipment	7	Grinding and drying of APC for proscribed solid propellant motors	Destroyed under UNSCOM supervision
Welding equipment	4	Production of proscribed solid propellant motors	Destroyed under UNSCOM supervision
Maraging steel (sheets and disks)	114	Production of proscribed solid propellant motors	Destroyed under UNSCOM supervision
Quality control equipment	5	Measurement and acceptance of proscribed solid propellant motors	Destroyed under UNSCOM supervision
X-ray equipment	5	Examination of motor case welds	Destroyed under UNSCOM supervision

		and composite nozzle	
Presses, shearing and turning machines	7	Manufacture of components for proscribed rocket motors	Destroyed under UNSCOM supervision
Thermal chambers	4	Conditioning of proscribed rocket motors	Destroyed under UNSCOM supervision
Electronic equipment	1	Static testing of proscribed solid propellant rocket motors	Destroyed under UNSCOM supervision
Hydrostatic test equipment	1	Testing of proscribed motor cases	Destroyed under UNSCOM supervision
Measurement bench	1	Testing of the alignment of proscribed rocket motors	Destroyed under UNSCOM supervision

76. Through its verification and assessments, the Commission has come to the conclusion that Iraq had not received complete operational BADR 2000 missiles nor other assets required for the operational use of such missiles. The facilities specifically dedicated to BADR 2000 missile production and testing were destroyed or rendered harmless under the Commission's supervision. What remains of these facilities is currently under the Commission's monitoring as a part of the on-going monitoring in Iraq.

Supergun System

77. In response to resolution 687 (1991), Iraq declared a project to develop a gun intended to fire rocket assisted projectiles with ranges of over 150 kilometers. In 1988, Iraq contracted a foreign company for the design of such "superguns". Components were procured by Iraq for guns with a caliber of 350mm and 1000mm. Iraq conducted several trials of the 350mm guns using lead projectiles. Iraq claimed that it had never received any design, assistance, materials or equipment for rocket associated projectiles.

78. In response to resolution 687 (1991), Iraq declared components that it had acquired for both the 350mm and 1000mm guns. The Commission supervised the destruction of the declared components in 1991. An accounting of the components is provided in Table 12.

Table 12

Item	Declared Quantities	Accounting Status
Complete 350 mm gun system	1	Destroyed under UNSCOM supervision
Tubes for 350 mm gun	6	Destroyed under UNSCOM supervision
Tubes for 1000 mm gun	44	Destroyed under UNSCOM supervision
Slide bearings	15	Destroyed under UNSCOM supervision
Hydraulic recoil cylinders for 1000 mm gun	4	Destroyed under UNSCOM supervision
Steel breech for 350 mm gun	1	Destroyed under UNSCOM supervision
Brackets for 1000 mm gun	4	Destroyed under UNSCOM supervision
Bearing for 350 mm gun	1	Destroyed under UNSCOM supervision
Propellant charges for 350 mm and 1000 mm guns	1 tonne	Destroyed under UNSCOM supervision
	11 tonnes	Destroyed unilaterally
Slugs for the 350 mm gun	7	Unilaterally destroyed by Iraq. No supporting documentation or remnants were provided by Iraq.

79. Based on information provided by Iraq, obtained from independent sources and through its inspection and assessments, the Commission has come to the conclusion that, without the equipment destroyed under its supervision, Iraq does not possess a capability to indigenously produce or assemble guns of such type.

Facilities

80. In its resolution 687 (1991), the Security Council decided that Iraq should unconditionally accept the destruction, removal or rendering harmless, under international supervision, of all ballistic missiles with a range greater than 150km and related major parts, and repair and

production facilities. The following describes the status of such facilities in Iraq.

81. Iraq has not declared any facilities as "repair" facilities. The Commission has not identified facilities in Iraq which would fall under a definition of "repair facilities" for proscribed missiles under the terms of resolution 687 (1991).

82. Based on Iraq's declarations and the findings of the Commission's inspection activities in Iraq, the relevant production facilities can be subdivided into two broad categories:

(a) "main facilities" i.e. projects and factories which were dedicated to proscribed missile activities;

(b) "support facilities" i.e industrial establishments and factories in Iraq which were providing support in missile production to "main facilities". Such support was mostly in the form of the manufacture of various components of proscribed missiles or tooling for their production and assembly.

83. At the commencement of the Commission's activities in Iraq, many missile production facilities had sustained damage during the Gulf War. Some of them were practically destroyed. The Council's requirements for destruction or rendering harmless of remaining missile production facilities in Iraq were implemented in two ways. In most cases, the Commission supervised the destruction of declared equipment of such facilities without taking any specific actions as to facilities' physical infrastructure such as buildings, power supply etc. In several other cases, destruction activities were required in relation to infrastructure where such infrastructure was specific to proscribed activities. In practically all cases, facilities where equipment or infrastructure remained have been placed under the Commission's monitoring.

84. The following two tables provide the status of the implementation of the requirements for destruction or rendering harmless of infrastructure of facilities for proscribed missile production in Iraq (Table 13 deals with "main facilities" and Table 14 deals with "support facilities"). Issues related to the destruction or rendering harmless of equipment for proscribed activities have been dealt with elsewhere in this report.

Table 13

Project and facilities	Main proscribed activities in the missile area	Site locations	Actions taken by the Commission pursuant to resolution 687	Current monitoring status	Remarks
Project 144/2	Production and	Taji site	No actions taken to	Facility abandoned.	Most buildings damaged or

(Mustafa Project)	modification of SCUD/ Al Hussein class missiles (airframes, warheads)		destroy the infrastructure	Used as a storage area for some items under on-going verification	destroyed during the war.
Project 1728 (project 144/3, Mutawakeel project)	Production of Al Hussein class missiles (engines)	Taji site	No actions taken to destroy the infrastructure	Under monitoring	Most buildings damaged or destroyed during the Gulf war
		Rafah site	No actions taken to destroy the infrastructure	Under monitoring	Most buildings damaged or destroyed during the Gulf war. Converted to a facility for non-proscribed activities
		Khadimiya site	No actions taken to destroy the infrastructure	Under monitoring	Converted to a facility for non-proscribed missile activities
		Shahiyat site	No actions taken to destroy the infrastructure	Under monitoring	Construction had not been completed. Site abandoned
Project 144/4 (Karama project)	Production of Al Hussein class missiles (guidance and control systems)	Wazeriya site	No actions taken to destroy the infrastructure	Under monitoring	Converted to a facility for non-proscribed missile activities
Project 144/5	Production of Al Hussein	Qa'Qa site	No actions taken to		Facility abandoned in

(Farooq project)	class missiles (launchers)		destroy the infrastructure		1988 after destruction during an industrial accident at the site
		Dora site	No actions taken to destroy the infrastructure	Under monitoring	Most buildings destroyed during the war. Converted to a facility for non-proscribed missile activities
Project 144/7	Production of Al Hussein class missiles (liquid propellants)	Qa'Qa site	No actions taken to destroy the infrastructure	Under monitoring	Converted to a facility for non-proscribed activities
Khalid factory	Production of Al Hussein class missiles (warheads)	Qa'Qa site	No actions taken to destroy the infrastructure	Under monitoring	Converted to a facility for non-proscribed activities
Badr 2000 project (Belat Al Shuhada factory)	Production of Badr 2000 missiles (final assembly and testing)	Yawm Al Azim site	2 buildings destroyed	Under monitoring	Converted to a facility for non-proscribed missile activities
Badr 2000 project (Belat Al Shuhada factory)	Production of Badr 2000 missiles (motor cases)	Thu Al Fiqar site	No action taken to destroy the infrastructure	Under monitoring	Converted to a facility for non-proscribed missile activities
Badr 2000 project (Belat Al Shuhada factory)	Production of Badr 2000 missiles (solid propellants)	Taj Al Marik site	9 buildings destroyed	Under monitoring	Converted to a facility for non-proscribed missile activities

Table 14

Facility	Proscribed activities supported	Actions taken by the Commission pursuant to resolution 687	Current monitoring status
Nasser State Establishment	Programmes to modify and produce SCUD-B/ Al Hussein class missiles. The BADR 2000 programme. The "supergun" programme.	No actions taken to destroy the facility	Under monitoring
Badr State Establishment	Programmes to modify and produce SCUD-B/ Al Hussein class missiles. The Badr 2000 programme.	No actions taken to destroy the facility	Under monitoring
Qadisiya State Establishment	Programme to produce Al Hussein class missiles	No actions taken to destroy the facility	Under monitoring
Saddam State Establishment	Programmes to modify and produce SCUD-B/ Al Hussein class missiles. The "supergun" programme.	No actions taken to destroy the facility	Under monitoring
Qa'Qa State Establishment	Programmes to modify and produce SCUD-B/ Al Hussein class missiles. The "supergun" programme.	No actions taken to destroy the facility	Under monitoring
State Establishment for Automobile Industries	Programmes to produce SCUD-B/ Al Hussein class missiles.	No actions taken to destroy the facility	Under monitoring
State Establishment for Mechanical Industries	Programmes to produce SCUD-B/ Al Hussein class missiles. The "supergun" programme.	No actions taken to destroy the facility	Under monitoring

Salahaldeen State Establishment	Programmes to modify and produce SCUD-B/ Al Hussein class missiles.	No actions taken to destroy the facility	Under monitoring
Kindi State Establishment	Programmes to modify and produce SCUD-B/ Al Hussein class missiles. The "supergun" programme.	No actions taken to destroy the facility	Under monitoring
Nida factory	Programme to produce Al Hussein class missiles.	No actions taken to destroy the facility	Under monitoring
Harith factory	Programme to produce indigenously proscribed missile engines.	No actions taken to destroy the facility	Under monitoring
Numan factory	Programme to produce Al Hussein class missiles.	No actions taken to destroy the facility	Under monitoring

Section 3: "Missile activities in Iraq after the adoption of resolution 687 (1991) relevant to verification of its proscribed activities"

85. In its resolution 687 (1991) of 3 April 1991, the Security Council decided that Iraq should unconditionally accept the destruction, removal, or rendering harmless, under international supervision, of all ballistic missiles with a range greater than 150 kilometres, and related major parts and repair and production facilities. The Council further decided that Iraq should unconditionally undertake not to use, develop, construct or acquire any prohibited items. By its resolution 715 (1991) of 11 October 1991, the Council approved the plans for monitoring and verification of Iraq’s compliance with its obligations not to resume proscribed activities and demanded that Iraq meet unconditionally all its obligations under the plans.

86. Shortly after the adoption of these resolutions, Iraq started missile-related activities. Since then, a number of facilities and a significant cadre of engineers, scientists and technicians have been engaged in missile-related efforts in Iraq. While the scope of these activities has varied over the past seven years, the primary declared effort has been the development of a ballistic missile system with a range of up to 150 kilometres. Known variously as the Ababil-100 and/or the Samoud, this missile system is being developed in both liquid and solid propellant versions. Additionally, numerous other missile-related projects have been initiated by Iraq.

87. In November 1993, Iraq informed the Security Council that the Government of Iraq had decided to accept the obligations set forth in resolution 715 (1991) and to comply with the provisions of the plans for ongoing monitoring and verification contained therein.

88. Through its disarmament and monitoring inspections, the Commission obtained evidence

that, after adoption of resolutions 687 (1991) and 715 (1991), Iraq undertook, in parallel to its activities declared under the Commission's Monitoring Plan, covert activities that were not in conformity with the requirements of those resolutions and the obligations of Iraq. The established cases of covert activities included:

> Retention of production equipment, tooling, missile components and documentation which were acquired or used by Iraq for production of proscribed missiles and would be required for similar proscribed activities in the future;
>
> Work on proscribed key missile components and designs; importation of proscribed missile components and secret acquisition of items declarable under the Monitoring plan;
>
> Concealment of ballistic missile projects and facilities specifically established for missile-related production.

89. Iraq's failure to comply with its obligations can be traced, in a number of cases, to decisions made at the highest levels of the Government of Iraq. Some proscribed or undeclared activities, planned or ongoing, were known to the Governmental ministries and agencies but were allowed to start or continue. These findings are based on Iraq's own declarations, contemporaneous documents available to the Commission and official explanations by Iraq. Iraq maintains that most or all of such decisions were made not by the Government but by Lt. General Hussein Kamil Hassan Al-Majid. Prior to his defection from Iraq in August 1995, Lt. General Hussein Kamil held a variety of top positions in the Government such as Minister of Defence, Presidential Adviser, Director of Military Industrialization Commission, Minister-Supervisor, etc.

90. The evidence available to the Commission and presented in this report shows that:

> at the time of the adoption of resolution 687 (1991), Iraq took a decision to retain, by a variety of methods, practically all available capabilities for the production of proscribed missiles, in particular liquid propellant missiles of Al Hussein class;
>
> in spite of the decision to unilaterally destroy all remaining prohibited items in July 1991, secret efforts were made to preserve essential capabilities for resumption of proscribed activities in the future;
>
> facilities in Iraq were tasked to undertake proscribed activities or carry out, in secret, activities that Iraq was obliged to declare under the Monitoring Plan.

91. These findings are based on evidence obtained by the Commission and information provided by Iraq itself since August 1995. They may indicate the origin of remaining gaps in the material balances of proscribed items as presented in this report. The following provides a brief description of the main established cases of activities, after April 1991, in contravention of Iraq's obligations under Security Council resolutions 687 (1991) and 715 (1991).

Retention of production equipment, tooling, missile components and documentation which were acquired or used by Iraq for its production of proscribed missiles and would be required for similar proscribed activities in the future

92. After the adoption of resolution 687 (1991), Iraq attempted to retain all available production equipment from its factories to manufacture liquid propellant engines for proscribed Al Hussein class missiles. As reported above, this equipment was destroyed or rendered harmless by the Commission only in July 1995. Up to November 1995, Iraq had been misleading the Commission as to the nature and capabilities of the equipment retained.

93. After the adoption of resolution 687 (1991), Iraq also retained specialized tooling and fixtures that had been used with production equipment for proscribed missile production. Only after the submission of its latest FFCD in the missile area in June 1996 and after the Commission presented its evidence, did Iraq declare that "most important" tooling for missile production equipment - in particular, for proscribed Al Hussein missile airframe and engine manufacturing - had been purposefully diverted from the earlier declared July 1991 unilateral destruction. According to Iraq, these tools and some missile components were then buried at a site of the Special Republican Guard in a manner such that they would be preserved for future use. Iraq claimed that the tooling hidden at this site had been excavated secretly by Iraqi personnel in March 1992 and had been subsequently unilaterally destroyed.

94. Iraq declared that, at the time of the adoption of resolution 687 (1991), it had also decided to retain components and assemblies of proscribed missiles but then unilaterally destroyed them in the second half of 1991. As reported above, Iraq stated that most of the items had been melted in secret.

95. Iraq also retained technological and know-how documentation required for the production of proscribed missiles, in particular of the Al Hussein class. Boxes of such documentation were obtained by the Commission in August 1995 at the so-called "Chicken farm". The documentation included detailed plans, procedure manuals and drawings for production of proscribed missiles and their components. It should be noted that technological documentation for the final assembly of Al Hussein missiles was not found either in the boxes of August 1995 or since.

96. Iraq retained, until late 1995, a parachute device for retarding Al Hussein warheads despite repeated questions posed by the Commission concerning such a proscribed device. Iraq has not provided technically consistent explanations for the procurement of such systems prior to adoption of resolution 687 (1991) nor for the retention of the set until 1995.

Work on proscribed key missile components and designs; importation of proscribed missile components and secret acquisition of items declarable under the Monitoring plan

97. The Commission has obtained evidence that Iraq continued work on some key proscribed missile components after the adoption of resolutions 687 (1991) and 715 (1991). In particular, this involved such areas as gyroscope instruments for prohibited missile guidance and control systems, a technology Iraq had not fully succeeded in developing itself prior to the Gulf war.

Most of these prohibited activities were declared by Iraq only in late 1995 or early 1996.

98. After the adoption of resolution 687 (1991), Iraq continued to import components for gyroscope instruments until at least November 1991. These components had been ordered by Iraq prior to the Gulf war specifically for use in proscribed missiles. Iraq initially denied any dealing with the supplier of these components but, given the information obtained by the Commission, admitted extensive deals with the supplier. Iraq could not provide evidence to support its statements that, contrary to available evidence and documentation, only a single contract was signed with this supplier in May 1988 for the delivery of proscribed gyroscope instruments and their components had been in force.

99. In November 1993, "working groups" were established in Iraq tasked to work on gyroscope instruments of the proscribed missile. Iraq declared that the order to begin this effort was issued by Lt. General Hussein Kamil. To accomplish the task, samples of original SCUD-B gyroscopes were required. As Iraq’s officials told the Commission, one engineer, of his own accord, had kept one set of three such gyroscopic instruments in his home as a "souvenir". The engineer then decided to turn these instruments over to the new working groups. In addition, a technician is said to have turned in microfilmed drawings of proscribed gyroscopic instruments done by a foreign supplier prior to the Gulf War. Iraq declared that the gyroscope project had been stopped after only two weeks of work. Drawings produced by the working groups, along with the gyroscopes themselves, were claimed to have been confiscated by Iraqi authorities in 1993, but it was decided not to hand them over to the Commission at that time. The microfilm with drawings was said to have been destroyed. Due to the lack of supporting documentation, the Commission is not able to verify Iraq's declarations on the nature and duration of these proscribed activities nor on disposal of all proscribed items and drawings involved.

100. Evidence available to the Commission shows that during the same period of time, in 1993, Iraq attempted to procure from abroad guidance components for proscribed Al Hussein missiles. This poses the obvious question why there was a need to procure, in 1993, components specifically used in proscribed missiles when all such missiles had been allegedly destroyed in 1991. A missile facility in Iraq signed a contract with a foreign middleman to acquire a key component (potentiometers) for proscribed SCUD-B/Al Hussein gyroscopes that Iraq stated it was not able to produce or procure before the Gulf war. Under the contact, the middleman purchased and brought to Iraq a number of components and samples of proscribed missile gyroscopes. According to Iraq, its officials learned of the content of the shipment and ordered it to be removed from the country. They warned missile establishments in Iraq not to deal further with this middleman. The shipment was declared removed from Iraq in May 1994. The Commission was not able to verify the content of the shipment nor its removal from Iraq.

101. In August 1994, two major missile facilities in Iraq signed new contracts with the same middleman whom they had been warned not to deal with. According to Iraq, the director of one of them included in his order a "secret list" detailing a wide variety of production and other technologies including missile gyroscope instruments that the middleman was to deliver. The "secret list" from this contract was worth several million dollars. After several months, the middleman obtained from a foreign supplier a cache of gyroscopes and accelerometers for long range missiles proscribed under resolution 687 (1991). The middleman managed to ship some of

these proscribed items to Iraq in July 1995. A shipment of additional gyroscopes under the contract was intercepted in Jordan in November 1995. Iraq initially denied that it had been involved in this acquisition of proscribed items. When it admitted its involvement in December 1995, it stated that the middleman mistakenly purchased gyroscopes which Iraq had never ordered. The Government of Iraq declared that it had formally investigated this case. Documents related to the middleman's activities were provided to the Commission. The Commission has conducted an extensive investigation into this case. The investigations confirmed that Iraq's authorities and missile facilities had been involved in the acquisition of proscribed components.

102. Until late 1995, Iraq retained a number of original gyroscope instruments for proscribed SCUD-B/Al Hussein missiles. In October 1995, Iraq turned over to the Commission more than a dozen proscribed gyroscopes and related technical drawings. Iraq explained that, following Lt. General Hussein Kamil's defection, an "amnesty" order was issued by the Government. By this order, retained proscribed components could be turned over "anonymously" at various collection points. The gyroscopes appeared as a result of this campaign. The Commission asked for specific explanations regarding the reasons for retention of proscribed items, the "collection" sites, dates of collection of items etc. Iraq has not provided complete clarifications of these events.

103. Available evidence revealed that Lt. General Hussein Kamil had a meeting with senior engineers in May 1993 to assess missile activities ongoing in Iraq at that time. Notes taken of the meeting indicated that among the issues discussed were a turbo pump to feed four Volga/SA2 missile engine combustion chambers and a design of the engine for a "larger missile". These activities were not declared to the Commission at that time. Such activities could have been of a proscribed nature.

104. Iraq declared that work on the turbo pump to feed simultaneously four Volga/SA2 missile engine combustion chambers actually started at the beginning of 1995. Assistance from abroad had been sought by Iraq for this project. Iraq stated that the effort achieved no tangible results. According to the Commission's assessment, a single stage missile with four engines of this type could have a range in excess of the permitted limit of 150 kilometres.

105. Iraq declared that work on the 7-ton thrust missile engine had only started in June 1995. Such an engine could increase substantially the propulsive force of the then-declared missile system under development, which already had a range just below the permitted threshold of 150 kilometres. The engineer involved in the project claimed to have no knowledge of the purpose of the development of the new engine. He stated that no designs had been completed. No documentation has been provided by Iraq regarding these activities.

106. At the end of 1994 or the beginning of 1995, an order was issued to design a multi-stage Space Launch Vehicle capable of placing a small satellite into a very low orbit. Such a missile system would be capable of carrying weapon payloads far beyond permitted ranges. According to Iraq's declarations, missile establishments started a feasibility study. Several designs based on Volga/SA2 surface-to-air missiles were simulated. The report on this study was prepared in February 1995, concluding that the idea was not feasible given the capabilities available to Iraq. Allegedly the project was stopped shortly thereafter. This project was declared to the Commission in August 1995. Simulations of the system's trajectory, some minutes of meetings

and a portion of the final report were provided by Iraq as supporting evidence. The chief engineer involved in the project stated that he knew at the time that this subject was prohibited by the United Nations and that clustering and multi-stage techniques as well as separation techniques were proscribed under resolution 715 (1991).

107. In January 1996, a Commission inspection team discovered, during an on-site inspection of a missile facility, computer files with a missile simulation programme. They contained evidence that in July 1992, a flight simulation of a 3-stage missile had been executed. The simulated missile was based on proscribed SCUD-B missiles. Iraq described the product of the simulation as a "Space Launch Vehicle" that was an effort of an unidentified engineer working on his own. The inspection team later determined that the input/output data, as well as the simulation programme itself, had been copied to floppy diskettes in September 1992. Forensic examination also revealed that the diskettes obtained by the team were part of a larger collection of computer disks that were not found by the team nor provided by Iraq. Due to the manner in which Iraq interfered with the team's analysis of the acquired diskettes, a proper chain of evidence was not maintained, resulting in additional questions related to the nature and implications of the proscribed activities discovered.

108. In late 1995, Iraq declared that it had imported, in 1994, a large vacuum furnace without providing a notification to the Commission. According to Iraq, it ordered this equipment from a foreign supplier prior to the adoption of resolution 687 (1991) and specifically for production of engines for Al Hussein missiles. Pending results of its investigation of this illegal procurement, the Commission tagged components of the furnace and placed them under monitoring. In mid 1998, Iraq undertook to assemble the furnace and began its installation at one of its declared facilities for production of missile engines. The ongoing installation activities were under the Commission's monitoring.

109. In late 1993, a large shipment of ammonium perchlorate, a key ingredient of missile solid propellant, was intercepted in one of the regional sea ports outside Iraq. The shipment was intended for Iraq's missile programmes. This attempt to import missile-related materials, explicitly covered under the Monitoring plan, was not voluntarily declared by Iraq until the Commission's knowledge of this attempt was revealed to Iraq by the Commission.

Concealment of ballistic missile projects and facilities specifically established for missile-related production

110. Available evidence shows that around August 1991, Iraq started a secret project to construct a surface-to-surface missile called "J-1" without notifying the Commission as required by the Security Council resolutions. No aspect of the J-1 programme – from design, to parts manufactured, to flight-testing – was declared to the Commission until late 1995 i.e. some two years after it was allegedly aborted. Iraq states that Lt. General Hussein Kamil issued the orders both for the project itself and for the requirement to keep it a secret from the Commission.

111. During the period when work on the J-1 project was ongoing, the Commission's inspectors were told by Iraq that it was merely developing a non-proscribed Ababil-100 missile that it had declared to the Commission. As it is known now, the Ababil 100 had some specifications similar

to the J-1. Iraq admitted later that its intention had been to hide the "covert" undeclared project from inspectors within "open" work being done at declared missile facilities. Specific measures were taken by Iraq to conceal the J-1 effort from the inspection teams. Components for J-1 missiles were hidden or removed before visits of inspection teams.

112. The J-1 project was declared abandoned in May 1993. According to Iraq's declarations, prototypes of the J-1 missile were built and six flight tests were conducted in January - April 1993. Iraq provided several documents as well as imagery showing some of the test launches. Some components said to be produced under the J-1 programme were also shown to inspectors. The Commission has conducted document and computer searches at the relevant facilities to find additional supporting data – such as contemporaneous production records – to verify Iraq's declarations, albeit without success. Iraq stated that some of the hardware associated with the project had unilaterally been melted in foundries after the J-1 project had been stopped in May 1993.

113. Iraq's development of the J-1 surface-to-surface missile was based on the Volga/SA2 surface-to-air missile with certain modifications, particularly to its engine and guidance and control system. There were key similarities between the J-1 missile and the Fahad missiles that were under development in Iraq before the adoption of resolution 687 (1991). The Fahad missiles, based also on modification of Volga/SA2 systems, were proscribed weapons with declared ranges of 300 or 500 kilometers.

114. Iraq declared that the J-1 missile had never been intended to reach proscribed ranges, and stated that the longest range achieved during the tests in 1993 was 134 kilometres. The Commission has no independent information that verifies the ranges achieved in the J-1 missile flight tests. The Commission's analysis indicates that the system, as tested, was inherently capable of reaching proscribed ranges. Given certain technical aspects associated with this project, it will be difficult to conclusively verify Iraq's declarations.

115. Available evidence revealed that after the adoption of resolution 687 (1991), Iraq operated in secrecy a facility for the production of liquid propellant missile engines. The facility known as the Sadiq factory was established by a team from Project 1728 (production of proscribed Al Hussein missile engines). The facility's activity was not declared to the Commission until December 1995. Iraq stated that the work on liquid propulsion missile engines began in early 1992. This effort was declared as directed at the reverse-engineering and production of the Volga/SA2 missile engine as well as the manufacture of certain components such as missile engine shut-off valves, which the original Volga/SA2 engine did not have, but which are required for a surface-to-surface ballistic missile. Specific measure were taken to conceal this effort from inspection teams.

116. A series of static tests under this project were conducted by Iraq in 1992 and 1993. The first five tests were not declared to the Commission and were thus not monitored by inspection teams. While the plan called for production of five sets of engine hardware, Iraq declared that a smaller number of parts and components had been actually produced but that no engine had ever been assembled. Some of these parts and components were later shown to an inspection team while others were declared to have been unilaterally melted. Little documentary evidence

has been made available by Iraq to support its declarations regarding the nature of missile engine production activities at the Sadiq Factory.

117. Iraq had a project, prior to the Gulf War, to construct a dedicated facility to indigenously produce proscribed missile propellants for Al Hussein missiles (for details, see Section 2, above). The project continued after the adoption of resolution 687 (1991) in April 1991. After the Commission presented its evidence of such activities to Iraq, Iraq admitted in 1996 that such a project had existed and its construction had continued after April 1991. Iraq explained that the completion of the construction of the project's buildings had been accomplished as a part of the "reconstruction campaign" and the project had not been fully implemented due to technical difficulties in the procurement of some equipment. No supporting documentation has been provided by Iraq to support its declarations.

118. Available evidence shows that since the adoption of resolutions 687 and 715 (1991), Iraq has been seeking foreign assistance to support its declared and undeclared efforts in the missile area. The assistance sought ranged from the acquisition of particular missile parts and components, to the provision of comprehensive support for the development and production of missiles in Iraq. In most cases, Iraq did not declare these efforts or its foreign partners to the Commission until they were either fulfilled, declared abandoned by Iraq, or discovered by the Commission.

Appendix II

STATUS OF THE VERIFICATION OF IRAQ'S

CHEMICAL WEAPONS PROGRAMME

Introduction

1. According to the requirements of Security Council resolution 687

(l991), in the chemical weapons area Iraq shall declare and have destroyed, removed or rendered harmless under international supervision all stocks of chemical weapons (CW), all related components and all R&D, support and manufacturing facilities. The Security Council also demanded in its resolution 707 (1991) that Iraq provide full, final and complete disclosure (FFCD) of all aspects of its programme to develop CW and of all holdings of CW, their components and production facilities and locations. Over a period of seven years, Iraq provided to the Commission three formal FFCD's and about 20 sets of clarifications with a status of integral parts of the FFCD's.

2. All elements of Iraq's CW programme are covered by the above-mentioned Security Council provisions, including CW-related R&D, production and support capabilities and activities. Given the fact that dual-use materials and equipment and information obtained by Iraq from abroad were used in the creation of these capabilities, the procurement of those is also covered by the requirements of the Security Council resolutions. The military aspects are also covered by Iraq's obligation to disclose all aspects of its CW programme. A diagram of the full scope of Iraq's CW

programme is given in the attachment.

3. The current paper includes the material balances of those major weapons-related elements of Iraq's CW programme, which could be quantified and accounted for. These include stocks of chemical weapons (filled and unfilled special munitions and bulk CW agents), key precursors for the production of CW agents and main CW production equipment. Issues relating to the procurement, extent of R&D activities, know-how documentation on the production of CW, and military aspects of the programme could not be quantified due to their nature. Therefore, only the status of the verification of these issues is provided in this paper.

4. Iraq's CW programme was initiated in the 1970s through R&D activities. Large-scale CW-related activities, including the construction of industrial CW production facilities, procurement and production of raw materials, CW components and production equipment, production and stockpiling of CW in quantities, were carried out, according to Iraq, in the period 1982-1990.

5. Iraq' s declarations cover the organizational structure of its CW-programme, procurement and R&D activities, holdings of CW, their components and production facilities during the entire period of the implementation of the CW programme, as well as their consumption. When UNSCOM began its verification activities in 1991, only part of Iraq' s previous CW stocks, their components and production facilities remained in Iraq. According to Iraq, more than 50% of its CW stocks were consumed in the 1980s. About 70% of the CW key precursors obtained by Iraq were used, according to Iraq, for the manufacture of CW agents, both consumed and those remaining in 1991.

6. Iraq also declared that the majority of its CW production facilities were destroyed during the 1991 Gulf war by the aerial bombardment, as well as certain quantities of CW and their precursors. The Commission's verification of the proscribed materials remaining after the Gulf war was further complicated due to the unilateral destruction of significant quantities of special munitions and precursor chemicals carried out by Iraq. Iraq conducted this unilateral destruction in the summer of 1991, in direct contravention of the Security Council' s resolutions.

7. The Commission's accounting of the material balances of special munitions, bulk CW agents, key CW precursor and major CW production equipment are given below. The accounting is based on Iraq's declarations on its overall holdings of the above mentioned items in the period from 1982 to 1991.

Unfilled and filled Special Munitions

8. Iraq declared overall holdings of more than 200,000 unfilled and filled special munitions (those produced and procured for CW and BW purposes) during the entire period of the implementation of its CW programme. For the purpose of the verification of the material balance of special munitions, the Commission simultaneously attempts to account for both chemical and biological munitions, given the fact that some types of weapons originally designed for CW purposes were later filled or planned to be filled with BW agents. Special munitions include aerial bombs, artillery shells, rockets for multiple launching systems and missile warheads.

According to Iraq, of the declared total holdings of more than 200,000 special munitions, about 100,000 munitions filled with CW agents were consumed or disposed of by Iraq in the period 1982 -1988.

9. The Special Commission reported to the Security Council (S/1997/774 of 6

October 1997) that Iraq's declarations on its total acquisition and expenditure of CW munitions during the period 1982-1988 could not be verified fully due to the absence of sufficient evidence of: the procurement, indigenous production, the filling with CW agents and the consumption of special munitions prior to 1988, as declared by Iraq.

10. With respect to the munitions which existed as of January 1991, Iraq declared 127,941 filled and unfilled special munitions. These munitions have been declared by Iraq and accounted for by the Commission as follows:

a) 56,281 munitions [22,263 filled munitions and 34,018 unfilled munitions] declared by Iraq as having remained after the 1991 Gulf war:

> 40,048 munitions were destroyed under UNSCOM supervision [these comprised 21,825 filled munitions and 18,223 unfilled munitions],
>
> 16,263 munitions were not destroyed, but nevertheless accounted for by UNSCOM. These include 15,616 unfilled munitions which were converted by Iraq for conventional weapons purposes in 1993-1994. These also include 438 filled munitions destroyed, according to Iraq, during a fire accident.

The numerical discrepancy of several hundred munitions in the overall accounting can be attributed to minor deviations in the physical counting of large piles of weapons.

b) 41,998 munitions [5,498 filled munitions and 36,500 unfilled munitions] declared by Iraq as having been destroyed during the 1991 Gulf war:

> The Commission has accepted the destruction of about 34,000 munitions on the basis of multiple sources, including physical evidence, documents provided by Iraq etc. However, it has not been possible to achieve a numerical accounting of destroyed munitions due to heavy bomb damage of the CW storage facilities, where these munitions had been stored during the Gulf war,
>
> the destruction of about 2,000 unfilled munitions remain uncertain,
>
> 550 filled munitions remain unaccounted for.

c) 29,662 munitions [854 filled munitions and 28,808 unfilled munitions] declared by Iraq as having been destroyed unilaterally:

> the destruction of about 13,660 munitions, both filled and unfilled, has been accepted by the Commission on the basis of multiple sources, including physical evidence, documents provided by Iraq etc. However, it has not been possible to make

a numerical accounting of these munitions due to destruction method used by Iraq (demolition),

the accounting for 15,900 unfilled munitions which, according to Iraq, had been melted, has not been possible,

about 100 munitions filled, according to Iraq, with BW agents remain unaccounted for.

11. The material balance of 127,941 unfilled and filled special munitions declared by Iraq remaining as of January 1991 is provided in table l.

Table 1

Iraq's Declarations		Accounting Status
Munition Type (fill)*	Quantity	
1. Munitions declared by Iraq as remaining After the 1991 Gulf war		
250 gauge aerial bombs (mustard)	1,243	1,233 aerial bombs were accounted for by UNSCOM. They were

		destroyed by Iraq under UNSCOM supervision during 1992 and 1993.
250 gauge aerial bombs (Unfilled)	8,122	1) 7,627 aerial bombs were accounted for by UNSCOM. They were destroyed by Iraq under UNSCOM supervision during 1991 and 1993. 2) About 500 aerial bombs have not been found. According to Iraq, 500 aerial bombs were delivered damaged by a foreign supplier.
500 gauge aerial bombs (mustard)	1,426	1) 980 aerial bombs were accounted for by UNSCOM. They were destroyed by Iraq under UNSCOM supervision in 1992-1993. 2) Remnants of several hundred destroyed aerial bombs from 438 bombs declared by Iraq as destroyed in a fire accident in 1988, were seen by UNSCOM.
500 gauge aerial bombs (unfilled)	422	1) 331 aerial bombs were accounted for by UNSCOM and destroyed by Iraq under UNSCOM supervision. 2) Some 100 aerial bombs have not been found. According to Iraq, 100 aerial bombs were delivered damaged by a supplier.
R-400 aerial bombs (binary components of sarin)	337	1) 337 aerial bombs were accounted for by UNSCOM. 336 bombs were destroyed by Iraq under UNSCOM supervision in 1992. 2) One bomb was removed for analysis outside Iraq by UNSCOM. 3) Evidence of a few R-400 bombs produced by Iraq for BW purposes

		has been found among 337 CW bombs declared by Iraq.
R-400 aerial bombs (unfilled)	58	58 aerial bombs were accounted for by UNSCOM and destroyed by Iraq under UNSCOM supervision.
DB-2 aerial bombs (unfilled)	1,203	1,203 aerial bombs were accounted for by UNSCOM. They were destroyed by Iraq under UNSCOM supervision during 1992 and 1993.
122-mm rockets (sarin)	6,610	6,454 rockets were accounted for by UNSCOM. They were destroyed by Iraq under UNSCOM supervision during 1992 and 1993.
122-mm rockets (unfilled)	6,880	7,305 rockets were accounted for by UNSCOM and destroyed by Iraq under UNSCOM supervision.
155-mm artillery shells (mustard)	13,000	12,792 shells were accounted for by UNSCOM. They were destroyed by Iraq under UNSCOM supervision in the period 1992-1994.
155-mm artillery shells (unfilled)	16,950	1) 1,700 shells were accounted for by UNSCOM and destroyed by Iraq under UNSCOM supervision. 2) In 1998, Iraq presented documents on the conversion of 15,616 shells to conventional munitions. Of these, 1,779 converted shells were accounted for by UNSCOM.
Special missile warheads (sarin/binary components of sarin)	30	1) All 30 warheads were accounted for by UNSCOM. 2) Of those, 29 warheads were destroyed by Iraq under UNSCOM supervision during 1992 and 1993, and 3) One warhead was removed for analysis outside Iraq by UNSCOM.

Sub total of munitions remaining after the 1991 Gulf war	56,281	
2. Munitions declared by Iraq as destroyed during the 1991 Gulf war		
500 gauge aerial bombs (CS)	116	1) No remnants of destroyed bombs have been found. 2) In 1995, documentary evidence was provided by Iraq that 116 bombs filled with CS had been stored at a facility destroyed during the Gulf war.
R-400 aerial bombs (binary components of sarin)	160	1) In 1992, remnants of bombs consistent with the declared quantity of bombs were seen by UNSCOM. 2) The circumstances of destruction have not been fully clarified.
DB-2 aerial bomb (sarin)	12	1) In 1991, remnants of up to 50 bombs were seen by UNSCOM. 2) In 1996, documentary evidence was found by UNSCOM that DB-2 bombs had also been filled with mustard (which was not declared). In 1997, Iraq stated that only a few bombs were filled with mustard for trials.
122-mm rockets (sarin)	4,660	1) In 1991, two locations were seen by UNSCOM where rockets had been destroyed. Evidence of many destroyed rockets was found. 2) In the period 1991-1998, remnants of about 4,000 rockets

		were recovered and accounted for by UNSCOM.
122-mm rockets (unfilled)	36,500	1) Completely destroyed hangers where rockets had been destroyed were seen by UNSCOM. Evidence of many destroyed rockets was found. Accounting for the remnants was not possible due to the extent of the destruction. 2) In 1995, documentary evidence was provided by Iraq that 36,500 rockets had been stored at a facility destroyed during the Gulf war.
155-mm artillery shells (mustard)	550	1) No evidence has been found of 550 shells declared by Iraq as having been lost shortly after the Gulf war. 2) In July 1998, Iraq provided a progress report on its ongoing internal investigation.
Sub total of munitions destroyed during the 1991 Gulf war 1	41,998	
3. Munitions declared by Iraq as destroyed unilaterally		
250 gauge aerial bombs (CS)	125	Remnants of bombs consistent with the declared quantity were seen by UNSCOM.
250 gauge aerial bombs (unfilled)	2,000	1) Remnants of 1,400 destroyed bombs were accounted for by UNSCOM. 2) UNSCOM was presented with ingots declared to be from the melting of 600 bombs. The material presented could not be assessed as adequate for proper verification.
R-400 aerial bombs	527	1) Remnants of bombs consistent with the declared quantity were

(binary components of sarin)		seen by UNSCOM. 2) Iraq presented supporting documents on the destruction of 527 bombs .
R-400 aerial bombs (biological warfare agents)	157	1) In the period 1992-1998, remnants of up to 60 bombs were accounted for by UNSCOM. 2) Supporting documents on the destruction were presented by Iraq (without reference to the type of agents filled into them).
R-400 aerial bombs (unfilled)	308	1) No evidence was presented of 117 bombs declared by Iraq as having been melted. 2) No evidence was presented of 191 melted bombs declared as defective.
122-mm rockets (unfilled)	26,500	1) Remnants of 11,500 rockets destroyed through demolition were seen by UNSCOM. Accounting was not possible due to the state of destruction. 2) UNSCOM was presented with ingots declared to be from the melting of 15,000 rockets. The material presented could not be assessed as adequate for proper verification.
Special missile warheads (binary components of sarin / biological warfare agents)	45	1) In the period from 1992 to 1998, remnants of 43-45 special warheads were recovered and accounted for by UNSCOM. 2) In the period from 1997 to 1998, remnants of 3 additional warheads declared as special training warheads were recovered. 3) In 1998, degradation products of

		CW agent VX were found on some of the remnants of special warheads. 4) Supporting documents were provided by Iraq on the overall accounting for special warheads and on the unilateral destruction of 45 warheads.
Sub total of munitions destroyed unilaterally	29,662	

1 - 20,000 motor bombs filled with the riot control agent CS, which were destroyed during the Gulf war at one of the storage facilities, are not included in the table.

2 - Components of special munitions, including boosters and fuzes, are not included in the table.

The majority of these components were not presented by Iraq for verification. According to

Iraq, single-use components were destroyed unilaterally and dual-use components were used

for conventional purposes. UNSCOM was able to verify their disposition partially.

* - The following unfilled munitions were produced indigenously by Iraq:

250 and 500 gauge aerial bombs, R-400 aerial bombs, DB-2 aerial bombs, warheads for 122-mm rockets, missile warheads.

The following empty munitions were procured by Iraq:

250 and 500 gauge aerial bombs, 155-mm shells and 122-mm rockets.

Bulk CW Agents

12. Iraq declared the overall production of 3,859 tonnes of CW agents during the entire period of the implementation of its CW programme. According to Iraq's declarations, mustard, tabun and sarin were produced in large quantities. Not withstanding the admitted production of 3.9 tonnes of VX, Iraq states that attempts to produce VX had failed.

13. According to Iraq, of the declared total quantity of 3,859 tonnes of CW

agents produced, 3,315 tonnes of agents were weaponized. Iraq declared that about 80% of the weaponized CW agents were consumed in the period from 1982 to 1988. In addition, some 130 tonnes of non-weaponized CW agents were claimed to have been discarded by Iraq in the 1980s.

14. The Special Commission reported to the Security Council (S/1997/774 of 6 October 1997) that Iraq’s declarations on its total production and holdings of CW agents could not be verified

fully due to the absence of sufficient evidence provided by Iraq and its former foreign suppliers of the procurement of CW precursor chemicals, production and weaponization of CW agents prior to 1988.

15. Iraq declared that 412.5 tonnes of bulk CW agents available in Iraq as of January 1991. These have been accounted for as follows:

411 tonnes of bulk CW agents were destroyed under UNSCOM supervision,

1.5 tonnes of CW agent VX were discarded unilaterally by Iraq and remain unaccounted for.

16. The material balance of 412.5 tonnes of bulk CW agents remaining in Iraq as of January 1991 is provided in table 2.

Table 2

Iraq's Declaration		
Bulk CW Agent (storage form)1	Quantity (tonnes)	
Mustard (20m3 / 1m3 containers)	295	295 tonnes of mustard were destroyed by Iraq under UNSCOM supervision.
Tabun (2m3 containers)	76	76 tonnes of tabun were destroyed by Iraq under UNSCOM supervision.
Sarin and its mixtures (2m3 containers)	40	40 tonnes of tabun were destroyed by Iraq under UNSCOM supervision.

VX (1m3 containers)	1.5	1) According to Iraq, 1.5 tonnes of VX were discarded unilaterally by dumping on the ground. 2) Traces of one VX-degradation product and a chemical known as a VX-stabilizer were found in the samples taken from the VX dump sites. 3) A quantified assessment is not possible.
Total	412,5	

1 - Only bulk CW agents are included in this table. The accounting of weaponized CW agents is covered in table 1.

Material Balance of key CW Precursor Chemicals

17. Iraq declared that some 20,150 tonnes of key precursor chemicals had been produced by Iraq and procured from abroad for the production of CW agents during the entire period of the implementation of its CW programme.

18. According to Iraq, of the declared total quantity of over 20,000 tonnes of key precursors, 14,500 tonnes were used either for the production of CW agents or for the production of other key precursors for these CW agents. The rest, 5,650 tonnes, was not used in the production of CW agents, and therefore needs to be accounted for separately.

19. Iraq's declarations on its total holdings of key precursors over the period of 8 years could not be fully verified due to the absence of sufficient evidence provided by Iraq and its foreign suppliers for Iraq's procurement and the consumption of key precursors in the production of CW agents prior to 1988, as declared by Iraq.

20. Iraq declared that 3,915 tonnes of key precursors remained in Iraq as of January 1991. According to Iraq, the discrepancy between calculated quantities of precursors left over from the production of CW agents (5,650 tonnes) and quantities of precursors declared by Iraq as remaining in January 1991 (3,915 tonnes) could have occurred due to the lack of sufficient information and full records on the actual delivery by former suppliers, on the consumption of precursors in the production of CW agents, and on the losses of key precursors, including through unsuitable storage, spillage, leakage etc.

21. 3,915 tonnes of key precursors remaining in January 1991 have been accounted for as follows:

2,850 tonnes were accounted for by UNSCOM. Of these, 2,610 tonnes of key precursors were destroyed under UNSCOM supervision,

823 tonnes were declared by Iraq as having been destroyed during the Gulf war. The Commission was able to confirm qualitatively the destruction of these precursors. It was not possible to make a quantitative verification,

242 tonnes were declared by Iraq as having been destroyed unilaterally in the summer of 1991. These include all precursors for the production of VX. The declared destruction of these 242 tonnes of key precursors was only partly accounted for.

22. The material balance of 3,915 tonnes of key precursors declared by Iraq remaining as of January 1991 is provided in table 3.

Table 3

	Key Precursor (related CW agents)		Iraq's Declarations (In tonnes)		Key Precursors physically remaining in Iraq and destroyed under UNSCOM Supervision
			Quantity of key Precursor destroyed during the Gulf war in 1991	Quantity of key Precursor destroyed unilaterally by Iraq	

				in summer 1991	
1	2	3	4	5	6
1	D4* (tabun)	166	none	none	166 tonnes were destroyed under UNSCOM supervision.
2	POCl3** (tabun)	477	none	none	576 tonnes were destroyed under UNSCOM supervision.
3	Dimethylamino-hydrochloride (tabun)	295	30 1) Evidence of destruction was seen by UNSCOM . 2) Accounting was not possible due to the state of destruction.	none	272 tonnes were destroyed under UNSCOM supervision.
4	Sodium cyanide ** (tabun)	371	none	none	180 tonnes were destroyed under UNSCOM supervision.
5	Thiodiglycole* (mustard)	377	120 1) Evidence of destruction was seen by UNSCOM . 2) Accounting	none	188 tonnes were destroyed under UNSCOM supervision.

			was not possible due to the state of destruction.		
6	Thionylchloride* ** (mustard, GB, GF and VX)	none	100 1) Evidence of destruction was seen by UNSCOM . 2) Accounting was not possible due to the state of destruction.	none	282 tonnes were destroyed under UNSCOM supervision.
7	PCl 3 ** (mustard, GB, GF and VX)	2,422	none	none	650 tonnes were destroyed under UNSCOM supervision.
8	MPF* (GB, GF)	67	9 1) Evidence of destruction was seen by UNSCOM . 2) Accounting was not possible due to the state of destruction.	30 1) Evidence of destruction was seen by UNSCOM . 2) Accounting was not possible due to the state of destruction.	20 tonnes were destroyed under UNSCOM supervision.
9	HF ** (GB, GF)	181	none	none	1) 11 tonnes were destroyed under UNSCOM supervision. 2) About 200 tonnes

					were released by UNSCOM for civilian use. 60 tonnes thereof have already been consumed and 140 tonnes remain under UNSCOM monitoring.
10	Isopropanol ** (GB)	465	none	none	445 tonnes were destroyed under UNSCOM supervision.
11	Cyclohexanol (GF)	120	105 1) Evidence of destruction was seen by UNSCOM . 2) Accounting was not possible due to the state of destruction.	none	Tens of tonnes were consumed by Iraq in the 1990s for civilian purposes under UNSCOM supervision.
12	P2S5 (VX)	242	85 1) Evidence of destruction was seen by UNSCOM . 2) 168 empty barrels (200L) from P2S5	157 1) Evidence of destruction was seen by UNSCOM . 2) 153 tonnes were accounted for by	none

			sufficient for 34 tonnes were accounted for by UNSCOM.	UNSCOM.	
13	Diisopropyl amine (VX)	210	174 1) Evidence of destruction was seen by UNSCOM . 2) Accounting was not possible due to the state of destruction.	none	22 tonnes were destroyed under UNSCOM supervision.
14	Chloroethanol (VX)	202	200 1) Evidence of destruction was seen by UNSCOM . 2) Accounting was not possible due to the state of destruction.	none	2 tonnes were destroyed under UNSCOM supervision.
15	"Iraqi" Choline* (VX)	55 1	none	55 1 1) UNSCOM took samples from the dump site. 2) Degradation products of choline were found in the samples. 2) Accounting was not	none

				possible due to the state of destruction.	
16	Sub total	5,650 2	823	242	2,810

1 - Quantities of key precursors declared by Iraq in 1995 as having been destroyed unilaterally in 1991.

2 - Only key precursors that Iraq declared as remaining as of January 1991 are included in the column. The following key precursors, according to Iraq, were fully consumed prior to 1991: DMMP, MPC, TMP, MPS, and they are not included in the table.

* - Key precursors, which Iraq was able to produce indigenously in varying quantities (including DMMP, MPC, MPS and TMP).

** - According to Iraq, discrepancies in rows # 2, 4, 6, 7, 9, 10 between calculated quantities of precursors left over from the production of CW agents (column 3) and quantities of precursors presented by Iraq (column 6) could have occurred due to the lack of sufficient information and/or proper record keeping:

a) on the actual delivery of precursors by foreign suppliers,

b) on the actual consumption of precursors in the production of CW agents, and

c) on the losses of key precursors, including through unsuitable storage, spillage, leakage etc.

Material Balance of major CW Production Equipment

23. CW production and support facilities were constructed in Iraq from 1983 to 1990. According to Iraq, all CW agent production plants were located at the Muthanna State Establishment (MSE). Iraq declared that all CW agents were produced only at MSE.

24. The special mechanical workshop for the production of two types of special munitions (250 and 500 gauge aerial bombs) was also located at MSE. Other types of indigenously produced special munitions were manufactured by general purpose establishments, Nasser State Establishment (R-400 aerial bombs), State Establishment for Mechanical Industries (DB-2 aerial bombs) and Project 144/2 (special missile warheads and warheads for 122-mm rockets). Iraq declared that all special munitions had been filled with CW agents only at MSE.

25. Prior to 1986, the majority of precursors for the production of CW agents were procured by Iraq from abroad. In the period 1985-1990, Iraq constructed three facilities (Fallujah 1, 2 and 3) and new production plants at MSE to produce indigenously CW precursor chemicals (PCl 3, POCl 3, SOCl 2 and TMP).

26. The majority of the equipment for the above mentioned production plants was procured by Iraq from abroad. Some of these production plants were constructed, assembled or completely

furnished with equipment by foreign companies.

27. Iraq declared that 553 pieces of production equipment were installed at 15 production plants which had been involved in or procured for the production of CW agents, their precursors and special munitions. These include chemical process equipment (reactor vessels, condensers, heat exchangers, columns and tanks). They also include mechanical equipment (presses, moulds, welding and rolling machines) used or planned to be used solely for the production of special munitions. These 553 pieces of equipment have been accounted for as follows:

480 pieces of chemical production equipment were accounted for by UNSCOM. 405 of these were destroyed under UNSCOM supervision,

75 broken pieces of equipment damaged during the 1991 Gulf war were accounted for by UNSCOM,

Several tens of pieces were buried under the debris of CW production buildings destroyed during the Gulf war.

28. In addition in 1997, 197 pieces of glass production equipment were admitted by Iraq and destroyed under UNSCOM supervision.

29. The material balance of the main production equipment from Iraq's CW production and support facilities is provided in Table 4.

Table 4

Production Plant/Unit (Location & past Use)	Iraq's Declarations on Quantities of key Pieces of Production Equipment in their original Configuration	Accounting Status
Mustard plant, P8 (MSE), production of mustard, attempts to produce VX.	22	1) The majority of equipment was destroyed during the Gulf war. 2) 12 remaining pieces were destroyed under UNSCOM supervision.

Tabun/sarin plant and hydrolysis plant, P7 (MSE), production of tabun & sarin.	16 + 20	1) Equipment was partly destroyed during the Gulf war. 2) The hydrolysis plant was used for the destruction under UNSCOM supervision of tabun, sarin and their precursors. After the completion of the destruction of sarin, the remaining 17 pieces of equipment were destroyed under UNSCOM supervision.
Multipurpose plant, Dhia (MSE), production of precursors (MPS), production of VX.	42	1) A few pieces of equipment were destroyed during the Gulf war. 2) 39 remaining pieces of equipment were destroyed under UNSCOM supervision.
Multipurpose plant, Malek (MSE), production of precursors (DMMP, MPC, MPS, choline), production of tabun & VX.	25	1) All equipment was damaged during the Gulf war. 2) 24 broken pieces of equipment were accounted for by UNSCOM.
Multipurpose plant, Mohammed (MSE), production of precursors (D4, MPC), production of tabun.	32	1) All equipment was destroyed or damaged during the Gulf war. 2) 25 broken pieces of equipment were accounted for by UNSCOM.
Multipurpose plant, A1 (MSE), production of precursors (MPC, MPF).	33	1) All equipment was destroyed or damaged during the Gulf war. 2) 7 remaining pieces of equipment were destroyed under UNSCOM supervision. 3) 26 broken pieces of

		equipment were accounted for by UNSCOM.
Multipurpose plant, A2 (MSE), production of precursors (MPF), production of sarin.	29	1) Equipment was partly destroyed during the Gulf war. 2) 14 remaining pieces of equipment were destroyed under UNSCOM supervision.
Multipurpose plant & associated facilities, A3 (MSE), production of precursors (PCl3, DMPH, MPC), production of phenol and other commercial chemicals.	40	40 pieces of equipment were destroyed under UNSCOM supervision.
Multipurpose pilot plants, H1, H2, H3 (MSE), production of precursors (D4, DMMP, MPC, MPF), production and distillation of sarin.	23 + 23 + 13	59 pieces of equipment were destroyed under UNSCOM supervision.
Precursor plant, Mamun (Fallujah 2), production of precursors (Thionylchloride, MPC, MPF).	29	1) Equipment was partly destroyed or damaged during the Gulf war. 2) 26 pieces of equipment were destroyed under UNSCOM supervision.
Precursor plant, TMP (Fallujah 2), construction was not completed.	15	All equipment was completely destroyed during the Gulf war.
Inhalation chamber (MSE)	1	Destroyed under UNSCOM supervision.
Equipment stores (Fallujah 2, Fallujah 3)	85	85 pieces of equipment were destroyed under UNSCOM supervision.
Aerial bomb workshop (MSE)	100	100 pieces of equipment were destroyed under UNSCOM supervision.

Filling station (MSE)	5	1) 4 pieces of equipment were completely destroyed during the Gulf war. 1) 1 unit was destroyed under UNSCOM supervision.
Total	553	1) 405 pieces of equipment were destroyed under UNSCOM supervision. 2) 75 pieces of broken equipment damaged during the 1991 Gulf war were accounted for by UNSCOM. 3) Several tens of pieces of equipment are buried under the debris of production buildings destroyed during the 1991 Gulf war.
Miscellaneous	1) 197 pieces of glass production equipment procured by MSE for pilot plants were admitted by Iraq in 1997 and destroyed under UNSCOM supervision. 2) 18 pieces of chemical process equipment, procured by MSE, but, according to Iraq, not used or planned to be used for CW purposes remain in Iraq at general-purpose establishments under UNSCOM monitoring.	

Procurement of Materials and Equipment used by Iraq for CW Purposes

30. Iraq declared the procurement of significant quantities of precursor chemicals, production equipment, empty munitions and machinery for the production of empty munitions from abroad in the period from 1982 to 1990. Iraq also declared having had foreign assistance in the construction of several CW-production and support plants in the 1980s.

31. Iraq's declarations on the procurement of chemical precursors were partly verified by the Commission on the basis of information provided by the foreign suppliers. Iraq supported its declarations with some original documents, including copies of several contracts and shipping documents. However, it has not been possible to verify the acquisition of several thousand tonnes of precursor chemicals due to the absence of information requested from the foreign

suppliers. This includes several hundred tonnes of essential precursors for the production of the chemical warfare agent VX.

32. Iraq's declarations on the procurement of the production equipment used or planned to be used for the production of chemical warfare agents and their key precursors were verified by the Commission with respect to the majority of the declared items. This was achieved through field inspections, evaluation of documents provided by Iraq, and through contracts and letters of credits made available to the Commission by Iraq and the foreign suppliers. However, the verification of equipment from the latest contracts, delivered to Iraq in 1988 and 1989, was not possible due to the lack of information from the foreign suppliers.

33. The Commission was only partly able to verify Iraq's declarations on the acquisition of empty munitions from the foreign companies. Despite many requests sent by the Commission to the foreign suppliers and their governments, the information required had not been made available to the Commission. Nevertheless, the Commission through inspection activities was able to independently establish the types and origin of munitions procured.

34. Iraq cooperated to a certain extent with the Special Commission on the verification of the procurement of the above mentioned CW-related materials and items. The Commission believes that in the area of the procurement of CW related items and materials, with the means available to the Commission, it has achieved a stage of verification where further progress could only be made with the full cooperation of the former suppliers.

R&D Activities

35. Iraq provided declarations on its chemical warfare agents and chemical munitions related R&D activities and their results. Some of these declarations were supported by the documentation provided by Iraq. In addition, in the files admitted by Iraq at the Haidar farm ("Chicken Farm") in August 1995 the Commission found many R&D reports which supported Iraq's declarations. As a result, the Commission has a good understanding of the extent of Iraqi research on the types of CW produced by Iraq in quantities. These include the following chemical warfare agents and munitions: mustard, tabun, sarin, CS, 122-mm rocket, 155-mm shell, BR-250, BR-500, LD-250, AALD-500, R-400, DB-2 aerial bombs and special warheads for the Al-Hussein missiles.

36. However, it was not possible to verify the full extent of several R& D projects carried out by Iraq from 1989 to 1990, due to the absence of sufficient data from documents and other verifiable evidence. Those include the research on new chemical warfare agents, BZ and Soman. These also include Iraq's efforts to develop new delivery means for CW-agents, such as special warheads other than for Al-Hussein missiles, i.e. FROG missile, and real binary artillery munitions and aerial bombs. Evidence of such studies was found in the documents from the Haider farm. On the other hand, the Commission did not find evidence that Iraq had reached the stage of industrial production of these materials and items.

Military Aspects of CW Programme

37. The military aspects of CW programme cover the deployment of chemical munitions, the firing and bombing tables for the specific types of chemical munitions, military requirements in chemical weapons, the field manuals on the use of chemical weapons, and the chain of command and the responsibilities for the use of chemical weapons.

38. The Commission's verification activities of the military aspects were the most sensitive elements of its investigation of Iraq's CW-programme. The Commission's attempts to clarify these issues created controversy on the Iraqi side. The document found by the Commission in July 1998 at the Head Quarters of the Iraqi Air force was an example of the documentation related to the military aspects. It detailed the expenditure of special munitions by the Air Force during the Iran-Iraq war. It was taken away by the Iraqi authorities from the Commission's inspection team in the course of the inspection and was not returned to the Commission.

39. The issue most evaluated from the military aspects of the programme is the deployment of chemical munitions from the production and storage facilities to the Army and Air Force in 1991. Undertaking the issue of deployment is an effective tool to verify quantities of CW remained in Iraq prior to the beginning of the Commission's verification. The majority of Iraq's declarations on the deployment were verified up to the level of regional depots and airbases through documents provided by Iraq and physical evidence found by the Commission. Questions remain concerning Iraq's declarations on the deployment of R-400 chemical and biological aerial bombs, special warheads for the Al-Hussein missiles and 122-mm rockets.

40. With the exception of a firing table for one type of 122-mm rocket found in the files from the Haider farm, no other firing and bombing tables for other types of special munitions have been seen by the Commission. According to Iraq, all these documents were destroyed by Iraq in 1991.

41. Military requirements are important to assess credibly Iraq's declarations on types and quantities of CW produced. The only document of this nature provided by Iraq to the Special Commission was the request of the Ministry of Defense for CW for 1988. According to Iraq, this request detailing types and quantities of CW needed was used as a basis for the production of different CW agents and munitions in 1990.

42. According to Iraq, there were no military field manuals specifically related to the use of chemical munitions. Iraq claimed that no specific units were trained to use chemical weapons. Iraq insists that planning for the combat use of CW was the responsibility of a special Tactical group established at the Muthanna State Establishment, Iraq's prime CW R&D and production site. According to the Iraqi authorities, the chain of command and responsibilities with respect to the combat use of CW are related to the national security of Iraq and could not be discussed with the Special Commission.

43. In general, due to the political sensitivity, military aspects are among the less evaluated issues of Iraq's entire CW programme and all its related activities.

CW-related "Know-how" Documentation

44. Technical manuals ("cook books") on the production of chemical warfare agents and their critical precursors were essential elements of Iraq's CW capabilities. These manuals were

developed through the scaling up of the processes of the production of CW related compounds and represent the collected empiric experience, including parameters of the chemical reaction in combination with the specific plant configuration and specifications for the equipment used.

45. The Commission found two examples of such manuals related to the production of precursors in the files from the Haider farm. The Commission also found references to manuals on the production of different types of chemical warfare agents, including VX. According to Iraq, the major part of CW related technological documentation was destroyed unilaterally in 1991.

Assessment

46. It should be recalled, that a significant number of chemical weapons, their components, related equipment and materials were identified and destroyed under the Commission's supervision in the period from 1991 to 1997. This included over 38,000 filled and unfilled chemical munitions, 690 tonnes of chemical warfare agents (including 411 tonnes of bulk agents), more than 3,000 tonnes of precursor chemicals and about 600 pieces of production equipment.

47. In its accounting for various weapons-related elements of Iraq's CW programme, the Commission has achieved various levels of confidence, depending on the availability of evidence found in the course of the Commission's inspection activities, provided by Iraq or by its former suppliers.

48. The Commission has a high degree of confidence in its accounting for proscribed items which were physically presented by Iraq for verification and disposal. This includes the accounting for: 56,000 special munitions, 411 tonnes of bulk agents, 2,810 tonnes of key precursor and 553 pieces of production equipment.

49. The Commission has a certain degree of confidence in the accounting for proscribed items declared by Iraq as having been destroyed during the 1991 Gulf war. The Commission has accepted through its verification the destruction of 34,000 special munitions and 823 tonnes of key precursors. Outstanding issues remain. These include the accounting for 2,000 unfilled and 550 filled special munitions.

50. The Commission has a lesser degree of confidence in accounting for proscribed items declared by Iraq as having been destroyed unilaterally. These include 15,900 unfilled and 100 filled special munitions, the CW agent VX and 50 tonnes of a precursor for the production of VX. Nevertheless, the Commission has accepted through its verification the destruction of 13,660 special munitions and about 200 tonnes of key precursors. However, residual questions remain with respect to proscribed items destroyed unilaterally. The presentation by foreign suppliers of information on the delivery of munitions and precursors requested by UNSCOM could be helpful in the verification of this area.

51. The priority should be given to the resolution of the most important outstanding issues. These include: material balance of chemical munitions (including verification of the expenditure of special munitions in the 1980s, which is required to increase a degree of confidence with

respect to Iraq's declarations of chemical weapons remained in Iraq in 1991; the accounting for 550 artillery shells filled with mustard; verification of the unilateral destruction of R-400 chemical and biological aerial bombs); accounting for the production of the chemical warfare agent VX, and; verification of the completeness of declarations provided by Iraq on the material balance of CW production equipment removed from the Muthanna State Establishment (MSE) prior to the UNSCOM inspections.

52. The Commission identified these issues as priorities on two grounds. Firstly, the resolution of these particular issues would allow the Commission to verify the disposition of Iraq's most advanced proscribed weapons and capabilities and secondly, their resolution would increase considerably the degree of confidence in the accounting for other areas where gaps and inconsistencies still remain. Firstly, the majority of these issues were identified as priorities by the Emergency Session of the Special Commission and endorsed by the Security Council in November 1997. In June 1998, they were included in the "Road map" of disarmament issues provided by the Commission to the Security Council. Finally, the chemical issues of the "Road map" were accepted by Iraq within the scope of the Schedule for work.

53. Several other outstanding issues still remain. These issues are related to the procurement, extent of R&D activities on new types of chemical warfare agents and munitions, disposition of know-how documentation on the production of CW, and military aspects of the programme. As mentioned in Paragraph 3 of this paper, these issues are not covered in the material balances , because they could not be quantified. Given the fact, that these issues do not affect directly the accounting for final weapons and means of their manufacture, the Commission did not include them in the list of priority issues.

-

Appendix III

STATUS OF VERIFICATION OF IRAQ'S BIOLOGICAL WARFARE PROGRAMME

Executive Summary

Iraq did not acknowledge its proscribed Biological Warfare (BW) weapons programme until July 1995. From the first UNSCOM inspections in 1991 until 1995 Iraq denied it had a BW programme and has taken active steps to conceal it from the Special Commission. These steps included fraudulent statements, forged documents, misrepresentation of the roles of people and facilities, and other specific acts of deception.

Since its first revelations in July 1995, Iraq has submitted three "Full, Final and Complete Disclosures" (FFCDs) of its proscribed biological programme. The first of these, presented in August 1995, was declared null and void by Iraq itself. The second, submitted in June 1996, was subjected to intensive efforts to verify its accuracy and

completeness through eight inspections and other technical discussions. In March 1997 an international panel of experts reviewed that FFCD and recommended its rejection because of the inadequacy of the material presented throughout the document.

In September 1997, Iraq submitted its third "final" FFCD since the July 1995 disclosures. This FFCD contained essentially no new significant information from the previous one that the Commission had rejected as incomplete. A panel of international experts reviewed it in September 1997 and considered it as deficient in all areas. Iraq however argued that it had not been given an adequate opportunity to present its case to the UNSCOM assembled experts and at Iraq's request, a Technical Evaluation Meeting (TEM) between Iraq and a Commission assembled panel of international experts convened in Vienna in March 1998. Iraq did not present any new information at that meeting and the experts therefore reviewed the same material for a third time.

The TEM team reviewed the entire FFCD, and concluded it was deficient in all areas. In summary:

Weaponization There is considerable uncertainty regarding weaponization. The Iraqi account of the Al-Hussein BW warheads cannot be reconciled with the physical evidence. On R-400 bombs, there are inconsistencies in the account and the experts had no confidence in the number filled or how many were filled with particular agents.

Production Bulk BW agent production appears to be consistently understated. There are discrepancies between production capacity and the amounts of bulk agent declared to have been produced. The lack of documentation contributes to a low level of confidence in the Iraqi account of agent production quantities.

Acquisition The declaration on imports of raw materials and equipment is incomplete.

Planning All aspects of planning are omitted. This ranges from the circumstances surrounding the decision to commence the programme, the planning and the direction of the programme, the reasons for decisions and the individuals and organizations involved. The Commission considers that a knowledge of planning and decision-making is important because without it, determining the scale and the scope of the programme is not possible.

Research and Development (R&D) R&D is said to be unplanned, but the evidence shows that the programme was thoroughly planned.

History of Iraq's BW Programme Iraq provided a selected and incomplete history of the BW programme.

Organizations The FFCD generally lacks information concerning organizational

information from the highest levels down. There is also a lack of information on the military (or intelligence) involvement in the programme in spite of the fact that the programme resulted in the deployment of weapons such as bombs and missiles.

Concealment and Deception Since its disclosures in 1995 Iraq has continued to deceive the Commission and conceal parts of its BW programme. This includes efforts to hide documents, media, equipment and operating locations.

At Iraq's request another review of the FFCD by a team of international experts was conducted in Baghdad in July 1998. By agreement with Iraq and the Special Commission this team focused on those elements directly related to the material balance: weapons, bulk agents and materials such as bacterial growth media. This team concluded:

Weapons On weapons the team concluded that the material balances and their sub-components (production, filling and destruction) declared in the FFCD for biological bombs (R-400) and Al-Hussein warheads, could not be verified. Furthermore the account in the FFCD on biological spray devices, modified drop tanks and the aerosol generator (Zubaidy device), could not be verified.

BW agents The material balances for bulk BW agents and their sub-components (production, filling, losses and destruction) for all declared agents *(Clostridium botulinum* toxin, *Bacillus anthracis* spores, aflatoxin *Clostridium perfringens* spores and wheat smut) could not be verified.

Media The media material balance and its sub-components (acquisition, consumption, losses and destruction) could not be verified.

FFCD Iraq's FFCD in its totality cannot be verified. The team also expressed the view that verification cannot be achieved in the present circumstances whilst the Commission has an incomplete understanding of the philosophy of the programme including the military and other (such as security service) requirements for biological weapons. Without such an understanding, the Commission has an inadequate basis on which to assess whether the Iraqi account is complete. Accordingly, the FFCD in its present form, is an inadequate document for verification purposes.

Both the Vienna TEM and the experts' review in Baghdad concluded that Iraq's biological FFCD is an inadequate document for verification purposes. The FFCD does not provide a coherent or comprehensive account of Iraq's BW programme and lacks any supporting framework such as descriptions of planning, objectives, policy and organizations involved. The experts found that much of the information collected by the Commission to verify the FFCD in fact contradicts statements therein, particularly the evidence regarding weaponization, the quantity of agents produced and the media balance. The hundreds of interviews that the Commission has conducted with Iraqi officials also fail to provide a

comprehensive account and even allowing for errors of memory, often contradict the account in the FFCD.

Supporting documentation is generally lacking. Iraq explains that this was because a decision was made in 1991 that all documents relating to the BW programme were to be destroyed. After the departure of Lt. Gen. Hussein Kamel Hassan in August 1995, the Commission was told that some documents had however been saved and about 200 documents relating to the BW programme were recovered by the Commission from buildings at the Haidar Farm. Most of these documents related to research and did not add a great deal to the Commission's overall understanding of the programme. In addition to these documents, since 1995 and after much prompting by the Commission, Iraq has provided a number of additional documents of variable quality. Most of them are peripheral to the verification process and are open to various assessments. Thus, except in some limited areas, documentation provided by Iraq is grossly inadequate for verification purposes.

On technical, industrial and scientific developments of Iraq's BW programme, it has not been possible to compile a comprehensive assessment because Iraq has not been transparent in its FFCD nor in its clarifications of the account of its BW programme.

The review also attempted to quantify levels of confidence in the accounting for the various elements of Iraq's BW programme. In reaching its assessment, the Commission has taken into consideration the quality of information in its possession; documentary, physical, and personal testimony provided by Iraq; and the correlation of this information with other information such as that provided by Iraq's former suppliers, from inspections or otherwise obtained by the Commission.

The Commission has a degree of confidence in the accounting for some proscribed items which Iraq presented for verification and disposal. This includes, for example: the destruction of buildings, and equipment at Al-Hakam, the destruction of large quantities of growth media acquired for the programme; and evidence that R-400 aerial bombs and Al-Hussein warheads contained BW agents and consequently that *Bacillus anthracis* spores and *Clostridium botulinum* toxin were indeed weaponized.

The Commission has far less confidence in the accounting for proscribed items declared by Iraq as having been unilaterally destroyed. These include, for example: the number and fill of R-400 aerial bombs destroyed at Al-Azzizziyah; the number and fill of BW

Al-H4ussein warheads destroyed; and the fate of the biological warfare agent to be used with drop tanks.

The Commission has little or no confidence in Iraq's accounting for proscribed items for which physical evidence is lacking or inconclusive, documentation is sparse or nonexistent, and coherence and consistency is lacking. These include, for example: quantities and types of munitions available for BW filling; quantities and types of munitions filled with BW agents; quantities and type of bulk agents produced; quantities of bulk agents used in filling; quantities of bulk agents destroyed; quantities of growth media acquired for the programme; and quantities of growth media used/consumed. In addition the Commission has no confidence that all bulk agents have been destroyed; that no BW munitions or weapons remain in Iraq; and that a BW capability does not still exist in Iraq.

From 1987 onwards Iraq undertook pilot and industrial scale production of BW agents. Iraq denies any parallel activity to develop weapons capable of delivering the BW agents it was producing. During inspections, Iraq has stated that its policy was to evaluate weapons that had been developed for Chemical Warfare (CW) purposes, to establish whether they could be adapted for BW agents. It is difficult to accept that Iraq claims it had not initiated a BW-specific weapons programme in the late 80's, possibly in the MIC Naval and Aerial Bombs Section, in order that efficient and effective dissemination weapons be made available. It is not clear whether such weapons have been developed and are not disclosed, or have been partly developed, not reaching a stage where they could be manufactured.

Several other outstanding issues also remain to be resolved. These issues are related: to the scope and extent of R&D activities; the acquisition of supplies and equipment; the involvement of military and other agencies in the BW programme; and deception and concealment of the BW programme.

Iraq has not provided evidence concerning the termination of its offensive BW programme. The evidence collected by the Commission and the absence of information from Iraq, raises serious doubts about Iraq's assertion that the BW programme was truly "obliterated" in 1991 as it claims.

7

Abbreviations

Agent A.....Clostridium botulinum toxin

Agent B.....Bacillus anthracis spores

Agent C.....aflatoxin

Agent D.....Wheat Cover Smut

Agent G.....Clostridium perfringens spores

Al-Hakam.....Al-Hakam Factory for Production of BW agents

ATCC.....American Type Culture Collection

Bt.....*Bacillus thuringiensis*

BW.....Biological Warfare

CN.....1-Chloroacetophenone, riot control agent

CS.....o-Chlorobenzylidene Malononitrile, riot control agent

CW.....Chemical Warfare

DIALOG.....Computer Database

FFCD.....Full Final and Complete Disclosure

FMD.....Foot and Mouth Disease Vaccine Factory

Haidar Farm.....Storage site for documents of Iraq's weapons programmes

IAEA.....International Atomic Energy Agency

kg.....kilograms

km.....kilometres

Kimadia.....State Company for Drugs and Medical Appliances Marketing

LC.....Letter of Credit

MIC.....Military Industrial Commission

MOD.....Ministry of Defence

NMD.....National Monitoring Directorate

R&D.....Research and Development

SCP.....Single Cell Protein

SCR.....Security Council Resolution

SEHEE.....State Establishment for Heavy Engineering Equipment

SEPP.....State Establishment for Pesticides Production

SOTI.....State Organization for Technical Industries

TEM.....Technical Evaluation Meeting

TSMID.....Technical and Scientific Materials Import Division

TRC.....Technical Research Centre

UNSCOM.....United Nations Special Commission

VRL.....Veterinary Research Laboratories

Introduction

Iraq's offensive BW programme was among the most secretive of its programmes of weapons of mass destruction. Its existence was not acknowledged until July 1995. During the period from 1991 to 1995 Iraq categorically denied it had a biological weapons programme and it took active steps to conceal the programme from the Special Commission. These included fraudulent statements, false and forged documents, misrepresentation of the roles of people and facilities and other specific acts of deception. For example, Iraq claims to have destroyed much of the documentation and overt evidence of the programme. At the same time Iraq maintained other aspects of the programme such as the equipment, supplies (e.g., bacterial growth media), and personnel as an intact entity and facilities of the programme such as the Al-Hakam facility that produced BW agents.

In 1995, when Iraq was confronted with evidence collected by the Commission of imports of bacterial growth media in quantities that had no civilian utility within Iraq's limited biotechnology industry, it eventually, on 1 July 1995, acknowledged that it used this growth media to produce two BW agents in bulk, botulinum toxin and *Bacillus anthracis* spores, between 1988 and 1991. It was not, until August of 1995, however, that Iraq acknowledged that it had weaponized BW agents, and had undertaken weapon tests from 1987 onwards. This admission only occurred after Lt. Gen. Hussein Kamel Hassan departed. Shortly afterwards, Iraq released a considerable quantity of documents concerned with its weapons of mass destruction programmes. The documents relating to biology represented just 200 documents with some pages out of a total of more than a million pages. Many of the biological documents were scientific reprints from foreign journals. Clearly, they represent only a minor portion of a BW programme that ran from 1973 until at least 1991.

Since July 1995, the Commission has conducted 35 biological inspections directly or indirectly related to investigations of Iraq's proscribed BW programme. In addition, two inspections devoted to the destruction of sites, known to be integral components of the programme, have been undertaken. The past programme investigations have concentrated on issues that are directly related to disarmament and have attempted to validate these aspects of Iraq's Full Final and Complete Disclosure (FFCD), generally without success. This considerable effort has been negated by Iraq's intransigence and failure to provide cooperation concerning its biological weapons since January 1996.

After Iraq's acknowledgement of its BW weapons programme , Iraq has submitted three FFCDs of its BW programme. While the first of these FFCDs was declared void by Iraq itself in August 1995, the two latter FFCDs were reviewed by panels of international experts on four occasions. In March 1997, an expert panel recommended the rejection of Iraq's June 1996 FFCD because of the inadequacy of the material presented throughout the document. In May 1997, the Commission presented formats to enable Iraq to clarify deficiencies in its biological FFCD. All areas of concern to the Commission were clearly identified and discussed with Iraq. It was expected that these issues would be seriously and comprehensively addressed by Iraq in its next FFCD. However, in September 1997, Iraq provided a new FFCD that contained essentially the same information, ignoring all advice provided to it by the Commission. As reported to the Council, an international expert panel reviewed Iraq's biological FFCD in September 1997, and considered it deficient in most aspects. In March 1998, a biological Technical Evaluation Meeting (TEM) between the Commission and Iraq took place in Vienna dealing with all aspects of the biological FFCD. The Commission's team comprised 18 experts from 15 countries.

On each occasion the experts unanimously considered Iraq's FFCD presented an

inadequate, inaccurate account with deficiencies in all areas. Iraq's latest biological FFCD (submitted in September 1997) is not complete and fails to present a coherent, technically detailed, overall account. The shortcomings occurred not only in areas directly concerned with the material balance (e.g., weapons, bulk-agent products, and microbiological growth media), but also in all other areas (e.g., history, planning, acquisition, research and development). The TEM team also concluded that the FFCD had substantial deficiencies in all areas and Iraq's account of its BW programme could not be verified as a 'full and complete disclosure', as required by the Security Council. Iraq provided many explanations for the account in the FFCD but was unable to substantiate most of its disclosure, and was unwilling to add the missing components. In July 1998, another international team concluded the FFCD, in its present state, could not be verified as complete and accurate.

The Emergency Session of the Commission held in November 1997, concluded that the biological weapons file was the most serious area in which Iraq had consistently disregarded its obligations under SCR 687. The members of the Commission noted that the paucity of progress was largely attributable to Iraq's denial of the existence of any biological weapons programme until July 1995. The members of the Commission further noted that Iraq's FFCD of September 1997, was not substantially different from previous, unacceptable, versions, and it remained largely unsupported by evidence and documentation. The Security Council was urged to call upon Iraq to rectify the existing deficiencies.

In April 1998, the Commission's report to the Security Council (S/1998/332) listed the priority issues identified by the TEM. These included: history of the BW programme, organizations involved, acquisitions, research and development, production, weaponization and materials balance. In May 1998, Iraq provided clarifications of some issues arising from the TEM but has failed to resolve any of the key issues outstanding. Subsequently on 3 and 4 June 1998, the Commission provided a technical briefing to the Security Council. This gave an outline of the material balance and the main outstanding disarmament issues in each weapons area. In biology, this briefing highlighted the lack of verifiable details on virtually the entirety of the programme.

The Commission presented to the Security Council outstanding issues and sought to establish a programme of work that would enable outstanding issues to be resolved. In biology the priority concerns were: the production of materials and equipment; agents; munitions, and their possible destruction. Additional requirements from Iraq were the provision of the information and materials identified by the TEM. The Commission subsequently met with the Deputy Prime Minister of Iraq in June and agreed on a schedule of work for the next two months. As part of the schedule of work it was agreed, at

Iraq's request, to reconvene the international experts to discuss again, with a broad range of Iraqi experts the overall problems associated with the biological FFCD.

For these discussions, the Commission proposed that the approach should be "top down", that is focus primarily on weapons, in the belief that the many other important issues in biology might be more easily resolved if progress were made with respect to weapons. Accordingly, the discussions focussed on the provision of new material in the key area of the material balance of weapons, especially material not covered in the March TEM. Iraq did not provide any new information and the FFCD, presented to the Commission in 1997, was judged again to be inadequate.

Iraq has recently pressed for the experts to make a "quality assessment," as to whether any biological weapons or agent remain in Iraq. This was emphatically stressed by Iraq during a meeting between him and the Commission's Chief Inspector in July 1998. Given the present information disclosed by Iraq, such an assessment could not be made.

To assess the quality of any biological agent over time requires knowledge and confidence in that knowledge. This includes the physical state of the agent, e.g., liquid or dried, with or without stabilizers; storage conditions of the filled weapons or bulk agent, e.g., temperature, humidity, containers, etc.; tests done on the agent before and after filling, and the results of such tests. None of this information on Iraqi weapons is available to the Commission. SCR 687 (1991) requires the elimination of BW weapons regardless of its"quality".

The FFCD presents a limited account that deals only with some components of the programme uncovered during the Commission's investigations. Iraq states that it 'obliterated' the BW programme in 1991, claiming that this involved the destruction of all its BW weapons and associated records and documents. This has greatly complicated the determination of the material balance, and thus hindered verification. The FFCD portrays a programme designed to culminate in January 1991, suggesting that no plans existed beyond that time. In reality the programme was a continuing one, with objectives stretching well into the future. The statement that the programme was 'obliterated' in 1991 is contradicted by later evidence of deception and concealment. This activity continued until 1995, at least, and one of the aims could have been the preservation of essential components of the BW programme. Indeed, Iraq, after 1991, retained suitable growth media, BW facilities, production equipment, teams of expert personnel, and the essential technical knowledge.

Iraq has not revealed the planning process. No mention is made of the role of the military and intelligence services in defining the requirements for the BW programme, or in the subsequent planning to meet that requirement. Iraq's doctrine of use of BW weapons is not covered in the FFCD. Consequently, the Commission can not determine the organization, scope and fate of the programme. Iraq has yet to present any formal renunciation of the termination of its BW programme.

This paper presents a status report on the investigation and the various attempts to verify Iraq's FFCD. Greater emphasis is placed on matters that affect the Material Balance (Part I), i.e., unfilled and filled weapons, bulk agent, and microbiological growth media. Part II presents the status of verification of other areas, including history, acquisition of supplies and equipment, research and development, sites and facilities, involvement of other organizations such as military and intelligence organs. Part III presents other issues that also relate directly to verification. These include: investigation and verification inspections; Iraq's documentary evidence; technical coherence of Iraq's stated programme; technological progress of the programme; termination of Iraq's programme; and concealment and deception.

STATUS OF VERIFICATION CONCERNING THE MATERIAL BALANCE OF IRAQ'S BIOLOGICAL WARFARE PROGRAMME

Weapons Systems

To assess whether Iraq has met its obligations under Security Council Resolution 687 (1991), obtaining a full understanding of all aspects of Iraq's BW weapons is essential. Iraq's FFCD does not contain the required detail for such an assessment. It must include numbers, types, markings and a detailed account of individual weapon systems, supported by documents and physical evidence. The term 'weapons' in this paper refers to filled munitions, empty munitions, and bulk BW agents.

Al-Hussein Missile Warheads

In August 1995 Iraq declared that it had filled 25 Al-Hussein missile warheads with BW agents. This figure is not supported by conclusive evidence. In its FFCD Iraq has declared that five warheads were filled with *Bacillus anthracis* spores, 16 with botulinum toxin and

four with aflatoxin. Ten warheads containing botulinum toxin were deployed to an abandoned railway tunnel at Al-Mansuriyah. The remainder was stored on the banks of the Tigris canal. No credible evidence has been presented to support this account of BW agent filling and subsequent weapon deployment.

Iraq claims that the Al-Hussein warheads were not specifically developed for BW; instead the Chemical Warfare (CW) warheads were filled with BW agents. Although static and dynamic trials were undertaken with CW agents, Iraq denies that there were any BW trials. Most of the CW warheads had aluminium containers. According to Iraq, later CW, and all BW, warheads had stainless steel containers to be filled with CBW agents. The substitution of aluminium containers with stainless steel containers is explained as a response to difficulties in welding aluminium. It is not attributed to the needs of the payload. Thus this BW weapon was filled and operationally deployed without any field tests.

Iraq asserts that all 25 BW warheads were unilaterally destroyed at specific locations at Al-Nibai desert in July 1991. To verify the FFCD, the Commission in 1998 took samples from the remnants of agent warhead containers excavated from various locations at Al-Nibai. The results of the analyses do not support the statements made in Iraq's FFCD. Traces of *Bacillus anthracis* spores have been identified on remnants of containers from at least seven distinct missile warheads as opposed to the five declared. There are discrepancies between the Iraqi account of where groups of warheads containing particular BW agents were destroyed and the results of the analyses. This throws doubt on the accounts of weapons filling, deployment and subsequent destruction.

In response to this evidence, in July 1998, Iraq changed its account of BW warhead and other munitions filling. It stated to an Commission team that, instead of the declared five *Bacillus anthracis* spores and 16 botulinum toxin warheads, there had been in fact 16 *Bacillus anthracis* spores and five botulinum toxin missile warheads. Iraq insisted that this change in disclosure would not affect Iraq's declaration on the total quantity of BW agents produced and weaponized. These changes also included alterations to the numbers of R-400 aerial bombs filled with *Bacillus anthracis* spores and botulinum toxin. Iraq did not present any supporting documents or other specific evidence to substantiate the new statement. In the original account, Iraq emphatically asserted that all ten weapons in the Al-Mansuriyah railway tunnel were filled with *Bacillus anthracis* spores and only later was this adjusted to botulinum toxin.

This new explanation contradicts many aspects of the accounts of the unilateral destruction of special warheads, including those filled with BW agents. Further, it is

inconsistent with the accounts provided during the preceding three years by Iraqi personnel directly involved in warhead filling and destruction activities. The new statement does not fit the physical evidence available of the unilateral destruction of biological warheads.

The account of Iraq's Al-Hussein BW warheads has changed frequently over the past few years. In July 1998, even in the space of a few weeks, Iraq made 'suggestions' changing the numbers of warheads filled with particular BW agents and their deployment and destruction. The physical evidence from the destruction area and the analyses of the remnants contradicts the account contained in the FFCD. Thus the FFCD account is inaccurate and is not validated.

This table provides a summary of Iraq's declarations concerning Al-Hussein missile warheads.

FFCD	UNSCOM Assessment	
Al-Hussein Missile Warheads Produced for the BW Programme,		
Produced 25	There is no conclusive evidence that only 25 warheads were produced for BW use. The number cannot be ascertained.	No evidence has been offered by Iraq, nor can UNSCOM find any, to indicate the numbers of BW warhead containers produced. Iraq acknowledges this lack of evidence.
Al-Hussein Missile Warheads Filled with BW Agents		
Total filled 25	The evidence is circumstantial. The sole supporting document does not clearly refer to BW warheads. There is no credible evidence that only 25 were filled.	This number is based solely on a document that refers to the "integration" of 25 warheads and mentions the presence of an officer connected with the BW programme.
Filled with botulinum toxin 16	The figure of 16 appears to be derived solely by deduction; there is no supporting information. The number is inconsistent with evidence available.	In September 1995, Iraq stated that 15 warheads had been filled with botulinum toxin; later this number was changed to 13. Later still the number was adjusted to 16. In July 1998, an Iraqi official suggested that only five may have been filled with botulinum

		toxin. According to Amer Rashid, this last figure was based on mathematical reasoning coupled with the results of the analysis of warheads recently excavated at Al-Nibai.
Filled with *Bacillus anthracis* spores 5	The figure of five appears to be derived solely by deduction; there is no supporting information. The number is inconsistent with the evidence available, which suggests that more than five warheads contained *Bacillus anthracis* spores.	In September 1995, Iraq stated that 10 warheads had been filled with *Bacillus anthracis* spores; later this number was changed to five. In July 1998, an Iraqi official suggested that 16 may have been filled with *Bacillus anthracis* spores. According to Amer Rashid, this last figure was based on mathematical reasoning coupled with the results of the analysis of warheads excavated at Al-Nibai.
Filled with aflatoxin 4	The figure of four appears to be derived solely by deduction; there is no supporting information.	In the original declaration of the contents of the Al-Hussein missile warheads, in September 1995, no mention was made of aflatoxin. Later Iraq stated that two had been filled with aflatoxin. Finally this number was adjusted to four.

Other 0	Documents presented by Iraq indicate that 16 warheads were filled with an agent that had a "time to effect" of greater than one week. This implies that the agent mentioned would not cause significant casualties until more than a week had passed following exposure. This raises the possibility of an agent other than *Bacillus anthracis* spores and *Clostridium botulinum* toxin which have a time to effect less than one week.	Aerosol exposure to *Clostridium perfringens* spores fit this description. Iraq has declared the production of 340 litres of this agent but denied weaponization. Iraq has failed to account for very large quantities of a growth component, i.e., peptone, that could have been used to produce more than 7,500 litres of this BW agent. The description could apply also to aflatoxin, however, the amount of aflatoxin produced by Iraq's account, was insufficient to fill 16 warheads.
Al-Hussein Missile Warheads for BW Destroyed		
Destroyed 25	Remnants excavated from Al-Nibai, the site of their declared unilateral destruction, include sufficient stainless-steel agent containers to account for declared quantities of BW and possible CW warheads, however the locations of the remnants are inconsistent with the FFCD account.	Iraq declares that 25 warheads containing deactivated BW agent were destroyed.

R-400 Aerial Bombs

Iraq has declared, that 200 R-400 aerial bombs were manufactured for BW purposes. However, Iraq acknowledges that the numbers of bombs filled with particular BW agents are "guesses".

Iraq's accounts concerning the development of the R-400 bomb for BW purposes have changed since 1995. In 1995 when the personnel who conducted the programme were explaining the programme, they described it in considerable detail. There was a series of field trials using a total of six R-400 bombs, two each charged with *Clostridium botulinum* toxin, *Bacillus subtilis* and aflatoxin. Many animals were said to have been used. These field trials were reflected in the June 1996 FFCD. Subsequently, Iraq has denied that any such trials were conducted. It is very difficult to reconcile this change with very specific accounts of R-400 trials given by scientists, the attendant veterinary surgeon and workers, at what was said to be the site, namely Al-Mohammediyat. There was also a trial in August 1990 to determine the size of 'booster charge' charge required to disperse the agent. All attempts by Iraq to locate the exact site at Al-Hakam and find any evidence have failed.

Iraq initially claimed that 166 R-400 bombs were filled with BW agents. It was stated that three agents were used: agent 'A' (*Clostridium botulinum* toxin), agent 'B' (*Bacillus anthracis* spores), and agent 'C' (aflatoxin). Subsequently, to accommodate a document provided by Iraq that suggested that 157 R-400 bombs were destroyed, the figures were adjusted by a new claim by Iraq that only seven, and not 16 R-400 bombs were filled with aflatoxin.

Evidence of the destruction of three botulinum toxin filled R-400 bombs was found in 1997 when and remnants of another 20 R-400 bombs in the same area were identified. Remnants of another 25 R-400 bombs were also found in 1991, by a Commission inspection team, at a time when Iraq was declaring a total of only 40 R-400 bombs (stated to be all CW) at Al-Azzizziyah. It cannot be determined whether all these weapons had ever been filled. The figure of "157" R-400 bombs is based on a document provided by Iraq that suggests that 157 were destroyed. There is no evidence to support that these were in fact biological bombs.

A review by international experts of all information available to the Commission demonstrated that the account of R-400 bombs in the 1997 biological FFCD is both incomplete and inaccurate. The FFCD provides no documented account of filling. This means that a material balance for the weapons and the BW agents incorporated within them cannot be established. There is no confident upper limit on the number of bombs

filled for BW purposes. There is no authenticated account of the destruction of the BW agent contained in the weapons. The possibility that such weapons remain in Iraq, cannot be precluded or that agent produced for such weapons exists in bulk storage.

The 1997 biological FFCD omits, or does not substantiate, many aspects of the R-400 programme, such as quantitative aspects of filling weapons, location and timing of filling, storage, deployment and destruction of weapons and military deployment or use. Photographic evidence shows that biological R-400 bombs were at an undisclosed site in October 1991, which is after Iraq claims that the BW programme had been "obliterated". This is of particular concern as it affects the credence of the account of R-400 weapons in the FFCD. The total number of R-400 bombs that would have been available for filling is not known.

The account of Iraq's R-400 aerial bombs has been changed several times since 1991. Even in July 1998 Iraq has made 'suggestions' changing the numbers of bombs filled with particular BW agents. The inconsistency between the FFCD account and the physical evidence means that the Iraqi account cannot be confirmed. Thus, the FFCD account is not verified.

The frequent changes in the Iraqi account of the Al-Hussein missile warheads and the R-400 aerial bombs are more than adjustments of detail. They cast doubt on the entire Iraqi declaration on weaponization.

The table provides a summary of Iraq's declarations concerning R-400 aerial bombs.

FFCD	UNSCOM Assessment	Comments
R-400 Aerial Bombs Produced		
Produced 200	The number of R-400A bombs produced cannot be established. From production documents it is evident, that more than 200 bombs were available for BW. Senior Iraqi officials stated that the numbers given in the FFCD are only estimates. Partly coated bombs both with and without black stripes have been found by UNSCOM that is inconsistent with Iraq's account.	Initially, Iraq ordered 200 R-400A bombs for the BW programme, externally marked with two longitudinal black stripes and with an internal protective coating. Iraq claims that, because of time constraints, a decision was made to produce only 175 R-400A bombs and another 25 without the epoxy coating or black stripes.

R-400 Aerial Bombs Filled with BW Agents		
Total filled 157	The figure 157 is based solely on an extract from a diary that states 157 R-400 bombs were destroyed. However, it is unclear if the items destroyed were associated with BW agents.	In 1991 Iraq claimed that only 40 R-400 bombs were destroyed at Al-Azzizziyah. In September 1995 Iraq declared that 166 bombs were filled. After presenting a diary that indicated 157 R-400 bombs were destroyed at Al-Azzizziyah, the number was changed to only 157 filled.
Filled with botulinum toxin 100	Iraq did not present any evidence in support of its claims. Evidence of botulinum toxin was found by UNSCOM in two destroyed R-400A bombs at Al-Azzizziyah. However, botulinum toxin was also found in one recovered R-400 bomb. In 1991, empty R-400 bombs bearing markings consistent with botulinum toxin fill were presented as chemical weapons to a UNSCOM team.	Iraq states that 100 R-400A but no R-400 bombs were filled with botulinum toxin. A senior Iraqi official suggested in July 1998 that many more than 100 contained botulinum toxin. According to Iraq, the numbers are only estimates.
Filled with *Bacillus anthracis* spores 50	The account is not supported by documents. No evidence of *Bacillus anthracis* spores has been found among the remnants recovered at the destruction site.	Iraq states that 50 R-400A but no R-400 bombs were filled with *Bacillus anthracis* spores. A senior Iraqi official in July 1998 suggested that probably fewer than 50 contained *Bacillus anthracis* spores. According to Iraq, the numbers filled are only estimates.
Filled with aflatoxin 7	Iraq has not provided any documents to support the filling of R-400s with aflatoxin. No evidence of aflatoxin has been found among the remnants recovered at the destruction site.	Iraq initially stated that 16 uncoated R-400 but no R-400A bombs were filled with aflatoxin. Later the number was reduced to seven to correspond to the decrease in total numbers of bombs filled. According to Iraq, numbers filled are only estimates.
Other 0	There is no complete account of the agents to fill R-400 weapons. An analysis of all the available evidence does not rule out the possibility that	The inconsistencies in markings indicating agent type on the R-400 bombs coupled with the lack of evidence on filling, the presence

	another BW agent was filled into some weapons, either in addition to those declared, or substituting one already declared.	at Al-Walid Airbase of two undeclared R-400A weapons and the frequently changing accounts of Iraqi personnel make it impossible to confirm the BW agents deployed or used for filling purposes.
R-400 Aerial Bombs Destroyed		
Empty bombs destroyed 43	Video tape and still photographs of destruction activity are the basis for this number. Not all bombs were visible. Iraq states that none of these bombs was ever filled. Based on the markings on the weapons and other circumstantial evidence this cannot be confirmed.	Iraq states that a total of 37 R-400 bombs "intended" for filling with BW agents were destroyed at Al-Muthanna under UNSCOM supervision (26 black-striped and 11 non black-striped). An additional six were claimed to be defective and not filled. These were recovered from the River Euphrates in December 1994.
Filled bombs destroyed 157	Evidence of the destruction of BW bombs was found at Al-Azzizziyah. The total numbers destroyed could not be determined from the remains at Al-Azzizziyah. In addition there is evidence that R-400A bombs carrying BW markings were present at an airfield where no BW weapons were declared.	Iraq states, based on a diary, reporting the events, that 157 BW-filled bombs were destroyed at Al-Azzizziyah in July 1991. Evidence that all were indeed BW-filled was not presented.

Aircraft Drop Tanks

In September 1995, Iraq declared the existence of two projects concerning the use of aircraft drop-tanks to disseminate BW agents. One employed a Mirage F-1 aircraft, the other a MiG 21. The Mirage F-1 drop-tank project was said to have commenced in

November 1990 when a prototype, made from a modified drop-tank, was manufactured and a series of trials undertaken. Following the last trial, just before the Gulf war, the Mirage with the prototype tank attached was left in a shelter at Abou Obeydi Airbase, near Al-Kut. Iraq states the shelter was bombed and the Mirage F-1 and its drop-tank were said to have been destroyed by fire. Three further drop-tanks were modified. This work, which appears to have been straightforward, requiring only a few days' efforts, continued throughout the period of the war at several establishments. The weapons were completed in March 1991. It is stated that these items were destroyed in summer 1991. The remains of three such tanks have been inspected. Iraq's plan was for the modification of 12 tanks in total. Iraq states that only the scarcity of a key component, an electric fuel cock, limited the number to three.

The drop-tank project appears to have been pursued with the utmost vigour by Iraq. It seems to have been the only BW weapon system that continued in development after the start of the Gulf war. Two mobile tanks for bulk BW agents, each with a capacity of 1000 litres, were found buried at the Al-Azzizziyah outstation of Abou Obeydi. This raises questions about the state of readiness of this weapon system. Iraq will not discuss the details of concepts of use and flatly refuses to acknowledge the plan for this project.

Iraq has claimed for two years that the drop tanks were intended to deliver *Bacillus anthracis* spores. *Bacillus subtilis* spores were used as simulant in a test with this intent. In the Vienna TEM Lt. Gen. Amer Al-Saadi reversed this statement by claiming that botulinum toxin was the agent to be used. His technical experts were unable to provide technical information in support of this claim. The availability of agent, and its nature, greatly influence an assessment of the material balance. Four drop tanks would require 8000 litres of agent. The FFCD fails to state which agent was intended to be used.

There is no evidence that the prototype weapon and aircraft were destroyed, nor is there sufficient documentary evidence concerning this weapon and its components. The FFCD account is not validated.

Pilotless Aircraft Project

The concept was to produce a MIG-21 aircraft that could take off and fly on a preset flight path without a pilot on board. The plane would carry a drop-tank containing BW agent. After a preset time the valves on the tank would open and disseminate the agent. The aircraft would continue to fly until it ran out of fuel. One experiment was undertaken on 10 January 1991 at the Iraqi Air Force Al-Rasheed Airbase. The reason given for dropping the project was the intervention of the 1991 war, expressed as "the situation at

that time".

Apart from one letter, thanking the project workers, all the information on this matter stems from interviews. However, there is a lack of evidence. The accounts given of the project are credible, when dealing with its technical aspects. When the management of the project, its place in the BW programme and the concepts of use of the weapon are considered, the accounts are contradictory and have changed between 1995 and the summer 1998. The FFCD gives abbreviated details of this project. No mention is made of the intended use of the pilotless aircraft for the dissemination of BW agent.

The FFCD account is too brief, considering the apparent intended use of this equipment. There is no clear evidence of the termination of the development of pilotless aircraft for BW dispersal. It is known that such work continues, although for a different stated purpose (targets for anti-aircraft artillery). The attempts to dissociate the MIG-21 project from the development of aircraft spray tanks has not been convincingly explained. The FFCD account is not validated.

This table provides a summary of Iraq's declarations concerning fixed wing aircraft spray systems:

FFCD	UNSCOM Assessment	Comments
Modification of F-1 Drop-Tanks		
Drop-tanks produced 4	There is no evidence to corroborate that only four were produced. Interviews indicate that 12 tanks were to be modified.	Iraq declares that one Mirage F-1 drop-tank was modified for dissemination of BW agent by 15 January 1991. Subsequently three more were similarly modified during the period of the Gulf war.
F-1 Drop-Tanks Destroyed		
Drop-tanks destroyed 4	The original prototype drop-tank is said to have been destroyed by bombing. There is no physical evidence to support this. The remains of the other three drop-tanks were inspected by the Commission.	There are extensive piles of damaged aircraft at Abou-Obeydi, however, the remains of the prototype drop-tank and Mirage F-1 fighter carrying it have not been identified among the debris.
Pilotless Aircraft Development		

Pilotless MiG 21 1	Interviews generally support the statements on the development of a pilotless MIG-21. It is unclear whether the MIG-21 was intended to carry BW or CW weapons. Interviews suggest that the drop-tank and its delivery aircraft were being developed for both CW and BW. There is no evidence to confirm that the project was dropped before completion.	The letter offered as evidence that the project terminated provides no such confirmation.

Aerosol Generators/Helicopter Spray System ("The Zubaidy Device")

An aerosol generator for the dispersal of biological warfare agents or toxins was developed by the Technical Research Centre at Salman Pak by modification of helicopter-borne commercial chemical insecticide disseminators. These modified aerosol generators are assessed as suitable for the dissemination of BW agents from helicopters or slow moving fixed-wing aircraft and are referred to as Zubaidy devices. A description was included in the June 1996 FFCD. It did not however cite the number of devices produced nor account for their final disposition. In the current FFCD, the devices are only briefly mentioned. A document has also been submitted by Iraq reporting the successful field-testing of these devices in August 1988 to spray *Bacillus subtilis* spores. However it was stated at the Vienna biological TEM in March 1998, that Iraq now considers these devices to be inconsequential.

The absence of a comprehensive account of the Zubaidy devices including their disposition and supporting evidence is an example of the incompleteness of the current biological FFCD.

The following table provides a summary of Iraq's declaration concerning the Aerosol Generators.

FFCD	UNSCOM Assessment	Comments
Aerosol Generators: Numbers produced not stated in FFCD.	Iraq claims this device was not effective, but documentation provided by Iraq states that it was successfully field tested to spray bacteria. Experts assess this device as a most effective BW munition. Iraq turned over to UNSCOM	From interviews Iraq has acknowledged 12 devices produced. None destroyed

	developmental devices but not the final tested devices. These remain unaccounted for.	by UNSCOM.

The Commission has evidence of a parallel development by the Technical Research Centre (TRC) of a similar device, probably for delivery by drones. Iraq officially denies all knowledge about this second device but this denial is inconsistent with indications from interviews. It is unknown whether development of this second device continued to deployment but the possibility exists that it did and that such a weapon system still exists in Iraq.

Other Weapons Systems

Cluster Bombs: Iraq has been asked whether cluster munitions, which are inherently a more effective delivery system for BW agents than aerial bombs, were part of the BW programme. On one occasion, an Iraqi representative mentioned that, although cluster munitions were never used in the CW programme, they were part of the BW programme. He later retracted this remark formally. Since then Iraq has strenuously denied that cluster munitions played any part in the BW programme.

122mm Rocket Warheads: The majority of the declared BW field trials carried out by Iraq involved the testing of 122mm rocket warheads. This part of the programme proceeded in an ordered and logical fashion, commencing with static tests of single warheads and culminating with salvoes of rockets charged with BW agent or simulant. There are documents, video tapes and interview information detailing this work. The Iraqi reports on these trials submitted to MIC, point out the success of the system and recommend adoption of this weapon for the delivery of Agents A, B, C and D. Despite the progress made over a period of years, the development of 122mm warheads was said to have been abandoned by August 1990. The 122mm warhead was considered unsuitable by Iraq "for the impending conflict". The full scope of this work, the rationale for the use of these weapons and the seemingly abrupt end of the project have never been satisfactorily explained.

Artillery Shells: A single 155mm artillery shell was found at Iraq's main BW production facility Al-Hakam, recovered from the River Euphrates. It was of the same type used for CW agents. It contained water. Another smaller calibre shell was also found. It had been detonated. These shells were said to have been for evaluation. Four similar shells were

used in a trial for the dissemination of the BW agent Ricin, . No further evidence has been found. It appears that these trials produced indifferent results, and that, apparently, these projects were not continued.

LD-250 Aerial Bomb: Static trials of LD-250 aerial bombs to disperse agents were conducted in 1988. It is likely that further such trials were conducted. These tests were considered successful. Despite this, and the adoption of the weapon for CW agent delivery, it is claimed that no further development occurred.

Fragmentation Weapons: Experimental work on the sub-dermal introduction of *Clostridium perfringens* spores, applicable to fragmentation weapons, was acknowledged by a senior Iraqi worker in the field. He admitted that the work was relevant to fragmentation weapons that are designed to cause gas gangrene. Iraq denies carrying out any developmental work on weapons exploiting this research

Land Mines: When Iraq was considering which weapons to use for the dissemination of BW agent, land mines were considered. One of the scientists was sent to Al-Qa'a Qa'a, the explosives factory, to look for types of anti-personnel land mines that could be used for the purpose of filling. He found that there was nothing available suitable for filling with liquid BW agents.

350mm and 1,000mm Calibre SuperGun Projectiles: The Iraqi SuperGun programme was developing long-range projectiles for both 350mm and 1,000mm calibre weapons. The drawings of various designs for the 350mm device, depict a projectile with a guidance and control section, control surfaces on the fins and a payload of around 20 kg. Plans existed for a 1,000mm calibre weapon that would have had a longer range, and a payload greater than 100 kg. Iraq denies that there was any connection between the BW programme and that of the SuperGun. This project, like the BW and CW programmes, was managed solely by MIC. Like the BW project, no objective or planning has been acknowledged. The development of this weapon system was well advanced, with several sites being used and plans prepared for new and more versatile weapons. The intended purpose of this weapon has not been revealed. A long range delivery system, with its guided projectile, capable of delivering relatively modest pay-loads suggests the use of very potent warheads, such as CW or BW agents, or even radioactive material. The range and payload delivery are of a similar order to those of the Al-Hussein. Without a more comprehensive disclosure by Iraq, the possibility that this weapon was being developed for the delivery of a BW payload cannot be ruled out.

BW Agents

Bulk warfare agent production appears to be considerably understated by Iraq. Production accounts are incompatible with resources available to Iraq's BW programme, including growth media and fermentor capacity. Production figures in the FFCD remain unsupported from 1987 to 1989 and 1991. The sole supporting document, for 1990, differs from information contained in the FFCD itself. Experts' calculations of possible agent production quantities, either by equipment capacity or by growth media amounts, far exceed Iraq's stated results. Significant periods when the fermentors were claimed not to be utilized are unexplained, especially for a period after August 1990, when Iraq's BW production facilities were ordered to operate at their maximum capacity. Stated low productivity of readily available equipment has not been adequately explained. The idle times for fermentor utilization and low productivity, which are technically not credible, cast doubt on the elemental credibility of the 1997 FFCD.

Quantities of each agent (and indeed what agents were placed) placed into munitions are unclear. Similarly, the quantities of bulk agents destroyed can not be verified. The quantities cited by Iraq are deduced and may have little relationship to actual quantities. The place and method of destruction is not established. There is no assurance that bulk agents were not recovered, in some instances, from weapons prior to destruction of the weapons.

Iraq has not reported all the known quantities of bacterial growth media that was imported for its BW programme, nor has it accounted credibly for all the media that it has reported. Iraq's declared failed batches are excessive and inconsistent in totality. In production of botulinum toxin, Iraq reported that thioglycollate broth when used at half strength of that recommended by the manufacturer produced acceptable toxin levels. These factors add to the quantity of BW agent that might have been produced by Iraq.

Fermentor usage: Iraq has calculated the quantity of agent produced by an assigned frequency and efficiency of fermentor utilization as well as assumed numbers of failed batches of agent production. For the years 1987 to 1989 there are no records to support production and the frequency and efficiency of fermentor operation is inconsistent with the overall information. Additionally, fermentors appear to have been available earlier than stated. For example, the fermentation line acquired from the Veterinary Research Laboratories (VRL) at Abu Ghraib is stated to have been acquired only late in 1988 when it was moved and installed at Al-Hakam. However, documents provided by Iraq indicated consideration of its use *in situ* at the VRL and spare parts for this line were ordered by the

BW programme beginning late May 1988.

Fermentor idle times: Relative to available resources, Iraq has declared less than expected production of bulk agents. Declared quantities are based on limited availability of capability such as fermentors and a shortage of specific bacterial growth components. As a proof for the limited production output Iraq claims, fermentors were not used for considerable periods of time. For example, Iraq claims lack of spare parts and a needed overhaul of some fermentors as an explanation for "idle periods". In fact, UNSCOM has evidence indicating spare parts were available. There is no corroborating documentation to support the less than optimal bulk agent production levels reported in the FFCD. The low production figures are particularly difficult to accept without supporting evidence during a period in mid-1990, when allegedly maximum production was ordered by Lt. Gen. Hussein Kamel Hassan.

***Clostridium botulinum* toxin, Agent A: It is not possible to verify the amount of Agent A produced, placed into munitions or otherwise consumed as presented in the 1997 FFCD. Various accounts of the destruction of bulk Agent A were made in both the FFCD and by independent Iraqi testimony. There is insufficient documentation to verify either the quantity of Agent A destroyed or whether remaining bulk agent in summer 1991was destroyed. Methodology employed in destruction and location of destruction, similarly, can not be determined.**

***Bacillus anthracis* spores, Agent B: It is not possible to verify the amount of Agent B placed into munitions or otherwise consumed as presented in the 1997 FFCD. UNSCOM cannot exclude the production of Agent B from facilities other than Al-Hakam based on analytical evidence of *Bacillus anthracis* spores in equipment (one fermentor and two tanks) located at the FMD facility at Daura. An Iraqi explanation for this finding presented during the inspection was not credible. Overall, bulk agent production quantities and the location of production of Agent B cannot be determined because of the lack of sufficient supporting documentation.**

There are various accounts derived from both the FFCD and independent Iraqi testimony concerning the destruction of bulk Agent B. Laboratory analysis of samples obtained at Al-Hakam has demonstrated the presence of viable *Bacillus anthracis* spores at an alleged bulk agent disposal site. Iraqi experts cannot explain adequately how viable *Bacillus anthracis* spores could have been present at this site. The inactivation procedures described by Iraq for the "excess" bulk agent would preclude any live agents remaining following that inactivation procedure. The explanation provided by Iraq, i.e., endemic contamination is not credible. An alternative explanation proposed by Iraq that the viable organisms came from material discarded during agent production operations in prior years was contradicted by earlier information provided by Iraq. Further, that explanation, if true, would preclude verification of the destruction of bulk agents. There is

insufficient documentation to verify either the quantity of Agent B destroyed or whether remaining bulk agent was destroyed. Methodology employed in destruction and location of destruction, similarly, can not be determined.

Aflatoxin, Agent C: Declared production of the BW agent aflatoxin could not have occurred using the process stated by Iraq. In its June 1996 FFCD, Iraq claimed that, in September 1990, it had zero balance on hand, having produced only 40 litres of aflatoxin that were nearly all consumed by weapons field trials. Assessments by the Commission show that the quantity produced would have been inadequate for the declared number of field trials. Iraq claimed to have produced 1,782 litres of aflatoxin for filling weapons from 1 October to 31 December 1990 and continued the production two weeks into January 1991 for an additional 119 litres. Taking into account the technology, organization and production limitations including facilities, equipment, and personnel available, such large production volumes are doubtful. The impact on production of aflatoxin of mixing CS, CN, and smut spores with aflatoxin is not clear. A new account of aflatoxin production and weaponization is contained in the September 1997 FFCD, but the changes are not adequately explained or supported by documentary evidence. The new account is no more credible than the June 1996 version. Iraq has not offered any credible explanations to support its statements other than the 1990 Al-Hakam report that cites 2200 litres produced without the details of where and how it was produced. During an inspection in July 1998, Iraq tried to establish among themselves the figures of aflatoxin produced, indicative of Iraq's uncertainty with aflatoxin production quantities.

It is not possible to verify the amount of Agent C placed into munitions or warheads or otherwise consumed as presented in the 1997 FFCD. The question remains open regarding the aim and reasons of the choice of aflatoxin as an agent for BW. It is not clear what Iraq expected to obtain as a result of its use. One document refers to military requirements to produce liver cancer using aflatoxin and the efficacy against military and civilian targets. Understanding Iraq's concept of use for this agent may enhance the credibility of otherwise unsupported statements.

Iraq has indicated that the production data in the FFCD were based on recollection and back calculations due to a lack of production records.

***Clostridium perfringens* spores, Agent G: Stated amounts of Agent G produced, used, consumed or destroyed cannot be verified because of insufficient documentation. Iraq maintains that small quantities of Agent G, 340 litres, were produced because of limited availability of personnel and lack of critical growth media components. There is no documentation to support this, and the Commission has information which counters the allegation that growth media components represented a limitation. Iraq has not provided**

a credible material balance accounting for its known Peptone acquisitions by the BW programme. Peptone is a growth media component which appears to have been only used in the production of perfringens spores by the BW group.

Smut, Agent D: It is not possible to verify the amount of Agent D produced, used or consumed owing to a lack of sufficient documentation from Iraq.

Iraq had stated it produced smut coated with aflatoxin, but neither this statement, nor the destruction of bulk Agent D can be verified.

***Bacillus subtilis* spores, simulant for *Bacillus anthracis* spores dissemination: Stated amounts of *Bacillus subtilis* spores produced can not be verified. Stated quantities and time of production appear to be figures contrived to be compatible with the number and dates of field trials reported in the FFCD. Interview information and documentary evidence contradict Iraq's presentation of field trials conducted. Because of this artificial system for deriving production numbers, each additional trial that was not included in Iraq's arbitrary calculations, add to the disparity in quantities of simulant produced.**

***Bacillus thuringiensis* spores, simulant for *Bacillus anthracis* spores drying: Iraq cites the production of ~50 litres of *Bacillus thuringiensis* (Bt) spores in March 1990 for drying studies which are claimed not to have been done because of a failure to obtain a particular spray dryer. However, Bt spores were taken by Iraq to the supplier in December 1989 to test on the spray dryer it planned to acquire. The quantity of Bt spores produced can not be verified.**

Ricin: Iraq asserts that 10 litres of ricin were produced from 100 kg of castor beans and that this quantity was used in a field trial using 155mm artillery shells in November 1990. Documents obtained during an inspection in 1997 indicate that far more than 100 kg of castor beans were collected and processed in October, November 1990. If the Commission had a clear understanding of Iraq's objective for including Ricin in its programme, then perhaps much of the uncertainties surrounding Ricin could be resolved.

Other agents produced: It is not possible to determine if bacterial or toxin agents other than those stated in the 1997 FFCD were produced. Seed stocks of other agents were actively sought for and obtained by Iraq's BW programme.

Drying of agent: It is not possible to determine if bacterial and toxin agents produced were dried to enhance storage stability or for reasons of dissemination. This issue is of significance because Iraq actively procured drying equipment and obtained training in the use of such equipment for key personnel. Drying studies on bacteria started in 1974.

The following table provides a summary of Iraq's declarations concerning the bulk agent production (as active agent), filling and destruction (unless stated otherwise).

FFCD	UNSCOM Assessment	Comments
Botulinum toxin produced (10 to 20-fold concentrated) 19180 litres	Insufficient documents to support quantities. Equipment and unaccounted for growth media do not support the figures. Quantities could be more at least double the stated amount.	Iraq bases this estimate on 1990 "Al-Hakam" report with extrapolations into 1989 and earlier.
Botulinum toxin filled 10820 litres	Nothing to support statements. Iraq acknowledges numbers are estimates. Number of filled munitions could not be verified. See weapons tables.	Figure is based on the alleged numbers of munitions filled; 100 R-400 bombs, each filled with 85 litres, and 16 Al-Hussein missile warheads, each filled with 145 litres.
Botulinum toxin used for field trials 499-569 litres	Stated field trials can not be verified as accurate, hence quantities of bulk agent consumed can not be verified.	Quantities are based on unsupported number of field trials conducted.
Botulinum toxin wasted during handling 118 litres56	Nothing to support statements. Interviews differ with these estimates in ways that cast doubt in the account of filling.	Quantities are estimates. There is no basis for assessment of wastage.
Botulinum toxin destroyed 7665 or 7735 litres	Nothing to support statements as to quantities destroyed and where and when destroyed. Interviews differ from official declaration. Quantities are contrived estimates.	Stated as unilaterally destroyed in July 1991.
Bacillus anthracis spores produced (10-fold concentrated)	Insufficient documents to support quantities. Equipment and unaccounted for growth media does not support the figures. Quantities	Iraq bases this estimate on 1990 "Al-Hakam" report with extrapolations into 1989 and earlier.

8445 litres	produced could be at least 3 times greater than stated.	
Bacillus anthracis spores filled 4975 litres	Nothing to support statements. Iraq acknowledges numbers are estimates. Number of filled munitions could not be verified. See weapons tables. Quantities are contrived estimates.	Figure is based on the alleged numbers of munitions filled; 5 Al-Hussein missile war-heads, each filled with 145 litres, and 50 R-400 bombs, each filled with 85 litres.
Bacillus anthracis spores used for field trials None	No evidence has been presented to indicate whether or not *Bacillus anthracis* spores were ever tested.	Iraq states that no field trials were conducted with *Bacillus anthracis* spores; only a simulant was used.
Bacillus anthracis spores wasted 52.5 litres58	Nothing to support statements. Interviews differ with these estimates in ways that cast doubt on the account of filling.	Quantities are estimates.
Bacillus anthracis spores destroyed 3412 litres	Nothing to support statements as to quantities destroyed and where and when destroyed. Interviews differ from official declaration. Quantities are contrived estimates.	Stated as unilaterally destroyed in 1991.
Aflatoxin produced 2200 litres	Facilities, equipment, and personnel do not support production statements. Experts assessments are that Iraq could not have produced the quantity of aflatoxin claimed, given the equipment, facilities and personnel stated by Iraq.	Iraq bases the production of 2200 litres on the 1990 Al-Hakam report.
Aflatoxin filled 1120 litres	Nothing to support statements. Iraq acknowledges numbers are estimates. Number of filled munitions could not be verified. See weapons tables.	Figure is based on the alleged numbers of munitions filled; 7 R-400 bombs, each filled with 80 litres and 4 Al- Hussein missile warheads, each filled with 140 litres.

Aflatoxin used for field trials 231-301 litres	Stated field trials can not be verified as accurate, hence quantities consumed can not be verified.	Quantities are based on an unsubstantiated number of field trials conducted.
Aflatoxin wasted 30.5 litres59	Nothing to support statements. Interviews indicate wastage was much higher. Interviews differ with these estimates in ways that cast doubt on the account of filling.	Quantities are estimates.
Aflatoxin destroyed 900 or 970 litres	Nothing to support statements as to quantities destroyed and where and when destroyed. Interviews differ from official declaration. Quantities are contrived.	Stated as unilaterally destroyed in 1991.
Clostridium perfringens spores produced (10-fold concentrated) 340 litres	Insufficient documents to support quantities. Equipment and unaccounted for growth media does not support the figures. Quantities produced could be at least 15 times the quantity stated.	Iraq bases the 340 litres estimate on 1990 Al-Hakam report.
Clostridium perfringens spores filled None	Nothing to support statements.	Stated quantities produced are insufficient for weaponization.
Clostridium perfringens spores wasted None	Nothing to support statements.	No filling, ergo no wastage.
Clostridium perfringens spores destroyed 338 litres	Nothing to support statements as to quantities destroyed and where and when destroyed.	Quantities are estimates.
Ricin produced 10 litres	Documents and interviews do not support account.	Based on an inaccurate account of Ricin activity.

Ricin used for field trials 10 litres	Nothing to support statements.	Based on an inaccurate account of Ricin activity.
Wheat Cover Smut Not quantifiable	Nothing to support statements.	The total quantities remaining are claimed to have been destroyed in July 1991.

Mobile storage tanks. Eight mobile double-jacketed tanks were part of the VRL line transferred to Al Hakam. In addition, Iraq has acknowledged the production of an additional 39 mobile tanks by SEHEE. These tanks were used to transfer agent between production and filling or deployment sites and for storage of agent. Owing to their properties, they can be used for long-term storage of agent under controlled conditions or modified to function as fermentors suitable for the production of BW agent.

FFCD	UNSCOM Assessment	Comments
Mobile tanks acquired. 47 39 indigenously produced at SEHEE 8 from VRL	1990 Al-Hakam report refers to 70 being produced. Serial # 37 seen on remnants. 8 tanks are known to come from the VRL line.	39 tanks stated to have been manufactured by the Heavy Engineering establishment at Daura is based on a document in which SEHEE billed PC2/3 39ss vats (not specified) and 8 came from the VRL Vaccine line. The 1990 "Al Hakam" report cites 70 1m3 tanks.
Mobile tanks destroyed. Unknown	Remnants of 2 tanks were found at Al-Azzizziyah. Among other remnants turned over to UNSCOM, were the remains of approximately 22 tanks (4 tanks of the VRL line).	The number has not been stated in the 1997 FFCD. In the 1996 FFCD, 2 were said to have been destroyed at Al-Azzizziyah, and 22 were cut-up and disposed at Iskanderiah. Thus 20+ tanks remain unaccounted for.

Bacterial Growth Media

Media Acquisition

In the early days of Iraq's BW programme based at Al-Muthanna and Salman Pak small quantities (in the order of tens of kilograms) of media of various types were purchased by Iraq through the State Establishment for Pesticide Production (SEPP) for research and

pilot scale production for BW agent. . The media, some tens of kilograms, for the initial production runs of botulinum toxin at Taji in early 1988 is stated in the FFCD to have been acquired locally but the details are not provided and it is unknown whether the amounts declared represent the totality of the amount actually acquired. No supporting documentation is provided by Iraq for any of the acquisitions referred to above.

In late 1987 and early 1988, enquiries, and ultimately orders, were made for large purchases of media. Iraq acknowledges importing over 40 tons of media in 1988 and although no documentation is provided by Iraq. The Commission can confirm the four largest orders listed in the FFCD. However, the Commission has information that shows that the bulk media acquisitions as declared by Iraq are an incomplete listing and that further amounts in excess of 600 kg were imported and have not been declared. Furthermore, some of this undeclared media was received by Iraq prior to May 1988, suggesting that the statement in the FFCD that the Taji fermentor was shut down between April and July 1988 "due to the non availability of culture media", is incorrect.

Given the incompleteness of documentation regarding media acquisitions, particularly for local purchases, and evidence indicating that imports have been understated, the Commission cannot verify Iraq's declaration of media acquisition.

Media Used In Production

The account in the FFCD of media consumed in the production of BW agent is acknowledged by Iraq to be a mathematical calculation based on a) the claimed quantity of agent produced and b) the estimate of failed production batches that would have also consumed media. In addition other quantities are said to have been discarded during the production process (Iraq has stated this to be due to spoilage). Other than the 1990 Al-Hakam report outlining agent production at Al-Hakam for that year, Iraq has provided no records or other documentation to support its estimates.

Iraq had stated that in June 1991, before the arrival of the first UNSCOM BW team, the media remaining at Al-Hakam was transferred to the State Company for Drugs and Medical Appliances Marketing (otherwise known as Kimadia) within the Ministry of Health. Iraq has explained that the role of Kimadia was to provide a cover story for media that had been consumed in the weapons programme. Subsequently documentation was drawn up to indicate that media consumed in the programme had been sent to hospitals in outlying regions where riots had occurred and hence would no longer be traceable.

Thus the difference between the quantity of media imported and that remaining in stock in

1991, i.e., the shortfall, accounted for by Kimadia, represents the media consumed in the Iraqi BW programme between 1988 and June 1991. This provides a snapshot in time immediately following the stated end of the BW programme and potentially is a figure that can be used in the verification of Iraq's FFCD. The picture however became confused in July 1998 when Iraq stated that not all the media left over from the programme was transferred to Kimadia, but certain amounts (undocumented) were retained at Al-Hakam. Thus the Kimadia "shortfall" figures would reflect media consumed in the programme plus any remaining at Al-Hakam in 1991. If this is the case then the Kimadia documents become less useful as a verification tool. Furthermore some of the data from the Kimadia documents is in conflict with the FFCD. In discussions with Iraq during an inspection in December 1998, the issue of what quantity of media remained in 1991, became more unsettled. Iraq submitted "copies of documents" that casts further doubt on the usefulness of the "Kimadia documents" for verification. The "copies" provided during this inspection cast further doubt, however, may not be valid copies.

As noted above, Iraq has recently stated that in 1991 some of the media was transferred from Al-Hakam to Kimadia. What is unclear and has not been explained to the Commission is the basis for the retention of media at Al-Hakam. Peptone, for example, which had been used for the production of Agent G had no apparent role at Al-Hakam in 1991 if the BW programme had been abandoned. Also Kimadia had "covered" for all the media remaining in 1991 and therefore any media remaining at Al-Hakam had been written off and was untraceable. It is not clear why this media was not accountable in the Iraqi system if indeed Al-Hakam had been converted to legitimate purposes in 1991.

In summary the figures presented in the FFCD for media consumed in the production of BW agent are a theoretical calculation, have little supporting evidence and do not account for all media acquired. This current account therefore can not be verified.

Media Lost, Damaged or Destroyed

The FFCD identifies two losses of media prior to the first UNSCOM BW inspection. The first was said to have occurred during the evacuation of Al-Hakam and the relocation of its headquarters to Al-Asma'a school about 30 km away. It is stated that equipment important to the functioning of departments was relocated to the school on 22-23 January 1991. Included was an unknown quantity of media of various, but unidentified, types. At some time before the return to Al-Hakam in May 1991, Iraq claims the school was broken into and some items stolen and damaged including some of the media.

Iraq states that no investigation of the loss occurred and that the amounts and types of

media cannot now be recalled. The figures in the material balance table of the FFCD indicate that over 900 kg of media were "lost" including over 700 kg of peptone which is relevant to *Clostridium perfringens* (Agent G) production. There would appear to be no basis for these figures other than a calculation designed to account for all the media i.e. so that the material balance equals zero.

The Commission has reason to believe that no media was stored at the schoolhouse and that none was stolen.

A second loss of media is stated to have occurred during the clean up of Al-Hakam prior to UNSCOM's arrival in 1991. This was said to be an unquantified amount of media damaged during the evacuation and it is stated to have been burnt and buried at a site adjacent to Al-Hakam. This site was visited by the Commission's inspection team in 1995 and it was confirmed that media was burnt and buried there but the types and quantities are not known. During the inspection in December 1998, Iraq presented several improbable accounts of media lost, damaged and stolen that defies credibility. In conclusion therefore, the Iraqi account of lost media cannot be verified and in the case of the school house media, it is probably not true.

During the destruction of Al-Hakam in 1996, 22 tons of media were collected from several facilities and destroyed under the Commission supervision. However some of the 22 tons (unquantifiable) probably came from sources external to the BW programme i.e. some of the media from the original orders is still unaccounted for. It is also uncertain whether all the media acquired for the programme has been identified. Thus there is little confidence that all the media associated with the programme has been located and destroyed.

Material Balance

The following tables provides a summary of Iraq's material balance declarations for growth media acquisition, usage, consumption and disposal by four key media types: casein, thioglycollate broth, yeast extract and peptone.

FFCD	UNSCOM Assessment	Comments
Casein		
Casein acquired.* 17554kg	Fails to include several smaller but significant orders acquired for the BW programme.	Derived principally from 3 large orders in 1988.

Casein used for botulinum toxin production. 7074 kg	Production quantities are estimates and consequently media consumption figures are estimates that are based on estimates.	No supporting data other than the production figures for 1990.
Casein lost and wasted.** 145 kg	Not confirmed but represents 2% of that stated as used and does not therefore seem unreasonable.	Unsupported statement.
Casein remaining in 1991. 10335 kg	The 10335 kg figure appears to be based on a 1995 inventory made by Iraq and may have little relation to the actual amount in 1991. Unconfirmed.	Iraq also states 970kg remained unused in 1991 at Hakam. No supporting evidence for this
Casein destroyed in 1996. Not specifically stated: implied 10335kg	Iraq and UNSCOM inventories differ, but for casein, in general agreement.	Destroyed under UNSCOM's supervision.
Thioglycollate Broth		
Thioglycollate broth acquired.* 6036 kg	Fails to account for additional smaller but significant orders acquired for the BW programme.	Derived principally from 1 large order in 1988.
Thioglycollate used for botulinum toxin production. 4130 kg	Production quantities are estimates and consequently media consumption figures are estimates that are based on estimates.	No supporting data, other than the production figures for 1990.
Thioglycollate lost and wasted** 58 kg	Not confirmed, but about 1% of total stated to be used and therefore not unreasonable.	Unsupported statement.
Thioglycollate remaining in 1991. 1848 kg	The 1848 kg figure appears to be based on a 1995 inventory and may have little relation to the actual amount remaining in 1991. Unconfirmed.	No supporting documentation

Thioglycollate destroyed in 1996.Not specifically stated: implied 1848 kg	Iraq's and UNSCOM's inventories in 1995 differ, but for Thioglycollate, in general agreement.	Destroyed under UNSCOM's supervision.
Yeast Extract		
Yeast Extract acquired.* 7070 kg	Fails to include additional smaller but significant orders acquired for the BW programme.	Based on 3 large orders and 70 kg from an unidentified internal source.
Yeast extract used for agent production. Botulinum toxin 1768 kg *Bacillus anthracis* spores 185 kg Perfringens 11 kg	Production quantities are estimates and consequently media consumption figures are estimates that are based on estimates.	No supporting data other than the production figures for 1990. Iraq also stated 185 kg used in SCP production post 1991.
Yeast extract lost and wasted**. 15kg	Represents less than 1% of stated usage and not unreasonable.	Unsupported statement
Yeast extract remaining in 1991. 5090kg	The 5090 kg figure appears to be based on a 1995 inventory and may have little relation to the actual amount in 1991. Iraq has also stated (unconfirmed) that 4000 kg was retained at Al-Hakam in 1991 and 1807 kg sent to Kimadia, total 5807 kg: this is inconsistent with the FFCD.	No supporting evidence for the quantity retained at Al-Hakam in 1991.

Yeast extract destroyed in 1996. Not specifically stated: implied 4942 kg	Iraq's and UNSCOM's inventories in 1995 differ greatly for yeast extract. The majority of containers had been opened and the inventory was complicated by mis-labelled media, other sources of media possibly being added and duplicate labels.	Destroyed under UNSCOM's supervision.
Peptone		
Peptone acquired. 1500 kg	Does not include several smaller but significant orders including one for 100 kg peptone.	Quantity is based on a single large order.
Peptone used for *Clostridium perfringens* production. 45 kg	Production quantities are estimates and consequently media consumption figures are estimates that are based on estimates.	No supporting data other than the production figures for 1990. Iraq also stated 125 kg used for civilian work post 1991.
Peptone lost and wasted**. 705 kg	The basis for the figure appears to be a calculation designed to bring the material balance to zero. Unsupported by evidence.	The bulk of the 705 kg has been presented as having been stolen from an evacuation site. UNSCOM has reason to believe this is untrue.
Peptone remaining in 1991. 750 kg.	The 750 kg figure appears to be based on a 1995 inventory and appears to have little relation to the actual amount remaining in 1991. Unconfirmed.	Additional quantities of peptone were acquired after 1991 from the "local market".
Peptone destroyed in 1996. Not specifically stated: implied	Iraq's and UNSCOM's inventories in 1995 differ greatly for peptone. The majority of containers had been opened and the inventory was complicated by mis-labelled media, other sources of media possibly being added and duplicate labels.	Destroyed under UNSCOM's supervision.

625 kg		

*** Iraq has not reported all the media including casein, Thioglycollate broth, yeast extract, and peptone known by the Commission to have been imported for the BW programme. In response Iraq has suggested that the Commission must be confusing media ordered for the Forensic Laboratory with that ordered for the BW programme since both organizations used the same procurement system. If this is so, it implies that Forensic Laboratory had large quantities of media. However the purpose for this and its present whereabouts have not been declared.**

**** The "lost" media cited in the FFCD includes media that was wasted during production or handling e.g., by spoilage, and media said to have been lost or stolen during the relocation of the headquarters. There is no further breakdown of these figures so that it is not possible to establish, for example, what media may have been lost through handling errors and what may have been stolen.**

Assessment of Material Balance for Bacterial Growth Media

The material balance pertaining to media cannot be established. There are several factors which introduce uncertainty. On imports, Iraq's declaration understates the amount by at least 600 kg. Furthermore there is no documentation for the quantities of media said to have been acquired locally, nor any evidence whether this was the total amount. On media consumed, Iraq acknowledges that the figures it presents are derived from estimates of the quantity of agent produced. Since there is little supporting documentation relating to the quantities of agents produced, the amount of each type of media consumed carries similar uncertainties. On losses, Iraq's account of substantial amounts of media said to be lost during the evacuation of Al-Hakam cannot be quantified and furthermore the account of the theft of media from the school house, is probably untrue. The only fixed point in the material balance equation for bacterial growth media is the amount of imported media. Some more data can be derived from the amount of media destroyed by the Commission in 1996. However in relation to yeast extract and peptone there is considerable uncertainty in the destruction of the media. The majority of containers had been previously opened by Iraq and the Commission's assessment of their contents was complicated by mis-labelled media, other sources of media possibly being added and duplicate labels. In particular for peptone, the Commission's assessment of the media destroyed varies between 200 and 470 kg depending on the assumptions made with regard to labelling. This compares with 625 kg implied in the FFCD as having been destroyed. For all the above reasons, the material balance for bacterial growth media cannot be verified.

Although a material balance cannot be established, an estimate can be made of minimum amounts of media still unaccounted for. As discussed above, the Commission is aware of additional quantities imported by Iraq. If the quantity of media declared by Iraq to have been consumed and lost is added to the amount of media destroyed by the Commission, and then this addition compared with the amount imported, a minimum figure for media unaccounted for can be derived. This will be a minimum figure because there may be additional quantities of media imported of which the Commission is unaware, and it also relies on the estimates in Iraq's declaration some of which are not accurate.

The following table gives the Commission's estimate of key media types unaccounted for.

Media	Minimum unaccounted for (kg)	Remarks
Casein	460	Sufficient for the production of 1200 litres of concentrated botulinum toxin (depending on availability of other components including yeast extract). This would represent an additional 6% of that which has already been declared by Iraq.
Thioglycollate broth	80	A relatively small discrepancy but the estimate depends on the reliability of Iraqi estimates of quantity consumed or lost during the production of botulinum toxin.
Yeast Extract	520	This minimum estimate is uncertain and is likely to be much higher. It is based on a liberal assessment of the contents of many opened and irregularly marked containers. However this minimum figure is sufficient to produce 26000 litres of *Bacillus anthracis* spores or over 3 times the amount declared by Iraq.
Peptone	1100	Iraq states that about 700 kg of peptone was stolen. UNSCOM has reason to believe this is not true and therefore the estimate includes the entire amount not adequately accounted for. It is sufficient to produce 5500 litres of concentrated perfringens agent or about 16 times the amount declared by Iraq.

As evident from the tables the greatest concern is with unaccounted amounts yeast extract and peptone. Although the expiry date for this media would have passed, advice from the manufacturers is that given appropriate storage conditions, particularly away from moisture, the media would still be usable today. The Commission has no information regarding its fate, whether it was retained or used to produce additional undeclared BW agent. The amounts that are "missing" however are significant and would be sufficient to

produce quantities of agent comparable to that already declared by Iraq.

Material Balance

The most important elements of the FFCD are those related to material balance. That is weapons, filling of munitions, production of munitions, production of types and quantities of BW agents, acquisitions of growth media, supplies, equipment, and other material for the programme; bulk agents, munition and weapon destruction.

Establishing a material balance consists of determining the input materials and the output materials. In the case of biological weapons, the input materials are the bulk agents and munitions and the output material are the filled BW weapons. In turn, the input materials for bulk agents are the growth media components and the output materials are the bulk agents.

The quantities of bulk agent filled into munitions and allocation of munitions to agents, either by type or number for R-400 bombs or for Al-Hussein warheads cannot be determined from the information provided by Iraq. The munitions available for the BW programme cannot be verified. The lack of adequate documentation prevent the verification of the munitions available for the BW programme.

There is no documentation to indicate the number of munitions filled with BW agents. Nor, is there any adequate documentation to support the account of the destruction of the weapons, unfilled munitions and bulk agent.

Bulk BW agent must be considered to be a weapon. In addition to the munitions, Iraq developed two types of aerosol dissemination devices that would use bulk agents - the modified drop tank and the aerosol device for slow moving aircraft. There are no production records or production documents to support the stated bulk agent production. The input material for this production is the respective growth media, which is not accurately reported. Production quantities of bulk agent are acknowledged to be estimates and stated media consumption are estimates, based on these estimates. Production quantities of the four types of agents declared by Iraq as produced in bulk cannot be verified.

As a result of the above for each of the critical elements of the material balance, Iraq's current account in the FFCD cannot be verified.

Determining the number of weapons destroyed is very important but, without knowing the quantity of munitions produced and allocated to BW, determining the quantity destroyed does little to help verify that all weapons have been destroyed, for which documentation has not been provided.

In July 1998 international biological experts reviewed with Iraq, at the request of ist Deputy Prime Minister, its biological FFCD, specifically addressing material balance as outlined above. On the material balances for weapons, agents and media the team came to the following conclusions:

Weapons

None of the subcomponents of the material balance for R-400 bombs (production, filling, destruction of filled and unfilled bombs) could be verified.

None of the subcomponents of the material balance for Al-Hussein warheads (production, filling, destruction of warheads) could be verified.

The account in the FFCD on modified drop tanks and the Zubaidy spray device could not be verified.

Agents

None of the subcomponents of the *Clostridium botulinum* toxin material balance (production, filling, losses and destruction) could be verified.

None of the subcomponents of the *Bacillus anthracis* spores material balance (production, filling, losses and destruction) could be verified.

None of the subcomponents of the aflatoxin material balance (production, filling, losses and destruction) could be verified.

None of the subcomponents of the *Clostridium perfringens* spores material balance (production, losses and destruction) could be verified.

None of the subcomponents of the wheat smut material balance (production, losses and destruction) could be verified.

Media

None of the subcomponents of the media material balance (acquisition, consumption, losses and destruction) could be verified.

In its accounting for various BW weapons-programme-related elements, the Commission has achieved various levels of confidence, depending on the quality of information; documentary, physical, and personal testimony provided by Iraq; and the correlation of this information with other information derived from Iraq, information provided by its former suppliers, or otherwise obtained by the Commission.

The Commission has a degree of confidence in the accounting for some proscribed items which were presented by Iraq for verification and disposal. This includes, for example: the destruction of buildings, and equipment at Al-Hakam, the destruction of large quantities of growth media acquired for the programme; and evidence that R-400 aerial bombs and Al-Hussein warheads contained BW agents and consequently that *Bacillus anthracis* spores and botulinum toxin were indeed weaponized.

The Commission has less confidence in the accounting for proscribed items declared by Iraq as having been unilaterally destroyed. These include, for example: the number and fill of R-400 aerial bombs destroyed at Al-Azzizziyah; the number and fill of BW Al-Hussein warheads destroyed; and the fate of the agent to be used with drop tanks.

The Commission has little or no confidence in the accounting for proscribed items for which physical evidence is lacking or inconclusive, documentation is sparse or non-existent, and coherence and consistency is lacking. These include, for example: quantities and types of munitions available for BW filling; quantities and types of munitions filled with BW agents; quantities and type of bulk agents produced; quantities of bulk agents used in filling; quantities of bulk agents destroyed; quantities of growth media acquired for the programme; quantities of growth media used/consumed; and when or whether the programme ended. In addition the Commission has no confidence that all bulk agents have been destroyed; that no BW munitions or weapons remain in Iraq; and that a BW capability does not exist in Iraq.

Several other outstanding issues also remain. These issues are related: to the scope and extent of R&D activities; the acquisition of supplies and equipment; the involvement of military and other agencies in the BW programme; and deception associated with the concealment of the BW programme.

STATUS OF VERIFICATION IN THE AREA OF OTHER COMPONENTS OF IRAQ'S BIOLOGICAL WARFARE PROGRAMME

Iraq, under SCR 687 (1991), is required to declare the locations, amounts and types of all biological weapons and all stocks of agents and all related subsystems and components and all research, development, support and manufacturing facilities. In SCR 707 (1991) this requirement was reaffirmed and the Council demanded that Iraq provide a full, final and complete disclosure on all areas related to its BW programme. Part I of this status report reviews those elements of the FFCD that are directly relevant to a material balance. Part II reviews additional elements of the FFCD. The biological TEM conducted in Vienna in 1998 indicated the significance of those issues and it was stated in the expert report: "The FFCD also does not provide a clear understanding of the current status of the BW programme or wether, or when, it was terminated." In April 1998, the Commission's report to the Security Council (S/1998/223) further underlined the significance of these issues by listing the history, the organization, acquisition and research and development among the priority issues to be resolved with regard to the proscribed biological weapons programme.

Other Acquisition

Iraq has failed to include in its FFCD all the acquisitions of munitions, equipment, media and agents acquired for or used in its BW programme. Iraq has not included all its acquisition of growth media for production purposes which for the four principal components are covered in this report under Part I, para 3. Iraq has not acknowledged all its acquisition of media used in R&D as well as that used in the seed fermenters during production of bulk agents. Neither has Iraq reported all its acquisition of equipment and micro-organisms, nor has Iraq declared all the agencies and individuals involved in that process. Iraq has not provided an adequate account of materials and equipment acquisition. Further, Iraq has failed to provide adequate answers regarding its BW procurement network including the Arabian Trading Company, and other front companies. A complete understanding of acquisition is essential to defining a material balance for Iraq's BW programme.

The FFCD does not contain all imports for Iraq's BW programme known to the Commission, although Iraq claims that all imports for the BW programme were reported. The basis which Iraq claims it used in the FFCD for determining what imports by Iraq to include or exclude among the declared acquisitions was shown not be sound. Thus acquisitions, as measured by the number of orders including Letters of Credit (LCs) and cash deals through attachés at Iraq's Embassies overseas, are substantially under-reported. Without a complete accounting of all BW programme acquisitions, a material balance is not possible.

LCs and cash deals for such items as rotary evaporators, glassware, oven sterilizers, and Petrie dishes, are omitted from items attributed to the programme.

Not all strains of micro-organisms that were acquired bu\y Iraq are included nor are all attempted acquisitions of strains included. The FFCD contains only the Vollum strain of *Bacillus anthracis* spores to be obtained by TSMID, in 1989, but in 1988 an Iraqi scientist involved in the BW programme had tried to obtain known BW and other virulent *Bacillus anthracis* spores strains from outside Iraq. All local acquisitions of strains are not included in the FFCD. Further, the fungal and viral strains acquired are not reported in the FFCD.

The media listing is incomplete in that Iraq fails to consider several Letters of Credit and cash deals related to media imports; some of these orders relate to media or media components used in production but other orders relate to media used in R&D and for seed fermenters used during the production process. Media acquisition during the time of the BW programme at Al-Muthanna are understated as well.

There is inadequate or in some cases no supportive evidence for munitions acquisition, both for weaponization and for field trials. Although the account of the acquisition of materials for the aerosol generator (Zubaidy device) was incomplete in the 1996 FFCD, much of the information presented in that version has been intentionally omitted in the 1997 FFCD.

History of Iraq's BW Programme

Iraq is required to provide a comprehensive account of the history of its BW programme.

This may appear peripheral to disarmament and to material balance issues. But lacking documentary or physical evidence to establish a material balance, other elements of the Iraqi BW programme become essential as tools for verification. The history of the Iraqi BW programme is certainly an element of the FFCD, which, if correctly declared, would facilitate verification.

The introduction and chronology presentation of Iraq's BW programme encompasses only a part of the programme, is inaccurate with respect to dates and fails to provide an insight into the decision making process which facilitated its evolution. The account misleads because it presents the programme as an entity which came to fruition in 1990 whereas in reality it was a programme planned to reach maturity some time in the mid/late 1990s. The account also fails to provide any perspective to the programme merely listing a miscellany of chronological events linked only by time rather than requirement, strategic planning, or military utility. As such there is no continuity to the account which limits the Commission's understanding of the BW programme.

Iraq claims that the programme started in 1974 by Presidential decree and by the establishment of the Al-Hazen Institute. Interview evidence shows that consideration of a programme was earlier, as evidenced by the establishment of a functional purpose-built scientific research complex by mid 1974. Planning, design and construction of such a complex would had to have started at least in 1973 with concepts developed earlier. The affiliation of the Institute is not defined other than to a "State Security Organization".

The Al-Hazen Institute terminated on 16 January 1979 not 1978, as declared, because of fraud by the Chairman (Major Ghazan Ibrahim, not stated in the FFCD) and some senior staff, not for reasons of inadequacy of the facility, nor inability to make scientific progress as claimed by Iraq.

Before the apparent "resurrection" of the programme in 1985 work continued at Al-Salman to create resource for biological purposes including buildings established for the Institute including an animal house. Prof. Nasser Hindawi submitted a proposal for BW research in the early 1980s. The date on which the Director of Al-Muthanna Establishment (Gen. Nizar Attar) formally requested the addition of a BW research is not indicated.

It is stated by Iraq that no plans were elaborated for the large scale production, weaponization and storage of BW agents which is contrary to the statement of Gen. Nizar Attar who stated in 1995 that a plan was formulated in 1986 to achieve weaponization within 5 years (which is precisely what happened). The evolution of the programme over

the next five years appears to follow a well defined course implemented with urgency, authority, and great secrecy demonstrating considerable planning.

Research and Development at Al-Muthanna is claimed to have been restricted to consideration of just *Clostridium botulinum* and *Bacillus anthracis* spores whereas it is known that *Clostridium perfringens* was received on 10 November 1986 and that "DIALOG" database searches were undertaken for *Clostridium perfringens* on 13 May 1985 and 10 July 1985. Consultations were undertaken with Prof. Nasser Hindawi when at Mustansiriyah University in 1986.

In reality the Commission assesses that the transfer of the BW work from Al-Muthanna to Al-Salman (TRC) was to preserve secrecy. Al-Muthanna still had a requirement for the agents produced at Al-Taji and subsequently at Al-Hakam for field tests. Al-Muthanna continued to collaborate on both laboratory and field experiments from 1987 to 1991.

The establishment of the BW research group at Al-Salman in 1987 is accepted as stated although the means by which it was established and managed is far from clear. The relationship of the programme within TRC to other organizations is unclear. The responsibility and management for the expansion of the programme to include mycotoxins in 1987/88 and viruses and genetic engineering in 1990 has not been defined adequately.

The establishment of the BW agents production factory at Al-Hakam has not been related to a military requirement or a weapons testing and procurement requirement. The extent of the capability there has not been justified.

Field tests of BW agents started in late 1987/early 1988. The extent of such testing has not been revealed and some previously acknowledged tests are now stated not to have taken place.

The activities undertaken in 1989 and 1990 - field testing aerial bombs, rockets and other munitions; the expansion of the programme in terms of research and agent production, and acquisition of additional facilities remain ill defined and as such a confident determination of the extent and scope of the programme cannot be made.

Since the FFCD falsely states that the BW programme was obliterated in July 1991 no credible account is given of the preservation and concealment of the programme until 1995.

FFCD	UNSCOM Assessment	Commentary
1974 - Initiation BW Programme by Government decree.	Establishment of Al-Hazen required planning in earlier years.	No decree provided. Al-Hazen Institute established.
1978 - Liquidation of the Al-Hazen Institute.	Formally ceased activity on 16/1/79. Biological work continued at Al-Salman from 1979 to 1985.	Legal reports confirming financial fraud by senior staff provided.
1983 - BW was introduced in Al-Muthanna objectives.	This is probably correct. Date probably 1983 from testimony of Lt. Gen. Nizar Attar.	No documents to support statement. Statement by Head Al-Muthanna that BW added to CW programme was made in interview testimony.
1985 - Start Al-Muthanna BW research.	This is probably correct	Documentary evidence for the appointment of BW staff. Others were already engaged at Al-Muthanna. Requirement and assessment not provided.
1986 - No formal plans for BW.	Planning was an integral and essential part of establishing the BW programme for the military.	Contrary to statements of Gen. Nizar Attar and Haidar Farm documents.
1987 - Transfer BW research to Al-Salman under TRC.	It is accepted that this occurred in 1987.	Documents support the transfer of personnel. No realistic justification or rationale provided for the move.
End of 1987 - Production botulinum toxin for weapons tests.	Acquisition Al-Taji was Aug 1987 and indicates prior planning for weapons.	No documentary evidence of output of botulinum toxin. Acquisition Al-Taji supported by documents.
1988 - Start planning weapons tests.	Weapons were considered from 1986 when Gen. Nizar Attar planned BW programme. Detailed planning started in 1987.	No documents provided.

1988 - Expansion BW activities.	It is accepted that this occurred although the extent and scope cannot be assessed.	Recruitment of personnel and documented activity confirm this.
1988 - Establishment of Al-Hakam Factory for the production of BW agent.	Plans laid 1987; no justification provided; relation of scale to military requirement not explained. Gen. Nizar Attar started formulating plans in 1986.	Acquisition of site on 24 March 1988 documented.
1988 - Start aflatoxin research.	22nd May 1988 is accepted as the start date.	No coherent account of initiation of work has been presented.
1989 - Start Ricin research. Ricin considered CW agent.	The origin of and extent of programme unclear. Started in 1988.	No coherent account of initiation of work has been presented.
1989 - Start Botulinum toxin production on an industrial scale.	This is accepted	Consistent with evidence of construction and equipping Al-Hakam.
1990 - Botulinum toxin production continues on an industrial scale.	Scale not consistent with admitted weaponization activities.	Undertaken at Al-Hakam and Al-Manal.
September 1990 - Start of *Bacillus* anthracis spore production on an industrial scale.	In response to August order of Lt. Gen. Hussein Kamel Hassan. Production does not make maximum utility of equipment available. Evidence of *Bacillus anthracis* spore production at Al-Manal.	Al-Hakam 1990 report supports *Bacillus anthracis* spore production at Al-Hakam.
July 1990 - Start of virus research programme.	Appears to be correct, at least for Dr. Hazem Ali's work. Role of Dr. Hazem Ali, a virologist, in programme unclear.	Al-Hakam 1990 report supports this.
March 1990 - Start of genetic engineering programme.	Appears to be correct. No clear objectives provided for this. Location of activity unclear.	1990 Al-Hakam report confirms start.
August 1990 - Decision to produce biological weapons for war.	Accepted that the programme changed and was enhanced.	No documents provided in support. Presented as a unilateral decision by Lt. Gen. Hussein Kamel Hassan.

August 1990 - Enhanced production of BW agents.	Accepted that the programme changed and was enhanced.	No documents provided in support. Presented as unilateral decision by Lt. Gen. Hussein Kamel Hassan.
[September 1990 - R-400 tests at Al-Mohammediyat.]	Tests probably were undertaken with agents deployed.	Statement withdrawn by Iraq despite discussion of tests with weapons staff at Al-Mohammediyat which provided clear accounts of the trials.
September 1990 - Al-Manal established at FMDV facility Daura to produce botulinum toxin for weapons.	Evidence that Al-Manal was also used for *Bacillus anthracis* spores - denied by Iraq. *Bacillus anthracis* spore genes were found on a fermentor and storage vessels.	Documentary evidence that facility was acquired and 5000 litres botulinum toxin were produced.
January 1990 - Production of aflatoxin at Al-Fudhaliyah (Al-Safa'ah).	No technically coherent account for production given. Testimony indicates September 1990 for start.	1990 Al-Hakam report states 2200 litres aflatoxin produced, but location not identified.
December 1990 and January 1991 - Weaponization of BW agents.	The ordering and timing of weapons filling and deployment remains unclear. Timings of activities still not precise. It is unclear what the range of weapons used actually was.	R-400 bomb and Al-Hussein missile warhead remnants confirm that BW agents were used with these weapons.
January - July 1991 - Deployment of weapons.	Ambiguities remain on numbers and location of weapons deployed.	Iraqi accounts of the deployment of weapons continue to change.
July 1991 - Destruction of weapons.	Destruction of totality of BW weapons can not be verified.	Physical evidence of destruction of some R-400 and missile warhead weapons confirming in part the statement.
June 1991 - Destruction of bulk BW agent.	It is possible that bulk agent remains available to Iraq.	No physical or documentary evidence of this. Interview testimony supports agent destruction although there are inconsistencies in account.

Research and Development

Research is a fundamental cornerstone of Iraq's BW programme. It provides a scientific and technical basis for all aspects of the final developed programme. Although not all aspects investigated at the research level will lead to weapons development, the scope of the research programme is an index of the concept, strategy, and extent of the programme. No account whatsoever is given of review, concept, or theoretical projects undertaken by the research staff throughout the programme.

The Commission's understanding of the early years of Iraq's BW programme at the Al-Hazen Institute in the 1970s is poor. It is not credible that a single individual is portrayed as being solely responsible for initiating and planning the research programme. A military input is also denied, although it is acknowledged that officers from the Chemical Corps were members of the staff. A clear definition of the success, or possibly lack of it, is necessary because both outcomes would influence future development of the programme. A full account of the extent of the Al-Hazen programme has not been presented in the FFCD although this programme was offensive in nature. Subsequent clarification (12 May, 1998) provides some further background information but still fails to indicate the strategic planning that initiated a BW programme within Iraq.

The period of 1979 to 1984 remains a void in the Commission's understanding although there is considerable evidence of biological activities during that period - continuation of a building programme originally for the Al-Hazen Institute, retention of Al-Hazen staff at Al-Salman, Prof. Nasser Hindawi's submission for a research programme, acquisition of dual capable equipment, and placement of staff abroad for training. In other words the programme seems to have continued albeit with different objectives, emphasis, management, and resources.

The resurgence of the BW programme is attributed to Gen. Nizar Attar, the State Organization for Technical Industries (SOTI) and MOD, and the appointment of Dr. Rihab Taha as an investigator in early 1985. This resulted in an initial programme of work at Al-Muthanna where *Bacillus anthracis* spores and *Clostridium botulinum* are acknowledged to be the cores of the activities. However, according to Iraq, under Gen. Nizar Attar's direction a plan was formulated in 1985 to develop biological weapons which included at least one additional agent, *Clostridium perfringens*. Iraq states, that basic studies on cultivation, identification, and pathogenicity of only *Bacillus anthracis* spores and *Clostridium botulinum* were undertaken. Nevertheless, there are indications that a broader survey of agents was undertaken as evidenced by the range of BW agents and simulants obtained in 1986 together with literature surveys undertaken by Iraq's scientists.

In mid 1987 a group of biology researchers left Al-Muthanna to continue to undertake research within TRC at Al-Salman and to support biological weapons tests. The full circumstance of this transfer has not been presented. In addition it is stated that formal research on *Clostridium perfringens* started in 1988; aflatoxin, trichothecene and ricin work started, with the recruitment of further experts; and offensive work with *Tilletia* spp. (Wheat cover smut *or* bunt of wheat) continued at an increased level of activity. Additional research studies on the dissemination of BW agents using both liquid and dried BW agents was undertaken although the full depths of this work remains to be presented by Iraq. The extent of these studies has not yet been determined but documentation indicates a greater understanding of dissemination than revealed to the Commission.

At Al-Salman some fundamental research work on the enhancement of the toxicity and virulence of agents was also undertaken, some in conjunction with Al-Muthanna. Research on the scale up of agent production was undertaken and the searches for cheap efficient growth materials were undertaken, not all of which have been disclosed in the FFCD although both testimony by Iraq's experts and documents indicate activity undertaken. Studies on the storage and preservation of both seed stocks and bulk agents were undertaken. The effects of *Clostridium botulinum* and *Clostridium perfringens* spores were also determined. The rationale for this is not presented in the FFCD and no one accepts responsibility for the scientific and technical basis for this expansion other than Dr. Ahmed Murthada who by his own acknowledgement merely administered the programme. The relationship of the parent organization to Al-Muthanna, the Scientific Research Council, the University of Baghdad, the Iraqi Atomic Energy Agency and the Central Library of Iraq have not been defined. The extent of the research programme remains to be presented. In 1985, 1986, and 1988 a range of defined seed stocks of BW agents were acquired, some of which are not recorded as being a component of the BW programme.

In 1989 much of the research group and its attendant research was transferred to Al-Hakam where experiments on weapons materials compatibility was undertaken as well as quality control on BW agents produced at the industrial scale. The scale of the research work was further extended. In 1990 additional research locations were obtained at the Foot and Mouth Disease Vaccine Institute at Daura and apparently the Agriculture and Water Resources Centre at Fudhaliyah. Research on viruses was started by Dr. Hazem Ali and genetic engineering with Dr. Ali Nuria Abdel Hussein. The logic and intent for the selection of camelpox virus, infectious haemorrhagic conjunctivitis virus, and rotavirus are not stated in the FFCD. The objectives for the genetic engineering unit are not elaborated upon although testimony of Dr. Rihab Taha has indicated initially antibiotic resistant strains of *Bacillus anthracis* spores were to have been derived. Any relationship with that of the genetic engineering section of Al-Muthanna housed at the Serum and Vaccine Institute at Amiriyah under the direction of Dr. Al-Za'ag is denied.

Iraq's failure to identify and to present technically and scientifically competent staff who will accept intellectual and management responsibilities for the balance and emphasis of the research programme, the planning and development of the research programme makes the determination of the overall extent of the programme difficult. There is a denial that individuals from academia (other than Prof. Nasser Hindawi and Dr. Al-Akidi) or other Ministries (with one exception) contributed to the programme in a consultative or advisory role. There is also Iraq's denial that any coordinating or supervisory committees existed which is unlikely.

Documents concerning the research activities have been provided to the Commission. In August 1991 some ten papers concerning the research of Dr. Rihab Taha were presented to the Commission. These focussed on the three agents *Bacillus anthracis*, Botulinum toxin and *Clostridium perfringens*. In 1995 additional information was obtained by the Commission from the Haidar Farm, including research papers that indicateed that papers released in 1991 were carefully edited to mislead the Commission. No documentation concerning research on mycotoxins, smut, viruses, plant toxins and genetic engineering were included in the documents. In 1998 eight documents concerning research, apparently involuntarily provided by Prof. Nasser Hindawi, were provided to the Commission. The documents essentially confirmed earlier papers, although one three-page document which personally reviews Prof. Nasser Hindawi's contribution to the programme, bearing the date 1989, is given great credence by Iraq as defining the scope of the programme.

Iraq claims that research is one of the best documented areas of the FFCD. The account fails to give confidence that the full extent of the research programme has been described and that all achievements have been presented. This is partly because of a lack of documentation in areas of activity outside bacteriological warfare agents and partly inconsistent and reluctant oral accounts of such activities. No indication is given of weapons research which logically would have run in parallel with agent production activities.

FFCD	UNSCOM Assessment	Commentary
1974 - Initial research efforts to achieve a BW capability at Al-Hazen Ibn Al-Haithem Institute.	Overall correct but earlier start, probably 1973, based on the requirement to plan the building programme.	No documentation of substance provided in support. The account is partially supported by interviews.
1974 - 1978 - Al-Hazen Programme. The FFCD states that the biological	The scope can not be defined but broadly the range of research is accepted although	Interview testimony supports much of the statement although accounts vary in terms of the

part of Al-Hazen was "research on microorganisms for military purposes". It included antibiotic and environmental resistance, means of production, and agent preservation.	the true objectives of the work and the relationship to military requirement is lacking. *Clostridium botulinum*, *Bacillus anthracis* spores, *Shigella* spp., *Vibrio cholerae* and viruses were among organisms studied.	success and outcome of the research.
1978 - Liquidation of Al-Hazen Institute. Records of imprisonment of senior personnel is cited as evidence. Scientific fraud is asserted. BW Research stated as ending.	Formal termination of programme of Al-Hazen Institute occurred allegedly in January 1979 but work continued.	Evidence supports formal end of Al-Hazen, but in January 1979. It is probably a temporary end of part of the BW programme; work continued on biological issues. Court documents indicate financial not scientific fraud.
1979-1984 - Activities - not acknowledged.	Work continued at Al-Salman and planning for enhanced programme started. Iraq states no BW activities occurred during this period.	Evidence of further work at Al-Salman and other locations. Planning at Al-Muthanna for integration into CW programme. Ba'ath party receptive to research ideas.
1985 - A new start to BW research.	The actual year of initiation of work is not clear. Generally accepted that actual laboratory work of Dr. Taha's group started in late 1985.	In February 1985 BW research started at Al-Muthanna involving Dr. Rihab Taha. Documents citing her transfer from the University of Baghdad to Al-Muthanna. Research plans are denied. No theoretical or concept development acknowledged. UNSCOM has evidence of plans. Plans were presumably laid before 1985, Iraq's stated starting point.
1985 to 1987 - Al-Muthanna research was a basic programme for *Bacillus anthracis* spores and botulinum toxin only. Restricted to laboratory production, characterization and storage.	The time frame of research is accepted but the extent of the research is not determined.	No supportive evidence submitted. Such studies were conducted. Not possible to verify that research was as limited as declared. Aerosol studies were conducted. Forged research papers produced in 1991 and presented to UNSCOM in support of these activities.

1985 - Acquisition of BW agents and simulants.	In 1985, 1986, and 1988 a range of agents required to support programme were acquired, or attempted to be acquired, from a number of foreign sources including from ATCC. and Institute Pasteur. Local acquisition also occurred.	Documents support overseas sources, but many strains were also obtained from local sources; these are not cited. The rationale for the extensive range is not provided. The 12 May, 1998 declaration provides the year of import using the University of Baghdad as a cover.
1984 - Smut research at Al-Salman.	Smut research started at Salman Pak in 1984 and continued throughout the 1980s. Initially a civilian study, subsequently from 1987 offensive in nature.	Partially supported by interviews which also indicate an offensive side of the studies. Origin of offensive work unclear.
1987 - Transfer of "Biology Group"to Al-Salman.	The Al-Muthanna group was transferred to Al Salman from May to July 1987. Various reasons cited.	Evidence exists to generally support the time frame. Rationale for the transfer not convincing and conflicts with evidence.
1987 - Continuation of *Bacillus anthracis* spores and botulinum toxin research.	Advanced research including determination of pilot scale production and storage begun in 1988.	Evidence indicates earlier advancement to this stage. FFCD does not include all aspects indicated by interview testimony
1987 - Aerosol dissemination studies.	Aerosol work undertaken at Al-Muthanna in 1987, with small animals, and at Al-Salman, 1987, latterly with a variety of agents. Both dry and liquid forms of agents were evaluated.	No documents to support statements. Monkeys exposed at Al-Muthanna. Limited disclosure of this activity provided.
April 1988 - *Clostridium perfringens* research starts.	Start date of work unclear. The objectives and scope of the work greater than acknowledged.	Not all aspects indicated by interview are covered in the FFCD. Start cited as after hiring of a specific individual in 1988 and concentrating on the infectivity of spores, not toxin(s). Toxigenic strains selected. Documentary evidence of earlier interest and research.
1988 - Additional acquisition of BW agents and simulants	Procurement activity greater than disclosed.	In 1988, a range of additional agents required to support the programme were obtained.

1988 - Aflatoxin work started. Work initiated because of ease of production of aflatoxin.	Accepted that work started in 1988 with the appointment of Dr. Emad. Origins and extent of this programme still uncertain.	No documents concerning research other than weapons research.
1988 - Production technology.	Pilot scale production of *Bacillus anthracis* spores, botulinum toxin, and simulants undertaken in 1988/89; processing and storage parameters evaluated. Agent drying process under-reported.	No documents to support statements. Limited acknowledgement of production and downstream processing provided. Some work started much earlier than acknowledged. Drying know-how was greater than stated by Iraq.
1989 - Ricin work was initiated at Salman Pak.	Research began in 1988 (or earlier) at the request of an Internal Security Officer. Origins and extent of this programme still uncertain.	No documentary evidence. Even after Lt. Gen. Hussein Kamel Hassan's departure in 1995, documents were altered to conceal origins and organizations associated with this effort.
1990 - Trichothecene work starts in March.	Work began in 1987 by someone other than Dr Emad. Account for trichothecene work conflicting and under reported.	Documents indicate 1987 start to work.
1990 - Initiation of genetic engineering.	Began in 1990. Initiation of programme by acquisition of specific equipment and scientist.	Attempted acquisition of equipment documented. Start of effort and other details are not given. The rationale for this work not given. Antibiotic resistance in *Bacillus anthracis* was the objective according to Iraqi testimony. Denial that Al-Muthanna Genetic Engineering Unit at Amiriyah contributed to the BW programme in 1990 and 1991.
1990 - Start of virus studies.	Preliminary studies on growth and pathogenicity attempted in late summer 1990. Studies	Partially documented. The rationale for this work not given. Other possible uses include

	focussed on Camelpox, Infectious Haemorrhagic Conjunctivitis virus and rotavirus	incapacitating agents.
Al-Muthanna aflatoxin collaboration.	In 1989 studies on augmenting aflatoxin with smut, CS, CN and mustard undertaken.	Limited disclosure of this activity provided. The role of Al-Muthanna under-played.
Al-Muthanna ricin collaboration.	Documents indicate collaboration was extensive in 1989. Al-Muthanna assisted in set-up for a field trial in November 1990.	Role of Al-Muthanna under-played.

Sites and Buildings

There is a requirement for Iraq to provide the rationale, justification, and requirement for all sites including those for weapons tests, research and development, production, storage, weapons production and filling, deployment, and the destruction sites for weapons, documents and agents. Building diagrams must be provided where appropriate.

Such an account would correspond to one of the few tangible aspects of the programme which can be unambiguously presented - the actual buildings created and used. All that is provided in the FFCD is a physical description of some components. It does not relate activity undertaken or required to facilities available. Iraq has provided 23 site diagrams with little commentary after the Vienna Technical Evaluation Meeting (12 May, 1998) in response to the criticism.

The scale of a facility quite obviously relates to the scale of activities planned to be undertaken. In the case of a key facility within a BW programme it will accommodate the staff and resource required or projected to fulfill the objectives of the programme. The only sites that Iraq has acknowledged to be purpose built for BW purposes are the Al-Hazen Institute and Al-Hakam. It is conceivable that components of Al-Muthanna and Al-Salman were also designed with regard to biological weapons considering the common origin of the Chemical and Biological weapons programmes.

The Al-Hazen Institute was designed specifically for the start of the BW programme. In spite of this, few details have been provided by Iraq concerning the actual design and construction with regard to requirement. In addition the future requirements for Al-Hazen

as evidenced by the construction of the "cube" and "L-shaped building" together with an animal house are not acknowledged.

The Al-Salman account describes the accommodation occupied by the staff associated with the biological programme but does not indicate how this matches requirement and utility. The additional buildings erected specifically to support the programme (animal house, fermentor building and incinerator building) have not been related to planning, construction and requirement.

The Al-Hakam Factory is acknowledged to have been built with the objectives of undertaking research and development together with industrial scale production of BW agents. Dr. Rihab Taha has also stated that weapons filling at Al Hakam was also considered for the future. Iraq states that weapons were filled for experimental field tests in 1990 at Al-Hakam and R-400 bombs were assembled at Al-Hakam in preparation for their subsequent filling (which apparently occurred at Al-Muthanna) and their subsequent deployment. Consideration of weapons assembly, filling and storage (empty and full) would have been a part of the consideration of Al-Hakam in 1987/88 as would the storage of bulk agent and the media required to produce such agents.

The biological agent was stored in a bunker and a warehouse at Al-Hakam. The hardened bunker was capable of housing some twenty 5000 litres containers. Just four are acknowledged to have been manufactured and two were placed in the bunker and two were placed in the warehouse. It is not clear how many more 5000 litre containers were made or planned to be fabricated. The containers were specifically designed for pathogen storage and subsequent sterilisation. Containers with a capacity of 1000 litres, which were wheeled and so mobile, were also manufactured. Although the precise number made is uncertain it appears that at least 39 were made in 1989 and 1990. Some 70 were planned to be fabricated. These would serve both as storage and transfer vessels. The total planned storage capability is difficult to ascertain but it is probably in the region of 80,000 to 100,000 litres of agent.

Al-Hakam was intended to accommodate, in 1988, three five-cubic metre fermentors in the first instance. According to a document provided by Iraq two such fermentors were planned to produce Agent A (botulinum toxin) and one for Agent B (*Bacillus anthracis* spores). This is described as industrial scale production and implicit is that it satisfied the minimum military requirement for Iraq. No account of this requirement has been made. In the event the fermentation line from the Al-Kindi Company was installed comprising seven 1480 litre fermentors and two 1850 litre fermentors (i.e., a total of 14060 litres) which is a similar overall volume confirming the operational scale requirement. Operating at a 5-day cycle about 820,000 litres of agent could be produced per year equivalent to

82000 litres of 10-fold concentrated agent. Assuming an annual replenishment of agent it would appear the initial annual capacity of the factory would be about 80,000 litres. When both areas A and B of the large scale plant became functional the capacity would in essence double and remain at that level until the far larger capability in area D came on stream.

The site was used for the testing of weapons in 1990 and parts of the location lend themselves to experimental weapons tests away from the main production areas. As acknowledged the site is sufficiently remote to minimise contamination in the case of an accident and implicit is that it can be used for agent simulant testing.

This FFCD also omits any reference to mobile production facilities once considered, according to Lt. Gen. Amer Al-Saadi. It omits the rationale for the selection of the geographical location of Al-Hakam and consideration of other sites such as Basrah.

Since Iraq's overall account of sites is poor, and the FFCD fails to provide a coherent account of the overall military programme, it cannot yet be assessed whether the sites identified represent the entirety of the facilities used to support the programme. In the absence of a credible account of the overall planning and evolution of the programme some site related aspects cannot be fully evaluated.

Sites associated with Iraq's BW programme (the list of sites is not necessarily complete).

SITE	Function	UNSCOM Assessment	Comments
Abou Obeydi Airbase, near Kut	Test Site for drop tank dispersion tests	Used to test drop tanks for BW dissemination.	Description incomplete. Rationale for BW use of site not given. A poor quality incomplete site diagram is provided.
Agricultural & Water Research Station, Al-Fudhaliyah	BW aflatoxin production claimed. Aflatoxin and genetic engineering research.	No evidence, other than testimony, that site was used for this purpose.	Partial rationale for site given provided, no site diagrams. Video evidence of MIC interest in site acquisition.

Agricultural Aviation Division, Khan Bani Sa'ad	BW weapons development - Zubaidy device	Used for purpose stated - supported by documents.	Partial rationale provided on May 12, 1998. No site diagrams provided.
Airfield 37, near Ramadi	BW Storage for BW R-400 bombs	R-400 bombs at the site - no evidence of BW weapons at location	Poor site diagram provided on May 12, 1998
House at Al-Amiriyah, Baghdad	Preliminary R&D site, Al Hazen Institute.	May be correct. No site diagram provided.	Rationale not provided. Diagrams provided May 12, 1998. Location not known.
Al-Adile Stores (Kimadia)	Forged documents on growth media prepared at site	Possible site for preparation of forged media documents	Documents in UNSCOM possession. Forged documents acknowledged by Iraq
Al-Azzizziyah	BW Storage and Destruction Site	R-400 weapons destroyed at the site; weapons may have been deployed there.	Rationale and site diagram provided in May 12, 1998 clarification.
Al-Dabash Stores, Baghdad	Growth media storage	Media from BW programme stored at site 1991-96.	Iraq acknowledges role of site.
Al-Fao, Baghdad	Design & Construction Center for Al-Hakam	Evidence that it contributed to the design and construction of Al-Hakam.	No information provided by Iraq.
Al-Faris Factory, Al-Amiriyah, Baghdad	BW weapons development, drop-tanks	No information provided.	No information provided. Not acknowledged as a part of the programme.
Al-Hakam Factory	BW agent production	Accepted that it was one of Iraq's production plant.	Justification and rationale inadequately presented. A selection of site diagrams provided but insufficient to provide a definitive account.

Al-Hazen Ibn Al-Haithem, Salman	BW research	Accepted that it was a site constructed for research activities.	Rationale provided for first phase. Some diagrams provided on May 12, 1998.
Al-Kindi Company, Abu-Ghraib	Training, TRC personnel on fermentation line.	Source of fermentors for Al-Hakam.	Explanation and rationale only partial.
Al-Manal, Daura, Baghdad	BW Research & Production	Stated role may be correct for botulinum toxin production and virus research but evidence of *Bacillus anthracis* spores work at this site.	Explanation and rationale only partial.
Al-Mansuriyah	BW Missile Warhead Storage	Role is not confirmed.	Rationale only partly provided. A diagram and comments provided May 12, 1998 clarification.
Al-Meshada, Taji	Storage surplus R-400 bombs.	Stated role may be correct.	No diagrams.
Al-Mohammediyat	Test Site for weapons tests	Stated role may be correct.	Rationale only partially provided. No diagrams.
Al-Muthanna, Samara	BW Research & Weapons filling	Accepted that Al-Muthanna contributed to research and weapons, timing and detail of planning for activities unknown	Rationale not totally credible emphasises CW aspects of building planning. Some diagrams provided. Description of buildings minimal.
Al-Nahrawan, near Baghdad	Test site for prototype biological bombs.	Site not positively located.	Partial rationale. No site diagrams.
Al-Nibai	BW missile warhead destruction.	Missile destruction site still under investigation.	No site diagrams. Partial account provided May 12, 1998 clarification.
Al-Numan Factory, Baghdad	Fermentor component	Stated role may be correct.	Rationale and site diagrams not provided.

	manufacture.		
Al-Qa'a Qa'a, Latifiyah	Explosives.	Role accepted.	Rationale and site diagrams not provided.
Al-Rasheed Air Base, Baghdad	Pilotless MiG 21 test for drop-tank.	Stated role may be correct.	Partial rationale provided. No diagrams.
Al-Taji	BW Production.	Stated role may be correct.	Clear rationale not provided.
Asma School, Al-Hindaya	Media, equipment, supplies, and records evacuation site.	Stated role may be correct. However media aspect not supported by documentation.	Diagrams not provided. Document supports that it served as an alternate site.
HQ Air Force Technical Depot, Taji	Drop-tank storage, destruction.	Stated role may be correct.	Diagrams not provided.
Jarf Al-Sakr	Test Site - 155mm shells and Ricin.	Stated role may be correct.	Diagrams not provided.
Jurf Al-Nadaf	Aerosol chamber dump site.	Role confirmed by inspection.	Diagrams not provided.
Nasr State Establishment, Taji	R-400 bomb manufacture.	Stated role may be correct.	Rationale for R-400s not provided. Diagram provided May 12, 1998 clarification.
Project 144, Taji	BW weapons development - 122mm rockets and Al-Hussein warheads.	Stated role may be correct.	Rationale for warheads not provided. Inadequate diagrams provided.
Serum & Vaccine Institute, Amiriyah	Storage BW seed stocks. Genetic engineering.	Stated role may be correct.	Rationale for Genetic Engineering not provided. Site diagram provided May 12, 1998 clarification.
Site 85, near Latifiyah	BW deception site, acquisition.	Stated role may be correct.	Description and rationale inadequate.
State Enterprise for Heavy Engineering, Daura, Baghdad	Mobile and Storage Tank Manufacture.	Stated role may be correct.	Rationale for mobile tanks not provided. May 12, 1998 clarification.

State Establishment for Mechanical Engineering, Iskanderiah	Not acknowledged.	Involvement in destruction of mobile tanks.	Not acknowledged.
Store no 6, Misbah, Baghdad	Growth media storage.	Possible temporary media store.	Iraq claims site to be temporary media store.
Technical Research Centre, Salman	BW Research.	Stated role may be correct.	Rationale and diagrams provided. Destroyed by coalition bombing 1991.
Tigris Canal, near Fallujah	BW missile warhead storage.	The site may have been used for storage .	Explanation and rationale changed over last two years.
University of Baghdad, Baghdad	Procurement of BW equipment; BW agents procured for and used in the programme; deception.	Stated role may be correct.	Explanations, rationale, and diagrams not provided.
University of Technology, Baghdad	Design & Construction Al-Hakam.	No information provided by Iraq.	Explanations, rationale, and diagrams not provided.
Military Industrial Commission, Baghdad	Administrative Centre.	No information provided by Iraq.	No diagrams provided.

Organization of Iraq’s BW Programme

There is no comprehensive information about the organization of Iraq's BW programme, at all levels, and its relationship to other Iraqi bodies. This makes it impossible to determine the scope and nature of the programme. An understanding of the various relationships and interconnections between the diverse organizations that contributed to the BW programme is essential to gain a full appreciation of the programme and build confidence that the account provided is indeed full and complete. A variety of Government organizations would have contributed to the programme. Among these would have been the State Security and Intelligence, the Ministries of Agriculture, Health and Education, Ministry of Defence and some of its various branches, as well as the industrial and academic base in Iraq. The list of contributing organizations cited in the FFCD is incomplete compared to interview testimony and documentation. This can only be rectified by a full disclosure of relevant information supported by documents and details

of funding.

Iraq claims that the Ministry of Defence provided no support to the BW programme. It is also stated that there was no representation on the Military High Command or the General Council of Ministers concerning any aspect of the BW programme. It is explained by Iraq that the Director-General of TRC reported directly to Lt. Gen. Hussein Kamel Hassan in his capacity of head of the State Security Organ, rather than as head of MIC. Despite this, Iraq forcefully denies any interaction between the BW programme and any Iraqi intelligence agencies.

Iraq claims that the BW programme was controlled from the bottom-up. Such a system would not account for the degree of coordination which became evident as the programme progressed.

In contrast with the Al-Hazen Institute, which had a formal personnel recruitment programme for its BW activities, the later BW programme had no such formal arrangements, according to Iraq. Promising people within the BW programme were sent abroad for higher education. It is claimed that no directive or directions to academic institutions existed to conduct research related to BW. The description of academic connections does not accord with the evidence.

Military Involvement in Iraq's BW Programme

A clear description of the organizations driving, or influencing, the BW programme is critical to assess its dimension and significance. The lack of such descriptions reflects negatively on the credibility of accounts of R&D, production, and the selection and deployment of weapons. Without further physical or documentary evidence, the unclear explanations given, in these areas, make it impossible to confirm the information presented in the FFCD.

The account of military organizations involved in the BW programme is not seriously addressed in the FFCD. The contention that the MOD remained wholly unaware of Iraq's BW programme since 1987 is implausible. The programme started within the Al-Hazen Institute and was headed by a member of the Chemical Corps, Major Ibrahim Ghazim, and the biological component had two senior members recruited from the Chemical Corps. It is acknowledged that MOD was involved from 1983 to 1987 and that it endorsed the addition of BW to the remit of Al-Muthanna in 1983. Although, formally, the chain of

command may have altered when the BW research and production component was transferred to TRC within MIC in 1987, it is unlikely that it was not visible to senior military personnel within the MOD. Programming for the formal adoption of BW would have been a factor in the strategic planning of Iraq's military development along with the foreseen nuclear and chemical capabilities.

Iraq would have developed a requirement for a militarily significant arsenal of biological weapons in 1987/88, or possibly earlier, based on strategic planning. This in turn would define the technical scope of the programme and the appropriate funding to ensure the eventual success of the programme.

According to Iraq's account, the involvement of MOD in the BW programme ceased with the transfer of the biology group from Al-Muthanna to TRC that was under the control of MIC. Iraq asserts this MOD link was only re-established specifically for the deployment of weapons in January 1991. The explanation given is that MIC had a higher status than the MOD and was a self-contained entity that could progress from initiation to deployment of weapons without external input. This has not been substantiated.

The BW weapons would have to have been integrated into Iraq's strategic arsenal. For these, military objectives, the concepts of use and the mechanisms for releasing these weapons must have been defined. This would have required extensive planning, which Iraq denies.

The FFCD portrays Lt. Gen. Hussein Kamel Hassan as the sole key decision-maker and controller of the BW programme after 1987. Links between Lt. Gen. Hussein Kamel Hassan, the MOD and other organizations are vehemently denied. It is assessed by the Commission that such links must have existed. Without such links, understanding how Iraq defined its military requirement and planned the use of its BW weapons, is difficult.

OTHER ISSUES RELEVANT TO VERIFICATION OF IRAQ'S BIOLOGICAL WARFARE PROGRAMME

In Parts I and II the status of verification of elements of Iraq's BW programme described to one extent or another in its FFCD is presented. However, a status report would not be

complete without the inclusion of several other issues directly related to the verification of Iraq's BW programme. Iraq has attempted to portray the Commission as stalling in its verification efforts. As part of this effort, Iraq cites the numerous inspections and interviews conducted by biological experts as well as citing approximately 200 documents it has provided in support of its declaration. However, Iraq has failed to cite the obfuscation and deception by Iraq that has necessitated these multiple inspections. It has also not cited the type and nature of the documents provided. Quality is not measured solely on the number of documents or volume of material.

Other issues include the technological coherence of the programme. The less coherent the programme appears to be the greater the dependency for verification on documentation and physical evidence. Iraq tries to portray its BW programme as an inept programme without guidance or direction. The Commission's assessment of Iraq's level of technology does not support this contention. Iraq asserts that its BW programme was obliterated in 1991. There is little confidence that its programme has been ended. Throughout all of the issues in all three parts of this report is the pattern of concealment and deception employed by Iraq to prevent a true picture of its BW programme from emerging. These issues are addressed below.

Inspections 1991 to 1998

Over the past eight years the Commission has conducted some 70 inspections directly concerned with biological warfare activities undertaken by Iraq. In addition, six joint chemical and biological inspections have been undertaken, including one that included missile experts. Sixteen monitoring teams have followed biological activities in Iraq's industrial, agricultural, medical and academic facilities. More than twenty of these inspections were direct investigations of Iraq's proscribed BW programme and two were involved with destruction of facilities involved in the programme. The remainder included establishing protocols and procedures for monitoring, detailed audits of key facilities, determination of indigenous capability, and searches for documents. In addition two major meetings were held to exchange information, during August 1993, in New York, and March 1998, at the TEM in Vienna. On both occasions, Iraq produced no additional information to enable a true appreciation of its entire BW programme.

The past programme investigation consisted, essentially, of three phases. Firstly, the discovery inspections of 1991 and 1992, that showed that Iraq has not been forthcoming about the scale and scope of its programme. Second, from autumn 1994 to summer 1995, consisting of attempts to uncover the past weapons programme and to establish the credibility of statements being made by Iraq about its past programme and the claimed legitimate activities of sites assessed to have contributed to the programme. After the

departure of Lt. Gen. Hussein Kamel Hassan in August 1995, the Commission embarked on a third phase of investigation of the programme using, in part, information derived from the documents released by Iraq from the Haidar Farm. During the first and second phases, Iraq concealed from the Commission, the entirety of its programme. Iraq merely acknowledged a part of its research programme as a military research and development programme and falsely presenting its main BW agent production facility as a Single Cell Protein plant. During this period Iraq actively and deliberately concealed much of the research programme and the entirety of the remainder of the programme. This it achieved by outright lying, evasiveness, intimidation, forging of documents, misrepresentation of sites and personnel, the denial of access to individuals and the issue of successive FFCDs that were fraudulent. The account provided by Iraq wholly lacked credibility.

From September 1994 to July 1995 it became obvious that Iraq was failing to disclose a programme from the inconsistent, often conflicting and changing stories, presented without any substantiation. Eventually the failure of Iraq to account credibly for the vast amount of media imported between 1988 and 1990 led to the acknowledgment that Iraq, indeed, had produced industrial scale quantities of a significant military programme of two biological warfare agents (*Bacillus anthracis* spores and *Clostridium botulinum* toxin) although it was stated, incredibly, that this was done with no thought of weaponization.

Iraq has claimed that all documents concerned with its biological weapons programmes were destroyed in 1991. Lacking documents, other approaches have been adopted to investigate and verify Iraq's account of its programme. Interviewing personnel associated with the programme has been the main approach. Iraq has been reluctant to provide personnel to substantiate the details of its programme. Generally, only individuals identified from Haidar Farm documents and documents, otherwise recovered, have been presented. Technical assessments of the facilities and equipment acknowledged to be a part of the programme, sampling, and exploitation of recovered weapons and fragments have also contributed to the inspection process.

In August 1995 weaponization was acknowledged by Iraq including weapons trials and the prior deployment of weapons in January 1991.

From September 1995 the Commission investigated the full programme as revealed by Iraq. Initially the inspections undertaken in the latter part of 1995 were designed to understand and get and clarify information on Iraq's weapons programmes. Subsequently, attempts were made to verify the three succeeding FFCDs produced after August 1995. During these inspections it became obvious that the FFCDs were inaccurate and incomplete and so investigation of the programme was also begun again. The focus of

the inspections was the issue of weapons and the production of BW agents, together with the acquisition of bacterial growth media, weapons, and production equipment. Others aspects such as research and development still await thorough examination. Many aspects have not been addressed because Iraq refused to cooperate. The Commission attempted to help Iraq recall further information about its programme by participating in a seminar in May 1996, which dealt with chemical and biological weapons, by submitting detailed questionnaires to Iraq (which were largely ignored, although later incorporated into the 1997 FFCD), and by organizing a TEM (Vienna, March 1998) for extensive evaluation of Iraq's declarations by a full range of international experts. From June 1998, following discussions between the Commission's Executive Chairman and Mr. Tariq Aziz, Deputy Prime Minister of Iraq it was decided to adopt a focussed programme of inspections following a "top down" approach concentrating on establishing a material balance for biological weapons themselves. This started with an inspection concerned with weapons that concentrated on biological R-400 weapons. The decision of Iraq on 5 August 1998 to cease cooperation with the Commission on the issue of verification has meant that verification of Iraq's biological warfare programme is now in abeyance.

Besides weapons related issues, inspections have been conducted to investigate planning, the military and intelligence contributions to the programme, and the acquisition of materiel. Concealment and deception, and the means by which this has been achieved has also been examined with no information of significance provided by Iraq.

Many aspects of the programme now included in the FFCD have been revealed because of the result of the Commission's inspections although it is acknowledged that other aspects have been revealed by Iraq without prompting. Ironically many issues and details discussed in the series of inspections conducted on the past programme are omitted from Iraq's official account directly showing that the FFCD is incomplete.

General Assessment of Iraq's Documentary Evidence

Notwithstanding the reticence with which Iraq has provided documents needed for verification, the quality of documentation provided by Iraq concerning its past BW programme has presented difficulties in providing a strong evidential base for the verification process. Problems with documentation quality reside in their relevance to the proscribed BW programme, as well as their completeness and finally, their authenticity. With respect to relevance, the bulk of documents provided by Iraq to the Special Commission tends to be removed one or more levels from the key issues central to the BW programme and can be best described as derivative, e.g, rather than presenting documents

that unequivocally establish the identities of key personnel in the programme, Iraq has provided documents that track the departure of individuals from one place of employment to another. Alternatively, Iraq has provided documents that add nothing of relevance to its declaration by way of verification. With respect to completeness, Iraq has frequently provided fragmentary documentation which renders assessment and hence, verification, difficult because the lack of a full contextual basis. For example, the source of documentation for the 157 R-400 bombs unilaterally destroyed by Iraq, and which serves as a basis for Iraq's allegation that only this number of R-400 bombs were filled, was from a very few pages of a personal diary belonging to an Iraqi army officer apparently present at the time the bombs were destroyed. Finally, Iraq has "recreated" documents, such as the document on ricin production and research, that are at best questionable and may even hinder the verification process. Had Iraq provided appropriate documents of its BW programme dealing with the key elements of acquisition of materials, production of bulk agents, production of weapons, destruction of weapons, and destruction of bulk agents the verification process would have been better served.

Technical Coherence

One key factor in determining the veracity and credibility of Iraq's account of its biological weapons programme is the assessment of the coherence of the account. Any programme of activity will be managed to achieve set objectives within a specified, possibly flexible, time frame. Once the shape and coherence of the programme become apparent, verification can be achieved by selecting disclosures of appropriate components and determining that it is a faithful and authentic account. When these reference points are determined, other aspects will fall into place and need not be determined with such extensive rigour. Regrettably Iraq's account is not coherent, the first basic step.

Iraq fails on a number of levels to present a clear account of its programme. At the senior level there is no indication of the determination of a requirement for such weapons and planning for the acquisition and deployment of the weapons. At the management level there is no indication of how the requirement was to be met and how resources were acquired and utilized to fulfil the military need. In particular the scale and scope of the Al-Hakam Factory are not explained or justified; the inevitable weapons development programme to ensure effective BW agent dissemination is not presented at all. At the working level there is no rationale presented for research and development, or the industrial scale production of agent (especially before August 1990). The repeated statement by a senior Iraqi Government representative, that the programme was a minor programme, essentially run by unsupervised technicians who had an unrealistic programme of work, trivialises a serious programme of work and does nothing to help the Commission gain the appreciation of that programme. The denial of planning for the

programme, contrary to the evidence, means that the basic coherence for the programme cannot be established.

A weapons programme by definition is a military programme yet apparently there was no military involvement in the claimed last four years of the programme. A philosophy for the programme should have been developed which would require the interaction of military, intelligence, industrial and academic sources. Iraq denies any military committees or individuals contributed to the formulation of policy with regard to the acquisition and implementation of Iraq's BW programme.

The programme for biological weapons was immature in 1991. The failure of Iraq to account for its intended programme of work through 1991 and beyond also prevents the Commission from gaining a perspective of the interrelationships between the various components and so the coherence of the programme. This information will also be essential to determine if Iraq has indeed terminated its programme.

Technology Assessment

Iraq claims that the BW programme established was an immature programme that was ill considered and ineffectively executed. Further, Iraq claims that it lacked the industrial capability and expertise to manufacture equipment suitable for the production of BW agents and weapons. This is an argument frequently put forward by Lt. Gen. Amer Al-Saadi in his attempts to create the impression that Iraq does not pose a threat to its neighbours with regard to biological weapons.

The Commission could not make an accurate technical assessment of Iraq's scientific, industrial, and technical accomplishments because Iraq has not been transparent in its FFCD nor its clarifications about the BW programme. Since the programme has operated from 1973, it is reasonable to assume that Iraq attempted considerably more than has been revealed and that some components achieved success in areas not revealed to the Commission. Some 400 individuals are known to have contributed to the programme in various ways from research to weaponization. Civilians, civil servants, security, and military personnel were involved. Iraq has a record of denying and understating its weapons programmes. Iraq has preserved components of its BW programme since 1991, and much of the expertise remains in Iraq. The Commission has examined the indigenous capability existing in Iraq and has assessed in the course of inspection that Iraq is capable of manufacturing "dual use" equipment and munitions. The degree of sophistication of

these systems may not meet so called "western" standards but none the less are quite capable of fulfilling the requirements.

Iraq has a broad based research community in Universities, Medical and Agricultural Institutes, and the Military Industrial Commission covering microbiology, biological processing, materials science, genetic engineering, pathology, biological production, munitions and weapons.

Iraq also has an industrial base capable of manufacturing fermentors and their ancillary requirements, spray driers, and storage vessels for agents. The industrial base will also sustain the engineering and manufacture of weapons.

The End of the Iraqi BW Programme?

In mid-1995 Iraq admitted that it had possessed a BW programme. Since then, Iraq has often stated that its BW programme was 'obliterated' in 1991. Officials cite, as proof of this, the unilateral demolition of the deployed BW weapons, deactivation of bulk BW agents and the destruction some documents associated with the programme. Despite these activities in 1991, Iraq retained the facilities, growth media, equipment and groupings of core technical personnel at Al-Hakam, while denying the very existence of any BW programme.

Although Iraq continues to insist that no elements of its BW programme have been preserved, the Government of Iraq has yet to offer evidence of the formal renunciation of its BW programme. It is explained that a decree was never issued because of a 1991 decision to conceal the BW programme. Again Iraq has produced no information on the decision to conceal the programme.

Iraq insists that all its BW weapons were destroyed in July 1991. The numbers, location and timing of weapon destruction and, indeed, whether all weapons were destroyed, remain in doubt. Iraq's account of the destruction of the BW-filled Al-Hussein warheads changed with virtually every inspection team that addresses the issue with Iraq. No supporting evidence exists for the destruction of the bulk agent, also regarded by the Commission as weapons. Large quantities of bacterial growth media remain unaccounted for.

After 1991, Iraq maintained and expanded the purpose-built major BW production, research and development and storage facility, Al-Hakam. From that time, Iraq asserts that Al-Hakam was solely a single cell protein (SCP) production plant. However, no serious attempts to produce SCP ever occurred. SCP was only produced in insignificant quantities as a camouflage, principally by harvesting SCP from brewers waste rather than *de novo* production from petroleum products. Individuals, identified as key workers in Iraq's BW programme, continued as members of the staff of Al-Hakam. In the years after 1991, Iraq attempted to obtain dual-purpose equipment including industrial-scale fermentors from within the country and abroad.

In the years since 1995, the Commission's teams have continued to discover significant undisclosed dual-use equipment that could readily be used in a BW programme. In the six months period April to October 1998, some 150 undeclared items were found and tagged by biology monitoring teams. For example, many mobile tanks used in the BW programme are not accounted for. The significance of this lies in the fact that with only minor modifications these could be used as fermentors.

Although Iraq acknowledged its offensive BW programme in 1995, it has yet to make a full disclosure. One of the most obvious omissions is information concerning the termination of its offensive BW programme. The evidence collected by the Commission and the absence of information from Iraq, raises serious doubts about Iraq's assertion that the BW programme was truly obliterated in 1991.

Concealment and Deception

Verification is the basis of disarmament and arms control. Verification depends on serious cooperation between the parties concerned. It also depends on compliance, in principle. This includes the submission of comprehensive and accurate declarations which can be confirmed by supporting evidence. Without these, confidence in a verification regime as required under SCR 687 (1991) is limited, at best. Concealment of critical facts is a clear sign of non-compliance. It raises serious doubts in the efficiency of disarmament or any arms control work and unavoidably leads to speculations about the reasons motivating it. Concealment effectively precludes verification.

In April 1991, Iraq made a decision to conceal certain aspects of its weapons of mass destruction programmes from the world. With regard to its BW programme it decided to admit only a limited effort of research and development, that was restricted to a single

location, never reached the level of production of agent or weaponization, and was terminated unilaterally in August 1990. Iraq maintained this position until in 1995, when the departure of the head of Iraq's weapons of mass destruction programs, resulted in additional aspects of these activities being released. Iraq admitted having had an offensive programme centred around a purpose built research and production facility and including large scale production of BW agents and weaponization and deployment of aerial bombs and long-range warheads.

A high-ranking Iraqi official, Lt. Gen. Amer Al-Saadi, stated in 1998, that Iraq offers no defence for the period of denial of its BW programme. He admitted it was a political decision to conceal both the programme and consequently its obliteration from the Special Commission. In fact, the attempts to conceal the programme caused and continue to cause serious doubts amongst the Commission's experts over Iraq's declarations. This and a lack of documentary or other physical evidence greatly hinders the process of verification of Iraq's disarmament efforts to which it is obligated by international law and its own acceptance of those terms.

A serious concern remaining is that the unilateral destruction of documents, agents and weapons in 1991 was linked to the concealment issue rather than the issue of obliteration of its programme. The difference being, that in the first case, only part of all assets may have been destroyed, purely to deceive the Commission and feign liquidation of the programme. Indeed, the Commission is aware that Iraq at least retained suitable growth media, capable facilities, production equipment, teams of expert personnel, and the essential technical know-how. Until today, no credible declaration has been presented by Iraq as to if and when it obliterated its BW programme.

Since the disclosure of the BW programme in 1995, Iraq has released a number of documents to the Commission. Iraq has ascribed an inflated importance to certain of these documents and dismissed others. Indeed, some documents have been described as "first class", whilst on other occasions the same documents are described as unreliable or trivial. There is an attempt to disregard documentary evidence that contradicts the accounts of officials or material in the FFCD. It is apparent, that Iraq only releases documents and other information to address or respond to information the Commission had already become aware of.

The following tables detail events and actions taken by Iraq as a result and indicative of its decision to conceal the BW programme from the Commission. It portrays a systematic effort to deceive the Commission by a) false or incomplete declarations and b) removal or manipulation of evidence delineating the totality of its BW programme.

Concealment of Iraq's Biological Warfare Programme in its Declarations to the United Nations and its Bodies

Actions taken by Iraq		Comments
8 April 1991	A letter presented by Iraq implied Ratification of the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction.	Iraq later declared that in April 1991 it still had 157 biological bombs, 25 biological warheads and several thousand litres of unfilled biological agent in storage which would be a violation of the BWC. No article of implementation has been provided.
18 April 1991	Iraq declares to the Secretary General of the United Nations that it does not possess any biological weapons or related items as described in paragraph 8 of SCR 687 (1991).	Iraq possessed at least the weapons acknowledged above on this date.
2 August 1991	Iraq declares to the first biological inspection team of the Special Commission a limited biological research programme for military purposes focussing on three bacterial agents. It was initiated at Salman Pak in 1986 and abandoned in August 1990 before it reached the stage of production or weaponization of biological agent.	Iraq's current declaration of its BW programme describes an offensive military programme initiated in 1973 and abandoned in mid 1991. It comprised several research and production facilities and a variety of bacterial, fungal, viral and plant-derived agents were investigated and produced in large quantities. A number of delivery means were investigated and eventually utilized.
May 1992	Iraq submits an FFCD of its BW programme as demanded by S.C.R. 707 (1991). It details the activities outlined in its August 1991 declaration. It states that Al-Hakam, FMD facility and VRL were not related to any BW activities.	Al-Hakam and FMD facilities were later declared as Iraq's main production sites for *Bacillus anthracis* spores and botulinum toxin used in their BW programme. Equipment of the VRL company was transferred to Al-Hakam and used in that process.
Early 1994	False site declarations are submitted on Salman Pak, Al-Hakam and the FMD facility.	Salman Pak was described as the exclusive BW site undertaking limited research. Any involvement of Al-Hakam and FMD in the programme was denied.
March 1995	Iraq submits a second FFCD of its BW programme. It contained no	The FFCD attempted to explain the import into Iraq in 1988 of 39 tons of

	significant additional information from the prior FFCD.	growth media - a fact that was discovered by the Commission only in late 1994. Iraq declared that the media was imported for medical diagnostic purposes. Iraq presented documents in support of its declaration but later admitted that these were "recreated" from "originals" that were no longer available.
April 1995	Iraq declared during high-level talks in Baghdad that no further cooperation with regard to its BW programme could be expected by the Special Commission if the Chairman failed to report to the Security Council that the Missile and Chemical Files were closed and IAEA did not report the same in the nuclear area.	No production or weaponization of biological agent was admitted.
July 1995	Iraq decides that it would cease all cooperation with the Special Commission on 31 August 1995 if there was no progress towards the lifting of sanctions.	Iraq on 1 July 1995 in an oral presentation admitted to the Chairman of the Special Commission the large-scale production of biological agent. It still denied weaponization of any biological agent. The quantity of *Bacillus anthracis* spores was considerably under reported. Production of aflatoxin and *Clostridium perfringens* spores was not acknowledged.
4 August 1995	Iraq submits a third FFCD of its BW programme. The large-scale production of two agents, *Bacillus anthracis* spores and botulinum toxin at Al-Hakam is admitted. Iraq denies any attempts to weaponize these agents.	The FFCD was declared null and void on 17 August. This change was precipitated by the departure of Lt. Gen. Hussein Kamel Hassan, who over a considerable period of time was in charge of Iraq's weapons of mass destruction programme.
17 August 1995	Iraq presents additional information including weaponization of biological agents, research and production of additional agents and additional sites related to its BW programme.	Iraq does not acknowledge weaponization of aflatoxin.
June 1996, September 1997	A fourth FFCD was submitted in June 1996 and a fifth FFCD in September 1997.	Both were rejected by the Commission for reasons of a lack of comprehensiveness, accuracy and

		credibility.

Concealment of Iraq's Biological Warfare Programme and Deception of the Special Commission

Actions taken by Iraq		Comments
April 1991	Decision was taken to conceal BW programme from the Special Commission	Details of this decision have not been provided to the Commission.
	A Revolutionary Command Council Member under the supervision of the Deputy Prime Minister Mr. Tariq Aziz was responsible for the dealings with the Special Commission.	Lt. Gen. Amer Al-Saadi, adviser to the Presidency, explained in 1998, that the decision makers were and still are a group of senior people including Deputy Prime Minister Tariq Aziz, Minister Mohammed Al Sahaf, Minister Lt. Gen. Rashid Amer, Minister Lt. Gen. Murthada and himself. Lt. Gen. Hussein Kamel Hassan was excluded from that group.
May 1991	Foundation of the Operations Section for the day-to-day dealings with UNSCOM.	From this section, the National Monitoring Directorate (NMD) was established.
	Removal of Evidence from Al-Muthanna.	Traces of the BW programme were removed from the Toxicology Department and the filling station for Biological Weapons.
June 1991	Purported instruction by Lt. Gen. Hussein Kamel Hassan to destroy all documents, agent and weapons related to BW.	Despite this clear order, an unknown amount of documents "survived". Iraq claims these were collected by Lt. Gen. Hussein Kamel Hassan in November 1991. UNSCOM inspections have repeatedly discovered documents related to issues defined under SCR 687 (1991).
	Transfer of large amounts of bacterial growth media to Kimadia together with forged import documents. An inventory card indicating an arrival date for the media at Kimadia in 1989 was prepared later. In 1992, to explain the missing media that had been used for the production of BW agent, health departments were asked	Kimadia, operating under the Ministry of Health, was used as a front to explain the legitimacy of the import of the growth media.

	to sign fake receipts for that media for diagnostic purposes.	
July 1991	Iraq states that they unilaterally destroyed all biological weapons, bulk agent, related documents and some equipment.	There is no documentation for this destruction process. A lack of related documents or physical evidence impedes direct verification of elimination of material as defined in paragraph 8 of SCR 687 (1991).
August 1991	Rehearsals of answers to expected questions by UNSCOM inspectors. Al-Hakam is being systematically cleansed including all the equipment used in the BW programme to conceal any damming evidence	Preparations for the first UNSCOM Biological Weapons inspection.
	Declaration of limited BW related research on three bacterial agents.	A declaration was handed over to the first UNSCOM BW inspection on 2 August.
	Submission of 10 research papers in support of their declaration.	The papers were carefully edited to reveal only certain aspects of the programme.
September 1991	During inspection BW 2, Al Hakam is portrayed as a genuine civilian Single Cell Protein facility. A fake laboratory was presented. This account was maintained until July 1995. Prof. Nasser Hindawi, an expert in SCP, is presented to the team as the director of Al-Hakam.	Prof. Nasser Hindawi later admitted that he was not involved in a SCP project at the time of BW 2. He was appointed director of the Al-Hakam SCP project in November of 1991 and on 4 April 1992 director of Al-Hakam, only to be relieved from this post a few weeks later.
	Iraq declares to an UNSCOM team that 58 R-400 bombs located at Al-Muthanna were exclusively for Chemical Warfare (CW) purposes and were never filled.	56 of these bombs were destroyed under UNSCOM supervision and two removed for further study. Iraq later stated that about 36/37 of these bombs were in fact designated for biological purposes. Photo evidence of characteristic markings of the weapons supports this claim.
November 1991	Instruction by Lt. Gen. Hussein Kamel Hassan claimed to have been given to collect all important remaining documents relevant for BW and hand them over to him.	In 1995, following the departure of Lt. Gen. Hussein Kamel Hassan, these documents were handed over to the Special Commission and are referred to as the "Haidar Chicken Farm" documents. Despite Iraq’s claims, they are judged to be of

		low significance. The more significant documents, Iraq states to have collected in November 1991, have not been provided to the Commission, yet.
April 1992	Iraq presents to UNSCOM an account of the destruction of 40 CW R-400 bombs at Al-Azzizziyah.	Iraq states that 157 BW R-400 bombs were destroyed at Al-Azzizziyah. No CW weapons are now stated to have been destroyed there.
	Iraq presents an UNSCOM inspection team with the supposed remains of 45 CW warheads that had been unilaterally destroyed.	UNSCOM inspectors counted 43 nosecones as indicators for the 45 destroyed warheads. Iraq later admitted that it seeded about 25 nosecones in the area of excavation to deceive the inspectors. Thus, only the remains of 20 CW warheads were in fact presented. The remaining 25 were biological warheads that were not ready to be disclosed in 1992.
August/ September 1993	During technical talks in New York, Iraq insisted that the BW programme comprised only limited research.	This position was maintained until August 1995, when an offensive programme including agent weaponization was admitted. Since then, no further substantial information was presented to the Commission.

Summary

Since the adoption of SCR 687 (1991), in April 1991, and until July 1995, Iraq denied that it had any proscribed BW activities. Despite Iraq's denial, the Commission, through its inspection and verification procedures, was able to determine that Iraq had not provided a full and comprehensive disclosure of its biological programme nor had it accounted for items and materials acquired for that programme. The Commission reported these findings to the Security Council in April 1995. On 1 July, 1995, Iraq acknowledged that it had had an offensive BW programme, but denied weaponization. Subsequently, in August 1995, after the departure of Lt. Gen. Hussein Kamel Hassan, Iraq admitted that it had weaponized BW agents and had deployed them for combat use. However, the Commission has a far from complete understanding of all aspects of Iraq's BW programme. The

Biological FFCD neither contains the required detail, nor does it cover the full scope of Iraq's BW activities. In particular, a refusal to disclose, or even discuss, details of the military aspects of the BW programme is of concern.

Iraq has released information over the years very selectively. When Iraq is aware that the Commission has details of a particular event or circumstance, then a document will be released. Very little new information has been disclosed since 1995. There are many inconsistencies and contradictions in documents, personal testimony and physical evidence. However, the accumulation of inconsistencies creates patterns, which show that the FFCD is incorrect.

Iraq claims to have produced, filled, deployed and unilaterally destroyed 25 Al-Hussein missile warheads intended for BW use. No evidence exists to confirm the number of warheads produced as 25, or for a greater or lesser quantity. Confusion reigns, even among Iraqi officials, over how many warheads were filled with particular BW agents. There is no evidence of the proportions of weapons filled with particular types of agents. At Al-Nibai the numbers and locations of remnants of warhead stainless steel agent containers, some of which have traces of *Bacillus anthracis* spores, contradict the account of the weapons' destruction in the FFCD.

The FFCD states that 200 R-400 aerial bombs were manufactured for the BW programme, and that 157 of these were filled with BW agents, deployed and unilaterally destroyed. The evidence available indicates that more than 200 were available for the BW programme. Iraq admits that the numbers filled with particular agents are guesses. Statements in 1998 by Iraq have further confused this matter. The physical evidence from the remnants, accounts for less than one third of those said to have been unilaterally destroyed.

From November 1990 until the cease-fire in 1991 Iraq worked to produce a system able to deliver large volumes of BW agent aerosol from high-performance aircraft. It is stated that four such drop-tank weapons were produced. The remains of three have been accounted for. There is no evidence to establish whether only four were produced nor have other details of this aspect been addressed by Iraq. In tandem with this work, Iraq attempted to develop, apparently unsuccessfully, a pilotless aircraft to carry the drop-tank weapon. Very little information exists on this latter project, and it is possible that it was intended for CW use or both BW and CW.

The first weapon system for delivering BW agent investigated by Iraq was a helicopter-borne aerosol generator. Successful trials led to the manufacture of 12 such

items. There is no evidence of their destruction. Also the final, and presumably most effective, prototype of this aerosol generator has never been accounted for.

Besides the weapons that reached the production stage, several other potential delivery systems received some attention by Iraq. 122mm rocket warheads were extensively trialed with BW agent. Iraq claims to have abandoned this development. After briefly admitting that cluster munitions were part of the BW programme, Iraq withdrew the statement. Artillery shells filled with ricin were trialed. The LD-250 aerial bombs made by Al-Muthanna and used in early BW trials, were abandoned in favour of the more robust R-400 according to Iraq. Iraq investigated the use of gas gangrene relevant to application in fragmentation weapons.

A key determinant of the size and capability of the BW programme was the production of bulk agent. Apart from one document referring to a single year, no production records have been given to the Commission. All accounts and assessments are based on the capacities of the known production equipment, the amounts of growth media purportedly available and the time and personnel that could be used. The amounts of agent produced and declared by Iraq are unsubstantiated. Quantities far greater than those declared could have been produced without difficulty. Further to complicate this process, there are no records of storage, filling into munitions or destruction. As a result, experts have very little confidence in the production figures quoted in the FFCD.

The situation regarding bacterial growth media is similar to that of the production of bulk agent. There are disparities between Iraq's declared imports of media and information available to the Commission. The material balance of growth media is flawed. The absence of records of the use and discrepancies in the accountability of this material leaves open the possibility of significant undeclared production of bulk BW agent.

As in other areas of the BW programme there is a dearth of documentation relating to attempts (both successful and unsuccessful) to import the equipment and materials necessary to pursue the acquisition of a larger BW capability.

Research is a fundamental cornerstone of Iraq's BW programme. Although not all aspects investigated at the research level will lead directly to weapons development, the scope of the research programme is an index of the concept, strategy, and extent of the programme. No account whatever is given of review, concept, or theoretical projects undertaken by the research staff throughout the programme.

The account of the history of the BW programme, given by Iraq, encompasses only a part of the programme, it is inaccurate with respect to dates, and fails to provide insight into the decision making process that facilitated its evolution. The account is misleading because it fails to present the underlying strategy and the long-term goals of the programme. Iraq's known concealment and deception activities cast doubts on its claim that the programme was obliterated in 1991.

Iraq is required to provide the rationale, justification, and requirement for all sites including those for weapons tests, research and development, production, storage, weapons production and filling, deployment, and the destruction sites for weapons, documents and agents. The FFCD account fails to state the scale and scope of the requirements for the programme. No information is provided on planning and true objectives. All that has been provided by Iraq is a physical description of some components. It fails to explain the rational behind the selection of BW sites.

The absence of comprehensive information about the organization of Iraq's BW programme, at all levels, and its relationship to other Iraqi bodies, makes it impossible to determine the scope and nature of the programme. An understanding of the various relationships and interconnections between the diverse organizations that contributed to the BW programme is essential to gain a full appreciation of the programme and build confidence that the account provided is indeed full and complete. The list of contributing organizations cited in the FFCD is incomplete compared to interview testimony and documentation. This can be rectified by a full disclosure of relevant information supported by documents and details of funding.

A clear description of the organizations driving, influencing or otherwise participating in the BW programme is critical when assessing its dimension and significance. The lack of such descriptions reflects negatively on the credibility of accounts of research and development, production, and the selection and deployment of weapons. Further physical or documentary evidence in all these areas is needed to confirm the information presented in the FFCD.

Throughout the investigation of the programme there has been a systematic and comprehensive attempt by Iraq to conceal the programme and deceive the Commission. Until 1995 all aspects of the offensive BW programme were concealed and active measures taken to deceive the Commission. Since August 1995, Iraq has submitted a number of FFCDs of its declared BW programme. These declarations have been assessed by the Commission and by international experts as incomplete, inadequate and containing substantial deficiencies. They were not accepted as a full account of the scale and the

scope of Iraq's BW programme. This refers in particular to weaponization of produced BW agents, bulk BW agent produced and acquisitions for the BW programme. Consistently Iraq has tried to understate the scale and importance of the BW programme as a whole, and the success of individual components.

In the Commission's view, Iraq has not complied with requirements of the relevant Security Council resolutions on the disclosure of its BW programme. A full, complete and verifiable disclosure of all its biological weapons activities needs to be presented by Iraq.

Appendix IV

ACTIONS BY IRAQ TO OBSTRUCT DISARMAMENT

1. The history of the Special Commission's work in Iraq has been plagued by coordinated efforts to thwart full discovery of Iraq's proscribed programmes. These policies and actions began immediately following the adoption of Security Council resolution 687 (1991). It is against this backdrop that the significant positive and negative results described in the weapons annexes should be seen. What follows is a brief summary of the Commission's current understanding of the evolution of these concealment policies and practices.

2. Immediately following the Gulf war, the Iraqi Presidency collected reports on weapons remaining with Iraq's Armed Forces after the war, including its weapons prohibited by recently adopted resolution 687(1991). Such documents were provided to the Presidency in the spring of 1991. A decision was taken by a high-level committee (one of whose members was Deputy Prime Minister Mr. Tariq Aziz) to provide to the Commission only a portion of its proscribed weapons, their components and production capabilities and stocks. The policy, as deduced from a range of evidence available to the Commission including the initial false Iraq's declarations, was based on the following Iraqi actions:

-- provide a portion of their extant weapon stocks, with an emphasis on those, which were least modern.

-- retain production capability and the "know-how" documentation necessary to revive programmes when possible

-- conceal the full extent of chemical weapons programmes, including its VX project, and retain production equipment and raw materials

-- conceal the number and type of BW and CW warheads for proscribed missiles

-- conceal indigenous long-range missile production, and retain production capabilities,

specifically with respect to guidance systems and missile engines

-- conceal the very existence of its offensive biological weapons programme and retain all production capabilities

3. Iraq had initial success in much of its concealment efforts, but, based, presumably, on early experience with the IAEA and the Special Commission in inspection activities, Iraq, took a subsequent decision in late June of 1991 to eliminate some of these retained proscribed materials, on its own, and in secret and in such a way that precise knowledge about what and how much had been destroyed would not be achievable. This decision and action by the high-level committee was a so-called "unilateral destruction". It was taken following an incident in June 1991 when IAEA inspectors, following an inspection that turned confrontational at Abu Ghraib, obtained photographic evidence of retained nuclear weapons production components.

4. Iraq did not admit to its illegal unilateral destruction until March 1992, approximately nine months after the destruction activities, and even then only after the Commission indicated it had evidence that Iraq retained weapons after its supervised destruction. Iraq states that "The unilateral destruction was carried out entirely unrecorded. No written and no visual records were kept, as it was not foreseen that Iraq needed to prove the destruction to anybody." Such an approach also indicates that Iraq intended to pursue a policy of concealment in its relations with the Commission and the IAEA.

5. In 1992, the Commission examined the evidence of the unilateral destruction available at that time and to some extent found it consistent with the rest of Iraq's programmes as then declared by Iraq. What was not recognized at the time by the Commission, was that the unilateral destruction action itself was a determined measure taken to conceal evidence which would reveal retained capabilities. Only later, when the investigations by the Commission became more searching and the Commission received reliable reports of diversions from the unilateral destruction, did it become clear that thorough verification of Iraq's claims surrounding unilateral destruction was required.

6. Iraq undertook active deception measures, during the Commission’s verification of the unilateral destruction, such as "seeding" warhead destruction areas with parts unrelated to special warheads to lead the Commission's team to believe it had accounted for all that was claimed to exist. At that time, Iraq also melted down weapons and components to make impossible accurate identification or quantification of them. Because of Iraq's false declarations, the Commission was not in a position in 1992 to question, fully, Iraq's accounts. It was only later, after 1995, that the Commission became aware of the concerted deception efforts and was forced to reexamine the 1991-1992 period.

7. The Commission has conducted extensive examination of Iraq's claims concerning the period, July 1991, when Iraq stated that so much of its weapons programmes were secretly eliminated. The material balance and verification of Iraq's claims concerning the disposition of weapons in all areas (missiles, biological and chemical weapons) rests on accepting Iraq's declarations at face value. The Commission has conducted extensive excavation efforts with Iraq at places Iraq declared to have been the locations of explosive demolitions of proscribed weapons and burials

of destroyed remnants. Extensive interviews with Iraqi participants in the unilateral destruction have also been conducted. Analysis of overhead imagery of that period has been made. The results have been mixed with some evidence supporting Iraqi declarations. Other data raises serious concerns about the true fate of proscribed weapons and items.

8. One example concerns the destruction of launchers. Iraq claimed until August 1997 (including in its missile FFCD) that proscribed missile launchers were destroyed in July 1991. When the Commission attempted to confirm this by examining imagery, it found such claimed destruction did not take place. Only then did Iraq shift its claim and say that the destruction did not take place until October of 1991. Thus, Iraq changed the account given repeatedly to the Commission, for six years, without any credible explanation as to why it had deliberately given a false declaration in the first place. Two obvious consequences for the Commission's investigations are: the need to explore the reason for such deceptions; and, to demand more information in order to be able to verify other Iraqi claims.

9. Other elements of the unilateral destruction presentation by Iraq were also proved to be false. The precise locations of warhead destruction and the fill of warheads have been revised several times by Iraq. The movements of concealed warheads prior to unilateral destruction, claimed by Iraq, have been proven to be false. The explanations provided on concealment and movement of retained chemical weapons production equipment was likewise shown to be false. Iraq's admissions have only been made during 1997-1998. The Commission still does not know the precise meaning or significance of Iraq's failure to provide accurate data about proscribed weapons activities and it's provision of false information.

10. One incident which has now been partially investigated illustrates another example of the Commission's concern about the possibility of retained prohibited material.

11. The Commission focussed a dedicated effort into investigating Iraq's concealment policy and actions following the events of August 1995, when Lt. Gen. Hussein Kamal left Iraq. This investigation proceeded through various stages and developed progressively more information on not only what had been hidden up until 1995, but what still remained concealed. One piece of this investigation involved a Major in the Special Republican Guard, Izzadine al-Majid. He was tasked by higher authorities in July 1991 to receive a shipment of production equipment and critical components related to Iraq's indigenous proscribed missile programmes which had been diverted from secret unilateral destruction. He was ordered to hide these materials on the premises of a private villa in the west Baghdad suburb of Abu Ghraib. The materials remained hidden at that location until March 1992 when the Special Republican Guard retrieved them to move them to another location. Iraq did not declare any of this information, the Commission learned it from Major Izzadine al-Majid and other participants in the operation.

12. Further investigation of this "diversion" from the unilateral destruction raised further questions, which remain unanswered. According to Iraq, some material now acknowledged to have been diverted from unilateral destruction came from a site called al Alam. Iraq stated that ten vehicles containing prohibited missile items were sent to this remote location in July 1991. The Commission examined imagery of this area during that time-frame and found not just ten vehicles, but that there had been over 100 vehicles present at this remote location. No

explanation of the remaining 90 vehicles has been received from Iraq. Requests by the Commission for documents concerning this movement of vehicles either through Special Security checkpoints or vehicle movement logs have been rebuffed by Iraq with the claim that no documents are available. On the last occasion that this issue was discussed with senior Iraqi officials, in July 1998, Iraq conceded that for the preceding two years it had mislead the Commission concerning the events of the unilateral destruction of components for its indigenous missile engine programme.

13. This particular incident also showed that the Special Republican Guard had been involved. Other direct physical evidence of its involvement in the unilateral destruction activity is in the possession of the Commission. Iraq has minimized any involvement of the Special Republican Guard or security organizations.

14. With respect to the provision of documents to the Commission, Iraq has long claimed virtually all relevant documents had been destroyed. Again, following the departure from Iraq of Lt. Gen. Hussein Kamal and the subsequent provision of 150 crates of documents at the Haidar Chicken Farm, the Commission concluded that more exist. The Commission examined imagery of the Haidar farm and found that shortly before Iraq led the Commission to the farm to hand over the documents, several shipping containers had been removed from the site. Iraq has not provided a credible explanation of this. The documents provided from the farm have clearly defined gaps. For example, documents which would indicate WMD production techniques achieved by Iraq are not included. There are no documents related to the military or Ministry of Defense. The Commission has concluded that a segregation of documents must have taken place prior to delivery to the Commission. It has sought from Iraq further explanations of what happened to the documents and where they are located. This has never been provided.

15. One notable document received from Iraq in August 1995 should be mentioned. "The al-Atheer Center for the development of materials production: Report of achievements accomplished from 1 June 1990 to 7 June 1991" (called "the al-Atheer document"). It illustrates how this key facility for the development of nuclear weapon devices implemented the instructions of the high level committee in April 1991 on concealment action. The facility was instructed to remove evidence of the true activities at the facility, evacuate documents to hide sites, make physical alterations to the site to hide its true purpose, develop cover stories, and conduct mock inspections to prepare for UN inspectors. These types of actions are precisely what the Commission has encountered in its inspection activities throughout its work in Iraq. Iraq has claimed such deliberate concealment activities were ceased in 1995. However, Iraq has provided no documentation to substantiate these claims and the Commission continues to find evidence that the opposite is the case. Documents are found occasionally and reports from inside Iraq indicate continuing attempts to prevent the Commission from discovering documents or other materials.

16. The concealment investigation by the Commission, which has at times been contentious, has yielded a model of the decision making and organizations in Iraq which participate in actions to hide information and thwart the discovery of prohibited materials. The evidence collected included interviews with Iraqi personnel in and out of Iraq, documents found during inspection activity, imagery, analysis of vehicle movements and other Iraqi actions in reaction to

Commission inspections, and overall patterns of obstructions, delays, and changing accounts, "stories", by Iraq.

17. In its first phase, the analysis of the Chicken Farm documents was carried out and the implications of the retained and sustained prohibited programmes were examined. The Commission concluded that multiple organizations in Iraq had to be involved. The concealment and deception activities had distinct technical requirements. This implied, inter alia, the continued involvement of the Military Industrial Commission (MIC). Iraq acknowledged this. However, covert procurement required an overseas presence and the establishment of front companies. These activities had been conducted by the General Intelligence Service, the Mukhabarat, during the 1980's and its expertise would continue to be valuable. Analysis of how procurement was conducted in the period immediately prior to the Gulf war was conducted as a possible indicator of how Iraq would continue such efforts to the present. This simple, logical analysis bore fruit. The Commission soon had direct evidence of Mukhabarat involvement when long range missile gyroscopes, accelerometers and test equipment were discovered being imported into Iraq in 1995.

18. The logistics of the movement of proscribed materials required communications and transportation support of a highly reliable and sensitive nature. In examining imagery from 1991, it was found that Special Republican Guard vehicles had been used to move equipment involved in planned nuclear weapons production when it was being hidden from the IAEA. In addition, the personnel involved had Special Republican Guard affiliations - like Major Izzadine mentioned earlier. Also, imagery taken during inspections in 1996 and 1997 showed significant vehicle movement at Special Republican Guard sites in reaction to ongoing inspection activities.

19. The Commission assessed that overall direction came from a more senior entity and that this appeared to be the Special Security Organization (SSO). In late 1995, the Commission was only beginning to gain an understanding of SSO direct control over concealment actions. One example was that during interviews with the manager of the Haidar farm it was learned that the farm had been seized by officers of the SSO some ten days before the Commission was given access to it.

20. This period of interviews and analysis led the Commission to investigate further the involvement of relevant security organizations in ongoing activities of a proscribed nature. The technique of interviewing participants in known concealment events proved useful even when interviewees were heavily coached. During the spring of 1996, continued interview and investigation missions were conducted in Iraq with the goal of eliciting a true picture of concealment actions and confirmation that it had or would be ended. In addition, acting on information developed during late 1995, the Commission conducted an inspection of sites related to concealment activities. This inspection was conducted in March 1996 and resulted in several refusals by Iraq to provide access to sites in accordance with its obligations.

21. Iraq did not acknowledge concealment as a legitimate matter for discussion with the Commission. Iraq stated that all concealment had been ended and only if the Commission could prove otherwise would Iraq discuss the matter. The Commission had ample evidence of concealment up to 1995 and in addition, uncovered clandestine proscribed missile guidance

acquisition by Iraq in late 1995. Iraq claimed all such actions were terminated. The Commission had no evidence to support Iraq's claims, and, continued to receive reports to the contrary.

22. Given that Iraq would not willingly discuss the matter, the Commission planned another series of inspections of sites belonging to the organizations considered to have direct involvement in concealment. Two inspections took place in June and July 1996. There were lengthy standoffs. U-2 imagery taken during standoffs in June identified vehicle and other movements at SSO and Special Republican Guard facilities adjacent to Presidential areas that the Commission assessed as being related to concealment. The Executive Chairman had discussions with the Deputy Prime Minister on access issues and agreed on 22 June 1996 on a Joint Programme of Action which included the topic of concealment as a priority for verification work.

23. The Commission sent three additional investigation missions to Iraq during the remainder of 1996. Interviews were conducted and considerable discussion about the disposition of documentation took place. Little substantive progress was made. The Commission also continued to receive information about retained prohibited material in Iraq during this period. All information continued to support SSO/Special Republican Guard involvement.

24. In early 1997, the Commission again undertook an inspection of sites related to organizations identified with concealment actions. During these inspections, sites related to the hiding of proscribed material, transportation, and the organization of movements were inspected. In addition, sites were selected which were related to the procurement of material thought to be proscribed.

25. In June 1997, the Commission experienced delays and obstructions throughout the inspections including the removal of material from sites. The friction in conducting such inspections of sites is in some ways understandable given the sensitivity of such locations and organizations to Iraq. But, given the information about concealment practices and the absence of evidence about their termination, the Commission believed it had no choice but to continue. Ultimately, it was hoped that Iraq would provide a full and verifiable presentation on concealment. Inspections, while useful, would ultimately be blocked rather than permit discovery of prohibited materials. Nevertheless, evidence of non-compliance with the inspection regime was demonstrated in the form of non-cooperation. Missing files, cleansed rooms, purged computers and other techniques were encountered on a regular basis, at sites under inspection.

26. In August and September 1997, two inspections were conducted in an effort to uncover Iraq's efforts to deceive the Commission in the CW and BW areas. This reflected a decision to broaden the scope of the investigation aimed at thwarting Iraq's concealment efforts. During these inspections the same techniques of convoy movements occurred in direct reaction to the Commission's inspection activity. This provided still more evidence that concealment was ongoing.

27. In a further effort to continue to press Iraq to fully declare its programmes, the Commission reconfigured its concealment investigation work. Another mission went into Iraq in September 1997. Limited progress was made in obtaining Iraq's acknowledgment of Special Republican

Guard and Mukhabarat involvement. At that time, another inspection obtained an SSO document related to dual-use biological activities and materials. A follow-on inspection was denied access to an SSO site in a presidential area.

28. In January 1998, an inspection to conduct a concealment investigation was sent to Iraq. It was stopped by Iraq after one day.

29. The Commission continued to press Iraq to provide full and verifiable explanations of its concealment activities. Iraq insisted that it was not concealing any proscribed weapons. The Commission found: significant gaps in every weapons area; and, that Iraq's active measures to deceive the Commission were responsible for its inability to verify the disposition of prohibited weapons. Reports that prohibited material still existed in Iraq continued to be received by the Commission. The Commission, following its presentation to the Council, established its list of priority disarmament issues and discussed these with Iraq during the Summer of 1998. The concealment issue was included in that list. Iraq declined to discuss the issue at that time.

30. In July 1998, an inspection sought to uncover information related to Iraq's production, storage, and disposal of chemical and biological weapons. Iraq had long denied that any documents on these topics were available. In the course of the team's inspection of Iraqi Air Force Headquarters inspectors located a document detailing the use of "special weapons" during the Iran - Iraq war. Immediately after its discovery, the document was seized from the Chief Inspector. Iraq has not responded to the demand, expressed by the Security Council, to return the document. Information in the document, recorded by team members, shows significant discrepancies between the amount of munitions Iraq claims to have consumed between 1983 and 1988, and the actual amount presented by Iraq in its official declarations.

31. By the end of the 1998, there remained significant uncertainties in the disposition of Iraq's prohibited programmes.

32. The Commission has received information recently from multiple sources, identifying organizations that direct and implement the concealment effort in Iraq. While the information from these sources differs in some minor details, it agrees on several major points:

> The highest level of concealment-related decisions are made by a small committee of high ranking officials. The Presidential Secretary, Abed Hamid Mahmoud, chairs this committee;
>
> **The Committee directs the activities of a unit which is responsible for moving, hiding, and securing the items which are being concealed from the Commission;**
>
> **The Special Security Organization plays a key role in the operation of this unit and in the tracking and surveillance of Commission activities.**

Enclosure 2

IRAQ: ONGOING MONITORING AND VERIFICATION

Background and Overview

1. As part of the formal cease-fire following the end of the Gulf war, the Security Council, by its resolution 687 (1991), established, inter alia, the requirement for long term monitoring and verification of Iraq to assure that Iraq did not reconstitute or retain its prohibited chemical and biological weapons and missiles with a range greater than 150 kilometres.

2. By resolution 715 (1991) of 11 October 1991, the Security Council approved the Plan for establishing such monitoring in the chemical, biological and missile areas. Under this Plan, the Special Commission established its monitoring system which is comprehensive in its approach.

3. Iraq refused to acknowledge resolution 715 (1991) for two years. It was not until Iraq officially acknowledged it, on 26 November 1993, that real efforts to design and build the full OMV system could start.

4. Some key principles which underpin the design efforts for the overall OMV system:

> First, full access and cooperation by Iraq were assumed, as provided for in the Security Council's resolutions and the Plan for OMV, particularly following Iraq's acceptance of the Plan.
>
> Secondly, the system would be flexible and subject to continuing modification, expanding or contracting as circumstances dictated.
>
> Thirdly, the system would be designed assuming a verified baseline of what Iraq had acquired and achieved in each proscribed weapons area. Knowledge of Iraq's capabilities was considered to be important to the shaping and focussing of fully comprehensive monitoring efforts.
>
> Fourthly, the overall system would depend on a web of techniques and tools which, in total, would serve to detect or deter prohibited activities. This approach recognises that the ability to monitor in each discipline and the capability of each monitoring technique is specific.
>
> Fifthly, time was assumed to work for the Commission in the sense that the probability of detection would continue to increase over time.
>
> Finally, it was assumed that Iraq would have a significant incentive to abide by the Security Council's resolutions. Conversely, it was thought that there would be a significant disincentive for Iraq to be detected conducting prohibited activities.

5. It was believed, that the net combined effect of the system would be sufficient to provide a

credible measure of confidence that prohibited weapons and capabilities were not being retained or reconstituted.

6. The process of implementing the system involved a number of key tasks. The first required Iraq to provide information on sites having dual use capabilities as well as sites known to have been involved in prohibited weapons programmes. In early 1994, detailed formats for the provision of data relevant to ascertaining the capabilities and future monitoring of such sites were created and passed to the Iraqi counterparts for completion. Iraq provided data on identified sites. Throughout 1994, baseline survey missions were conducted by visiting teams of experts to sites in Iraq. These activities had, as their goal, the design and implementation of monitoring at each site and the creation of protocols for their monitoring.

7. Given that each site is unique, a regimen for inspecting each site was developed based on its importance, nature and size. Prescriptions for: how often a site should be visited; what parameters should be examined; whether sensors or cameras would be beneficial; what sorts of regular reports would be required from Iraq; and, other techniques for inspecting were identified and included in each site monitoring protocol.

8. Over three hundred sites were eventually included in the Commission's monitoring database. These sites are subject to regular inspections and Iraq is required, in most cases, to provide regular declarations in formats established by the Commission. These declarations are usually provided on a semi-annual basis, but some sites require more frequent declarations.

9. The Commission established a permanent and extensive facility in Baghdad as a base for its monitoring work. The Commission's earlier work had been conducted with a minimum of resident staff. With the advent of ongoing monitoring work, the necessity for a larger number of resident experts and administrative support was required. In 1994, Iraq provided a building for the use of the Commission and the IAEA. It was modified by the Commission to provide suitable arrangements and offices for monitoring work and a senior officer was appointed to head the Baghdad Monitoring and Verification Centre (BMVC). This building is shared with other United Nations Agencies. It incorporates the Commission's communications equipment, chemical laboratory, monitoring camera system control room and administrative and logistical support for field operations.

10. The monitoring design, in each area, faced unique issues. For example, missile related sites are the smallest in number, but, since specified missile activities are permitted to Iraq, there is a challenge in detecting prohibited activities latent in permitted activities. Scrutiny of all aspects of permitted programmes is essential, using cameras, requiring regular reports from Iraq, and most importantly regular detailed on-site inspections.

11. The chemical sites are more extensive, covering facilities with equipment and specialists that could be diverted to prohibited activities. Such facilities include pesticide plants, refineries and industrial chemical plants. Moreover, monitoring of dual-use chemicals, some used in large quantity for legitimate civilian purposes, was a problem to be managed.

12. The most extensive monitoring problem is in the biological area. BW agents can be produced in small facilities using relatively simple equipment. There are limited signatures to look for, if small quantities are being produced and not weaponized. Hence the net cast for monitoring must be large. A great number of facilities incorporating dual-use capabilities are inspected and are under varying degrees of monitoring. These include such facilities as production sites, research and development facilities, laboratories and other sites, apparently innocuous, such as breweries and drug production plants.

13. Following Iraq's acknowledgement of resolution 715 (1991), the Commission, the IAEA and the Committee established pursuant to resolution 661 (1990) (the "Sanctions Committee") developed a mechanism for the monitoring of any future sales or supplies by other countries to Iraq of items relevant to the implementation of section C of resolution 687 (1991) and other relevant resolutions. The lists of such items are contained in Annexes to the Commission's and the IAEA's Plans for OMV. Following consultations with States with export control experience, a report on provisions for a mechanism for Export/Import Monitoring was transmitted to the Security Council on 7 December 1995. On 27 March 1996, the Security Council adopted resolution 1051 (1996) which approved the provisions of the mechanism. A Joint IAEA-UNSCOM Unit was established in New York to run the mechanism and a corresponding office and resident monitoring team established in the BMVC.

14. The Export/Import mechanism is an integral and vital component of the overall monitoring system. It is a notification system which allows the Commission and the IAEA to be cognisant of, for monitoring purposes, the existence in Iraq of relevant equipment and materials. An important feature of the system is that, should any unreported notifiable imported equipment or materials be discovered in Iraq, and no adequate explanation is given thereof, the Commission and the IAEA have the right to destroy, remove or render such items harmless.

15. Export/Import inspections are conducted throughout Iraq, including at points-of-entry, but most emphasis is currently focussed on end-user customers inside Iraq. The current workload is mainly limited to items imported in connection with the humanitarian aid programmes. Any change in the status of the sanctions regime will have a significant impact throughout the monitoring system, but most particularly with respect to the operation of the Export/Import mechanism.

16. A further component of the monitoring system has been the aerial surveillance provided by the U-2 aircraft at high altitude since August 1991, the Mirage aircraft at medium altitude since June 1998, and the helicopter surveillance provided at low altitude since June 1992. These data have been useful in ascertaining the status of declared facilities. In addition, they provide information of particular importance in identifying possible new or undeclared facilities that may have monitorable dual-use capabilities or, indeed, be engaged in proscribed activity.

17. This touches on a key element of the monitoring system: the ability to detect undeclared, proscribed activities through the identification and conduct of inspections of newly identified sites. To monitor Iraq fully and deter violations, the Commission must have the credible and real ability to inspect any site in Iraq, on short notice. Sites for inspections may be identified by analysis based on previous inspection and monitoring activities or information generated from a

wide range of sources. Sources ranged from intelligence information provided by Governments, to information available publicly such as on the Internet, to information conveyed by Iraqis no longer in Iraq. This approach can be expected to continue to support credible monitoring as mandated by the Council.

18. In summary, the Commission has designed a monitoring system of many related parts. Each part could not provide high confidence in detection of infractions, but collectively, over time, the Commission believes the system is able to provide adequate and credible monitoring. However, it is vitally dependent upon the full exercise of the rights of access and Iraq's cooperation provided for in the resolutions of the Council. While making use of technology and sensors as much as possible, it is also important to note that the essence of the system is the presence of knowledgeable inspectors.

19. Despite several differences in the monitoring and verification techniques in the chemical, biological and missile fields, activities in all areas covered by the Plan for OMV represent an integral monitoring and verification system. It is based on the joint operational planning, inspection procedures and supporting elements, including Export/Import mechanism and aerial surveillance. In addition there is a significant overlap in the Commission's monitoring activities in the chemical, biological and missile areas due to the multipurpose character of activities and sites in Iraq. Therefore, an integral system comprising chemical, biological and missile elements represents an optimal approach of monitoring and verification in Iraq.

20. In the chemical, biological and missile areas, in contrast with the nuclear field, Iraq produced and deployed operational weapons. These three programmes were closely connected and intertwined. Proscribed missiles were equipped with warheads filled with chemical and biological warfare agents. Chemical weapons facilities were often used for research activities related to BW programmes and for weaponization of BW agents. Missile facilities manufactured different types of chemical and biological munitions. In a period prior to the adoption of Security Council resolution 687 (1991), all three programmes, chemical, biological and missile, were managed and coordinated by a single Governmental agency: the Military Industrialization Commission (MIC).

21. There will always be a continuum between accounting for Iraq's proscribed activities of the past and monitoring to ensure that proscribed programmes are not reconstituted. Monitoring does not necessarily imply a categorical change in inspection techniques or procedures. For example, no-notice inspections will be needed whether their proximate cause is to discover a possible residual weapon from the past or a newly built one.

22. The OMV system as designed and implemented by the Commission, has been based on the assumption that ultimately, the full verification and disposal of Iraq's proscribed weapons would be achieved, as directed by resolution 687 (1991). This had the implication that the OMV system, in the long term, would rest on a foundation of full knowledge of the disposition of proscribed weapons and capabilities.

23. This present review of the OMV system takes into account the possibility that the mandated objective of the full accounting of Iraq's proscribed weapons and verification of Iraq's prohibited

programmes will not be achieved but the Commission may, nevertheless, be required to operate its OMV system under the shadow of Iraq possibly retaining prohibited materials. It further takes into account that once sanctions are reduced or lifted, the Commission will face a considerable increase in its OMV work.

24. In these contexts, the Commission notes that the Plan for OMV approved by the Security Council in resolution 715 (1991), provides adequate potential for implementing a system of monitoring and verification more rigorous than had been in place in the past. It must be emphasised that the absence of the resolution of disarmament issues would lead to a degradation in the degree of confidence able to be provided by the OMV system, notwithstanding that additional measures would need to be introduced into the system in an attempt to offset the failure to bring all disarmament issues to account.

Key Elements

25. Three elements are of paramount importance for any effective and credible monitoring and verification system in Iraq. First, Iraq's full and unreserved adherence to its obligations and cooperation with the Commission's monitoring activities. The two other critical elements are: the Commission's access to sites for inspection and to information from all sources relevant to its mandate; and the resources available to the Commission for implementation of its mandate.

Iraq's Cooperation

26. The extent of Iraq's cooperation is the key determinant for the level of OMV procedures employed, and the resulting confidence in the system. Iraq has provided varying degrees of cooperation since 1991. Where cooperation has been good, monitoring has been good. The better the information and access provided by Iraq, the less intrusive the OMV procedures and the higher the confidence in the resulting assessments of Iraq's compliance.

27. A fundamental requirement is for the Government of Iraq to cease any prohibited activity. In this context, an important step by Iraq is the adoption of legislation prohibiting all natural and legal persons under its jurisdiction from undertaking anywhere any activity prohibited by the relevant resolutions and the Plan and to enact penal legislation to enforce such prohibitions. Such legislation was required to have been enacted within thirty days of adoption by the Security Council of resolution 715 (1991). Iraq has not yet taken this action.

28. Iraq states it ended its illegal concealment activities in 1995, but has never provided any evidence, such as documentation, to support this claim. In light of uncertainties concerning remaining disarmament issues, and less than full cooperation by Iraq, monitoring will have to take into account evasion techniques. If ongoing concealment were to be uncovered, this would be a matter of grave concern both intrinsically and in terms of the credibility of the OMV system.

Access to sites and information

29. Under the Plan for OMV, Iraq undertook to accept unconditionally the inspection of any site, facility, activity, material or other items declared by Iraq or designated by the Commission;

and to provide immediate and unimpeded access to any site, facility, activity, material or other items to be inspected. Timely and unfettered access for inspection purposes is crucial to obtaining information which could serve as a basis for assessments of Iraq's compliance.

No-notice Inspections

30. The Commission has the right to conduct inspections on a no-notice basis. In the practical implementation of this right, it is important to minimise the opportunity for Iraq to have predictable warning of specific sites to be inspected. Iraq has attempted to defeat the principle of no-notice inspection by working assiduously to track and predict the Commission's inspection activities. Iraq seems to have succeeded in identifying blocks of time and certain locations in which and at which inspections were to be conducted, thus minimising, and indeed in many instances eliminating the risk of discovery of prohibited items or undeclared activities. This is a serious issue involving both cooperation by Iraq and operational security on the part of the Commission. An effective OMV system requires that there should not be sanctuaries in time.

Sites for inspections

31. An effective OMV system also requires that there should not be sanctuaries of sites and facilities from inspection throughout Iraq. Statistically, the Commission has conducted a large number of inspections in Iraq, but for the most part such inspections under the Plan for OMV have been to sites declared by Iraq. This is not without its importance, but monitoring demands verification of the absence of prohibited activities at all other locations in Iraq based on reliable information or assessment. Inspections conducted in a credible manner lead to no ambiguous results. This is critical to both Iraq and the Commission.

32. The range of sites to be inspected on a regular basis depends on the Commission's knowledge of Iraq's proscribed programmes and its understanding of Iraq's activities which fall under the Plan for OMV. If certain disarmament issues are not resolved, the Commission may need to regularly inspect a broader range of military facilities in Iraq. For instance, if full accounting of 155mm mustard rounds were not achieved, regular inspections of ammunition bunkers and depots might be judged as necessary.

33. The identification and inspection of sites where undeclared or prohibited activity might be conducted is fundamental to any effective monitoring system. Such sites are identified through the analysis of data obtained from a variety of sources available to the Commission and are inspected by teams which may comprise resident or non-resident expertise, as required. It is necessary to maintain a coordinated approach to the identification and inspection of potential sites in order to maximise the effectiveness of these inspection efforts for the benefit of ongoing monitoring. The potential of inspections of undeclared sites makes an important contribution to the overall deterrent effect of the monitoring system.

34. The Plan for OMV does not envisage any sanctuary for inspections or limitation on assess to sites designated for inspection. In the past, following blockages of inspections by Iraq, special modalities for inspection of specific categories of sites were established. These were themselves the subject of further dispute and blockage. Given the terms of resolution 715 (1991) and the

Plan for OMV, the serious question arises of the impact of such modalities on a credible monitoring system, or indeed whether they should have any role with respect to that system.

35. A part of the resolution of disputes caused by Iraq blocking inspections and seeking to establish areas which may not be inspected at all, has been acceptance of the concern that Iraq's legitimate security, sovereignty and dignity must be respected. The Commission does not believe that the effective conduct of its work and these concerns are inherently incompatible. They could prove to be so if the claims by Iraq of such concerns were clearly being advanced as a rationale for avoiding its obligations. The Commission has and will continue to balance its need to conduct effective inspections with Iraq's legitimate security, sovereignty and dignity concerns.

Geographic Access

36. Shortened access time to sites designated for inspections could be achieved through the following steps, either separately or in combination: the creation of regional monitoring and verification sub-centers or operational bases, the use of fixed-wing aircraft for transportation within Iraq and the improvement of rotary-wing aerial transportation.

37. The creation of two regional monitoring sub-centers or operational bases in Mosul and Basrah, in addition to the BMVC, would enable the Commission to reach practically all of the listed sites in Iraq within two hours. The creation of regional centers would necessitate a further increase in the number of personnel on resident teams in Iraq. Another option would be the creation of regional operational bases where a sub-component of the monitoring teams would be able to operate from at any time on a temporary basis. The second option would not require a significant increase of personnel.

38. The use of fixed-wing aircraft within Iraq would allow for the transportation, to any operational airfield in Iraq, of inspection teams comprising 10 or more inspectors, together with all required verification equipment and vehicles for ground transportation. It would also allow the deployment of inspection teams to particular areas in Iraq straight from the Commission's field office in Bahrain.

39. The deployment of helicopters by the Commission would also allow the transportation of inspection teams comprising 10 or more inspectors, together with a limited amount of verification equipment and vehicles for ground transportation to any specific site designated for inspection.

Access to Information

40. The Plan for OMV approved by Security Council resolution 715 (1991) stipulates that the Commission shall have the right to "request, receive, examine, copy and remove any record, data, information or documentation and to verify inventories." Access to documentation has been emphasized in relation to verifying Iraq's proscribed activities. It will also be vitally important to OMV. Records relating to production and acquisition records, inventory lists, financial transactions documentation and tasking orders can be highly revealing for tracking Iraq's activities under monitoring. A credible monitoring system must make full use of relevant procedures based on the right of access to records and information.

41. Effective monitoring through the examination of records has shown the general need for experienced linguists. With the increased use in Iraq of electronic information systems, there is a further requirement for computer experts who can examine electronic records. The Commission has found many useful pieces of information through examination of computers. Continued examination of such media will remain essential.

42. In the implementation of its monitoring and verification tasks, the Commission will continue to rely on information from sources other than the Government of Iraq. Information of relevance to monitoring in Iraq has been provided to the Commission from a number of sources outside Iraq. Such data is assessed by the Commission and collated with what is known to be in Iraq. Inspections may be planned on the basis of such data depending upon assessment. Without such information, the level of success achieved by the Commission in understanding Iraq's prohibited programmes would not have been possible. This will continue to be the case for monitoring.

Resources

43. The ongoing monitoring and verification in Iraq is an operation that relies mostly on human efforts not on technical devices. The Commission has found that one of the greatest shortcomings in its work on monitoring in Iraq has been the relative lack of experts who have extended and detailed knowledge of Iraq's proscribed weapons programmes. The Commission has been provided experts for assignment to Baghdad from many Governments. Typically, these have been highly qualified technical experts in their fields, in their countries. What the Commission finds is that this expertise, while necessary, is not sufficient since additional knowledge of the Iraqi-specific programmes and activities is required. Moreover, in most cases these experts are loaned to the Commission for terms of three to six months. This does not allow enough time to become familiarized with Iraq's programmes and techniques. Over the long term, however, it will be necessary to recruit experts and other inspection personnel who will be engaged in the monitoring activities in Iraq for extensive periods.

44. At this stage, it is impossible to provide a very precise estimation of the size and cost of the OMV system in the future, as that would depend, in significant ways, on decisions regarding tasks, scope and objectives of such a system.

45. In the evaluation and identification of the possible magnitude of the OMV system in the future, the characteristics of the OMV system implemented by the Commission over the last years are provided as a point of reference.

46. In the past, the Commission has used a staff of over 200 personnel per year on a long-term basis (including experts, inspectors, policy officers, support personnel and aircrew), distributed among its three locations: Baghdad, Bahrain and New York. Although the staff was engaged in both disarmament and monitoring activities, since 1994 most of them were devoted to monitoring duties.

47. Additionally, an average of 700 visiting experts and other specialists were employed per year for short-term missions in Iraq, mostly for monitoring inspections.

48. The majority of the Commission's personnel has been provided by governments (as proposed

by the Secretary-General and endorsed by the Security Council in 1991 - S/22508). United Nations staff have also been seconded to the Commission. As the Council agreed in 1991, the Member States whose nationals serve on the Commission or assist it in the discharge of its responsibilities have been responsible for their salaries, while the Commission has borne the costs of travel and daily subsistence. These arrangements have helped to keep the overall budget of the Commission to a minimum.

49. In addition, the Commission has borne the costs of transportation, communications, acquisition of some but not all the required equipment, and administration.

50. The overall budget of the Commission has been around $35 million per year. This does not include the cost of significant in-kind support provided - without charge to the Commission - by several governments, such as the U-2 and Mirage IV operational costs, sample analysis and procurement of equipment, among others. Were that support to be borne by the Commission, the actual budget would have been considerably larger.

51. For effective implementation of the Plan for OMV in the future, substantial increases in the resources should be envisaged. Even without critical changes, the cost of the implementation of the OMV system and its size in the future may well double.

52. On a preliminary basis the Commission estimates that the OMV system in the future would require over $50 million, annually, for salaries of long-term (UN recruited) and short-term staff, including inspectors, specialists, support personnel, aircrew and administration. Travel costs, communications and other operational expenditures would require over $15 million per year. Contractual services for the provision of aerial transportation capabilities in Iraq (fixed-wing cargo aircraft and helicopters) would amount to over $10 million. Aerial surveillance support (high, medium and low-altitude aerial surveillance), if to be provided to the Commission, under contractual services, would represent a very considerable expenditure. At this stage, it is difficult to provide any estimate figure for these services. The Governments currently providing such services to the Commission have not provided data on their actual cost. Moreover, this kind of service is not available, currently, in the commercial market.

53. The Commission also estimates that the OMV system in the future, even without the introduction of more far-reaching changes (such as an increase in the resources devoted to the Export/Import mechanism), would require a staff of over 350 personnel for the implementation of all its activities. Most of them will need to be recruited under contracts with the United Nations. Additionally, the OMV system would require an average of 400 visiting experts and other specialists, per year, for short-term missions in Iraq.

Appendix 1

MISSILE MONITORING SYSTEM

The Establishment of Monitoring System: Mandate and Background

Mandate and Tasks

1. The Commission's Plan for the ongoing monitoring and verification of Iraq's compliance (the Plan for OMV) was approved by the Security Council in its resolution 715 (1991) of 11 October 1991. The Plan for OMV established specific obligations for Iraq. The Plan also laid out a set of comprehensive rights for the Commission under which it could develop and operate a monitoring system in Iraq in order to fulfil its mandate.

2. The Plan for OMV established that in order to ensure Iraq's compliance, the Commission should, through inspections and through aerial overflights, as well as through the provision of information by Iraq, monitor and verify that activities, sites, facilities, material and other items, both military and civilian, are not used by Iraq in contravention of its obligations.

3. The Plan stated that, in accepting unconditionally Security Council resolution 687 (1991), Iraq undertook not to use, retain, possess, construct or otherwise acquire, inter alia, any ballistic missiles with a range greater than 150 kilometres or any related major parts, including launchers, or any repair or production facilities. Provisions specifically related to missiles are contained in Section E (paragraphs 40-45) and Annex IV of the Plan for OMV. Paragraphs 41 and 42 provide important definitions of activities, sites and items subject to monitoring. Paragraphs 43 and 44 and relevant portions of Annex IV outline specific information and data that Iraq is required to provide to the Commission on a regular basis.

4. Iraq initially refused to accept its obligations under resolution 715 (1991) and the Plan for OMV approved by the resolution. Through early and mid-1993, the Commission undertook an effort in the missile area called "interim monitoring". It was designed to gain a better understanding of the requirements and resources that would be necessary to conduct future full-scale monitoring activities in the missile area once Iraq accepted the Plan for OMV. In May 1993, the Commission began the provisional installation of cameras to observe Iraq's main static test stand for missile engines.

5. In November 1993, Iraq decided to accept the obligations set forth in resolution 715 (1991) and to comply with the provisions of the Plan for monitoring and verification as contained therein.

6. The Commission then began implementation of the monitoring system in the missile area. It conducted a number of baseline inspections of missile facilities and facilities with dual-use capabilities declared by Iraq. Declared operational missiles subject to monitoring were inspected and tagged. In August 1994, a resident missile monitoring team was established, for the first time, at the Baghdad Monitoring and Verification Centre (BMVC).

Assumptions and Basic Considerations

7. At the time of the adoption of the Plan for OMV in 1991 and the subsequent establishment of the Commission's monitoring system in 1994, there was no established precedent for an international inspection and monitoring regime to verify missile related activities similar to the requirements established by the Security Council. No proven or tested procedures existed that could have served as a model for the construction of a regime for verification of Iraq's compliance with the prohibitions on proscribed missiles imposed by the Council, while allowing

Iraq to conduct a full scope of activities with missiles of a shorter range.

8. The Commission decided to establish and operate the least intrusive missile monitoring system in Iraq consistent with the overall objectives set forth by the Security Council. In arriving at this decision, the Commission made a number of basic assumptions that determined practical inspection procedures that have been used since in its ongoing monitoring in the missile area.

9. The primary assumption made by the Commission was that, in the implementation of its obligations, Iraq would willingly and fully cooperate with the Commission, inter alia, by: submitting full and accurate declarations; providing prompt, accurate and detailed responses to the Commission's inquiries and requests; granting unimpeded access to facilities, equipment, personnel, and records; and, facilitating aerial overflight and operation of monitoring equipment such as cameras and sensors. In this sense, the Commission has postulated "monitoring friendly" policies and behaviour by Iraq.

10. The second assumption was that the Government of Iraq would take a political decision to abide strictly by its undertaking not to initiate or engage in any proscribed activities and would enforce this decision throughout the territory of Iraq. If this was the case, then discrepancies that were always expected to be identified through monitoring, especially at its initial stages, would be interpreted as honest mistakes by individuals rather than as proscribed activities being deliberately concealed by the Government. The Plan for OMV provided that Iraq adopt legislation prohibiting all natural and legal persons under its jurisdiction from undertaking anywhere any activity prohibited by the relevant resolutions and the Plan, and to enact penal legislation to enforce the aforesaid prohibitions. Such legislation was required to have been enacted within thirty days of adoption by the Security Council of resolution 715 (1991) on 11 October 1991. To date, the legislation has not been enacted.

11. The third assumption was that the Commission would receive, from Iraq, full and complete disclosures of all its proscribed activities and capabilities, and that the identification and disposal of all proscribed weapons, materials and programmes would be achieved. Thus, no disarmament tasks or investigations of the past proscribed activities would need to be pursued under monitoring. The Commission's monitoring could focus solely on non-proscribed activities in Iraq to verify that they are not being misused. Based on this assumption, the current missile monitoring system has not been tasked to search for proscribed weapons and materials. This task has been carried out by the Commission separately through disarmament activities and investigations.

12. In an effort to operate the monitoring regime in the missile area in the least intrusive manner, the Commission decided to concentrate on "check points" rather than to carry out "blanket" monitoring of all relevant activities. A "check point" was defined as a selected stage in missile development or production that specific components, critical for final assembly of a missile, would have to pass through. In many cases, this involves dual-use equipment or technologies. Examples of "check points", in a liquid propellant missile, are flow-forming machines to produce sections of a combustion chamber, and, in a solid propellant missile, casting chambers for motors.

13. "Check points" were designed to assist the Commission in accounting for specific missile components under production in order to gauge the number of complete missiles that Iraq had produced or could produce using such components. "Check points" could also allow the detection of the diversion of components for undeclared use. For its monitoring purposes, the Commission has identified some 50 "check points" at various facilities in Iraq. Most of them are under continuous camera surveillance.

14. In designing its monitoring system, the Commission aimed at denying the use of "declared" facilities for proscribed purposes. If proscribed activities were undertaken, they would have to be conducted at other facilities. Thus, the Commission also incorporated inspections of "undeclared" facilities into its monitoring system.

15. Under the Security Council resolutions, missiles, as such, are not proscribed for Iraq to develop, test, produce or acquire. Only missiles with a range greater than 150 kilometres are prohibited to Iraq. From the technological point of view, there is no boundary to separate missiles with ranges below or above 150 kilometres. The Plan for OMV itself does not contain technical definitions that would distinguish proscribed missile features and characteristics such as permitted or prohibited length and diameter of a missile, weight of its warhead and propellants, technical specifications of the missile engine and other subsystems and parameters of flight trajectories. The monitoring system has to take into account that it is difficult, within this framework, to define, in a clear-cut manner, proscribed versus non-proscribed missile activities.

16. During the last year, the Commission studied the underlying assumptions of its missile monitoring system and the impact that they had on the level of confidence in Iraq's compliance. The Commission has also evaluated its monitoring practices in relation to progress in missile-related activities and available technologies in Iraq. This resulted in a review of the missile monitoring system. Through this review, several areas were identified which required additional or improved inspection efforts in order to monitor effectively Iraq's activities in the missile area. The implementation of some of these improvements were already in progress. Such improvements and other suggestions resulting from this review are outlined in the present paper.

Iraq's Missile Programmes relevant to Monitoring

17. After the adoption of resolution 687 (1991), Iraq declared that it would carry out activities related to non-proscribed missiles. In the course of implementation of the Plan for OMV, Iraq declared a number of specific missile projects. Some of these projects were a resumption of programmes that Iraq had been engaged in prior to the adoption of resolutions 687 (1991) and 715 (1991).

18. The main missile activity in Iraq under monitoring by the Commission since 1994 has been the development of a missile, with a declared range of just below 150 kilometres, for indigenous production in Iraq. This missile system, known variably as Ababil-100 or the Samoud, has been under development in both liquid and solid propellant versions.

19. Since the missile monitoring system was established in 1994, Iraq has achieved considerable

progress in the development of the Samoud liquid propellant missile system with a declared range of 149 kilometres. A number of static tests of missile engines were conducted. In October 1997, Iraq carried out its first declared flight test of a Samoud missile. This flight test was declared a success by Iraq and demonstrated a significant step in Iraq's indigenous missile production capabilities. Iraq continued active flight test activities in 1998.

20. Iraq has been working on the design and development of the Ababil-100 solid propellant missile with a declared maximum range just short of the 150 kilometre limit. Iraq is in the process of establishing the infrastructure for the production of solid propellant motors and other components for such a missile.

21. Other major activities by Iraq include efforts aimed at indigenous production of a short range missile; the development of remotely piloted vehicles; and, reverse engineering and modification of various missile systems available in Iraq.

22. Iraq has pursued the indigenous production of a battlefield missile with technologies which could be used in longer range systems. Several static and flight tests of indigenously produced missiles have been conducted.

23. Iraq has declared the development of a remotely piloted vehicle. The Commission is monitoring this programme due to its use of components from a monitored operational missile as well as missile related technologies and capabilities covered under the Plan for OMV.

24. Iraq has declared programmes related to reverse engineering or modification of a number of missiles available in Iraq. These projects are subject to monitoring as they use listed facilities for related design or manufacturing activities. Dual-use equipment, material and items covered by the Plan for OMV are associated with the projects.

25. It should be noted that after the adoption of resolutions 687 and 715 (1991), Iraq undertook a number of missile activities that are covered by the Plan for OMV. These were not declared by Iraq in accordance with the Plan. The most significant of these covert programmes was a project called J-1 to acquire surface-to-surface liquid propellant missiles through the modification of surface-to-air missiles already available to Iraq. This project was not declared to the Commission until 1995, that is, more than two years after it had been allegedly aborted.

26. The monitoring activities in the missile area take into account the established scope of ongoing missile projects in Iraq and are adjusted in response to the projects' overall progress and specific achievements and developments.

Current Monitoring System: Its Architecture

27. The missile monitoring architecture is based on a process that interleaves different inspection procedures, data collection efforts and analytical tools. These tools in the missile area include on-site inspections by resident and non-resident teams, remote camera surveillance, use of other sensors, declarations and notifications from Iraq, participation in aerial inspections and Export/Import monitoring.

28. Before proceeding to the discussion of the actual operation of the missile monitoring systems and tools used, it is worthwhile to address at least two notions that have prime significance: firstly, sites for inspection and secondly; dual-use items.

List of Sites

29. The Commission has developed and maintained a list of sites in Iraq for regular inspection by missile resident teams. This list includes facilities declared by Iraq under the Plan for OMV as being involved in missile related activities or possessing dual-use capabilities; facilities identified by the Commission, and some other sites. Sites which are included in the list are referred to as "listed sites". Currently, there are some 80 sites on the missile list.

30. The main purpose of the list is to assist resident teams in planning and executing routine on-site inspections and in the verification of Iraq's declarations. The list has never been intended to be the only source for the identification of sites for inspection activities under the Plan for OMV. The scope of monitoring is not limited in any way to "listed sites". The monitoring regime was rather established by the Security Council for the purpose of monitoring and verifying that, throughout Iraq, activities, sites, facilities, material and other items are not used by Iraq in contravention of its obligations under resolutions 687 (1991), 707 (1991) and 715 (1991). For this purpose, Iraq undertook, under the Plan for OMV, to accept unconditionally the inspection of any site, facility, activity, material or other items declared by Iraq or designated by the Commission; and to provide immediate and unimpeded access to any site, facility, activity, material or other items to be inspected. Under its missile monitoring system, the Commission has carried out inspections of sites not included in the list in order to ascertain that no proscribed activities or activities that were to be declared under the Plan for OMV, took place at those "non-listed" sites.

31. The sites and facilities in the current list in the missile area can be broken down into six main categories: key facilities; supporting facilities; dual-use facilities; sites involved in previous proscribed activities; operational sites and, other sites.

32. *Key facilities* are facilities declared by Iraq that are directly engaged in the ongoing missile development, testing or production programmes in Iraq. These facilities have equipment or capabilities to produce missile or major missile components for both proscribed and non-proscribed purposes. There are 12 such facilities on the list. They were singled out for special inspection procedures to ensure that all activities at these sites are for non-proscribed purposes. The procedures at these facilities include frequent no-notice inspections by resident teams, remote camera surveillance at multiple points, tagging of dual-use and other critical equipment, notifications by Iraq of all equipment movement and detailed semi-annual and, as required, monthly declarations from Iraq. Based on its experience, the Commission recently began to use more frequently at these facilities such inspection procedures as document searches, computer searches and interviews of key personnel.

33. *Supporting facilities* are declared facilities which are involved in the design or production of components or tooling for ongoing non-proscribed missile programmes in Iraq. In many cases, this involves the use of dual-use items, materials and equipment. There are 18 such facilities on

the list. The Commission inspects these sites for the number and type of components or tools that they produce for missile programmes as well as for their dual-use capabilities. Inspections of these facilities are critical since the components and tools produced could be misused for proscribed purposes or diverted for undeclared activities. These facilities have been subject to a lower intensity of inspection activities than key facilities. A more intensive inspection of supporting facilities may be required in response to progress in Iraq's missile activities.

34. *Dual-use facilities* are declared facilities which contain items and technologies listed in Annex IV of the Plan for OMV. As distinct from "key" or "supporting" facilities, dual-use capabilities at these facilities are not declared by Iraq as being used for the benefit of its missile programmes. There are 20 such facilities on the list. Such facilities are inspected to ensure that their missile related capabilities are only used in declared activities. The Commission maintains a minimal inspection presence through infrequent on-site inspections and remote camera surveillance of specific dual-use items. Based on experience, it is likely that some of these facilities would require more inspection efforts as more dual-use technologies and items might become available to Iraq.

35. *Sites involved in previous proscribed activities* are generally facilities which are currently abandoned. Inspections are done to ascertain that they remain so. There are eight such facilities on the list and they are generally subject only to aerial overflights.

36. *Operational sites* are those facilities which are involved in the maintenance or operation of non-proscribed missiles. On-site inspections are required to ensure that all missiles that require monitoring have been declared by Iraq and that the facilities are not involved in proscribed activities such as training for the use of proscribed missiles. There are some 10 facilities on the list. As it was assessed that Iraq was not producing indigenously or otherwise acquiring new missiles, the Commission, after an initial round of inspection of those sites, decided to limit further inspections of these facilities in order to respect Iraq's legitimate concerns relating to national security.

37. *Other "listed sites"* are sites which have some relation to the Commission's activities in Iraq, such as excavation sites at locations of the unilateral destruction of missile and related equipment, holding areas of proscribed components, former proscribed weapons and equipment hide sites, etc.

List of Dual-Use and Other Equipment

38. One way to collect the data required to assess Iraq's compliance is to monitor, throughout Iraq, equipment and other items that could be used by Iraq in proscribed missile activities or in undisclosed activities that Iraq is required to declare under the Plan for OMV. The Plan established a list of dual-use items for the missile area. This list constitutes Annex IV to the Plan. The Annex contains technical definitions of equipment, components, items, materials and technologies that are considered important to develop and produce proscribed missiles in Iraq. The list was subsequently revised to elaborate specific items which would be subject to Export/Import monitoring. Modifications to the list were mainly based on an internationally accepted missile non-proliferation regime, the Missile Technology Control Regime. This

modified Annex IV was approved by the Security Council in March 1995. Further modifications may be expected in the future in the light of experience.

39. The monitoring of dual-use items establishes surveillance of the most critical equipment, materials, tooling, components or technologies to seek to ensure that they are only used, in practice, for legitimate declared purposes and are not diverted to proscribed applications. Most of these items have applications in both proscribed and non-proscribed missile development or production. Many could also be used in non-missile related industries. There are numerous dual-use items and materials in Iraq. The Commission attempts to monitor them by a variety of methods depending on the nature of items, but primarily by maintaining running inventories of identified items at "listed" facilities. For example, 38 pieces of dual-use equipment are tagged in the missile area. The Commission also conducts specific inspections to verify that no dual-use items are present at other, "non-listed" facilities.

40. In addition to items in Annex IV of the Plan for OMV, the Commission monitors some other critical equipment located mainly at key facilities. Iraq is required to declare all equipment at key facilities and their movement. While other equipment with similar capabilities is likely to exist in Iraq, the Commission views the tracking of declared equipment associated with key missile facilities necessary to its effort to prevent the movement of declared capabilities to undeclared sites.

41. A number of items which were used or acquired by Iraq specifically for proscribed programmes in the past have been tagged by the Commission. While these items are not explicitly listed on Annex IV and while other such untagged items might exist elsewhere in Iraq, the Commission views the monitoring of these tagged items as important because of their association with past proscribed activities.

On-site Inspections

42. On-site inspections are the main tool used by the Commission for monitoring and verification in Iraq. The Commission has developed and employed a variety of inspections to meet specific objectives.

Baseline

43. In order to establish its current monitoring system in Iraq, the Commission conducted, in early 1994, baseline site inspections. They mostly covered Iraq’s declared missile research, development, testing and production facilities, and declared dual-use facilities. The objective was to determine specific requirements for monitoring procedures for each site. During an initial round of baseline inspections, 33 facilities were inspected to assess the level of technical capabilities of each facility related to both proscribed and non-proscribed missile activities, follow the production process at each facility, identify requirements for tagging and remote camera surveillance and elaborate specific details for Iraq’s declarations regarding each facility. All 33 facilities inspected were included in the site list in the missile area. The baseline inspections also assessed the overall status of each of the indigenous missile programmes declared by Iraq under the Plan for OMV.

44. The operation of the missile monitoring system revealed some weaknesses in initial assessments. As mentioned previously, the Commission assumed that Iraq would fully support the monitoring system. During over four years of missile monitoring, the Commission has learned that Iraq: sometimes provided incomplete declarations; had engaged in undeclared and even proscribed missile related activities; and, tended to understate the level of its achievement and technological skills.

45. In response to these events and Iraq's recent improvements in its non-proscribed missile related capabilities, the Commission began a process of a basic review of missile design, development and production activities in Iraq at their new levels. The goal is to maintain the Commission's ability to monitor effectively Iraq's activities. The Commission conducted new baseline inspections related to missile and dual-use production equipment at the end of 1997, and Iraq's solid propellant missile industry in the middle of 1998. Resultant assessments and recommendations are being incorporated into the monitoring system. Additional baseline inspections are still required to bring the current monitoring system up to speed.

Resident Teams

46. The centerpiece of the monitoring system is teams of resident inspectors stationed in the Baghdad Monitoring and Verification Centre (BMVC). No other tool is as flexible. Inspectors can be recruited with specific technical knowledge and trained to exercise a variety of mandated inspection procedures. Resident inspectors are tasked to carry out on-site inspections of "listed" and "non-listed" facilities, conduct analysis and assessment of specific areas of Iraq's activities, participate in aerial inspections, etc.

47. The majority of on-site inspections by resident teams are done on a no-notice basis. On average, 350 inspections per year have been performed by missile resident teams. During on-site visits, inspectors observe ongoing activities at facilities, check the accuracy of Iraq's declarations and confirm the presence of tagged and other declared items, if applicable. Inspectors might ask questions of the facility personnel to obtain better understanding of relevant activities and status of missile programmes.

48. No-notice inspections by missile resident teams did not include regular use of such procedures as document searches, computer searches, interviews of personnel or sample taking. The active and regular use of these procedures may become necessary in order to verify effectively Iraq's compliance.

49. Missile resident teams interact on a regular basis with other resident teams in the BMVC. For example, the missile monitoring system covers essentially the same facilities and equipment as the nuclear monitoring system. Several items of equipment are under joint remote camera surveillance by the IAEA and the Commission.

50. Missile resident teams provide assistance to the Aerial Inspection (AIT) and Export/Import (EG) teams at the BMVC. For example, assistance to the AIT involves the interpretation of imagery or the identification of areas requiring photographic coverage. The work with the EG team is in the form of expert assessment of items imported by Iraq and their relation to Annex IV

of the Plan for OMV. There has not been a significant inflow of such goods into Iraq. It is expected that the interaction between the missile and EG teams at the BMVC will increase in the future. This might necessitate the acquisition of dedicated personnel for missile resident teams to perform this specific coordination function.

51. The Commission has identified a requirement to improve the training of its resident missile inspectors. Their training and expertise have been declining to a level that could jeopardise the Commission's objectives in ongoing monitoring. The Commission has begun the development of a new training programme with a goal of meeting the new requirements.

52. The Commission has attempted to maintain five to seven technical inspectors on missile resident teams in the BMVC. In response to increased workload and the diversification of the team's tasks, it is expected that this number will need to be more than doubled in the future.

Non-resident Inspections

53. While missile resident teams have the responsibility to inspect sites on a daily basis, the Commission also sends non-resident teams to Iraq to conduct special monitoring inspections. Such inspections require specialised expertise, training, operational planning and support. Examples of such inspection missions are: missile tagging and tag checks; missile test activity observation; missile technology updates; baseline inspections; and, compliance inspections. Several missions went to Iraq to conduct discussions of monitoring activities with the Iraqi counterparts. Over 40 non-resident teams have been to Iraq on monitoring inspections and missions since 1994.

54. It is important to keep track of the technological progress of Iraq's industries to ensure that the ongoing monitoring is properly focused. Technology update inspection teams go to Iraq, usually on a semi-annual basis, to assess advancements in the technology base and to make recommendations for improvements in the monitoring system. Inspectors on such teams bring fresh perspectives on missile related developments and on the application of emerging technologies for monitoring purposes. Technology update inspections are critical to keeping the monitoring system in the missile area up-to-date. There have been seven such teams in Iraq since 1994.

55. Pursuant to the Plan for OMV, in particular its paragraph 43(a), the Commission monitors specified operational missiles in Iraq to ensure that they are not modified for prohibited purposes. Since mid-1994, 22 non-resident teams went to Iraq to conduct inspections for this purpose. A more detailed discussion of relevant issues is presented in a section below dealing with operational missiles.

56. As the development of the Samoud missile system progressed, Iraq has engaged in more test activities, both static and flight. In order to properly evaluate these activities and test results, the Commission reverted to the practice of supplementing, on a temporary basis, resident teams with special equipment and personnel, including missile test engineers. This practice has proven to be very useful. Some 10 such supplementary groups have been sent to Iraq starting in late 1997. In the future, test engineers and specialists will have to be placed permanently on missile resident

teams to cover effectively and in detail all missile test activities.

57. Other non-resident inspection teams were sent to Iraq as required. They were involved in baseline inspections, monitoring discussions and compliance inspections. Baseline inspections are discussed above. Monitoring discussions were carried out on numerous occasions to clarify, elaborate or resolve technical issues related to ongoing monitoring in the missile area. For example, during these discussions, issues related to formats of Iraq's declarations and notifications, definitions of missiles, facilities, equipment and items subject to monitoring, deployment and operation of sensors and interaction between inspectors and Iraqi personnel have been addressed.

58. Seven compliance inspections have already been sent to Iraq since 1994 to verify information gained from inspections or received from other sources concerning Iraq's compliance with its obligations under the Plan for OMV not to use, develop, construct or acquire proscribed items. Most of them carried out investigations of Iraq's attempts, after the adoption of resolution 687 (1991), to procure from abroad items or assistance for its missile programmes. A number of cases were identified when Iraq imported or sought to import missile-related items that it was required to declare under the Plan for OMV. Some of these efforts were not declared to the Commission. In one particular case, the Commission established that Iraq imported proscribed gyroscopes in 1995 that could be used in long-range missiles.

59. The Commission's use of non-resident inspections is likely to increase in the future to meet a growing number of specialized tasks that would need to be carried out in the framework of the missile monitoring system.

Inspections of Non-Listed Sites

60. In order to seek to deter or uncover Iraq's use of facilities or sites for undeclared or proscribed purposes, missile resident and non-resident teams conduct inspections of sites in Iraq that are not included in the missile site list. Such "non-listed" sites are designated by the Commission for inspection based on their assessed capability to be involved in proscribed activities or based on information that they are involved in undeclared or proscribed activities. Inspections of "non-listed" sites are crucial to the development of overall assessments of Iraq's compliance with the Plan for OMV. The Commission expects that the importance of this type of inspection in the missile area will increase in the future to improve the effectiveness of monitoring.

Sensors

61. In addition to on-site inspections by expert personnel as its central element, the monitoring system in the missile area makes extensive use of technical devices. Cameras allow the surveillance of activities and equipment on a continuous basis. Application of tags ensures detection of tampering. As sensor technologies progress, the Commission intends to avail itself of emerging capabilities.

Cameras

62. The primary sensor in the missile monitoring system is remote surveillance cameras. Cameras installed at missile facilities and their workshops allow continuous observation of selected locations and recording of ongoing activities. The system is also capable of transmitting imagery back to a camera control room at the BMVC.

63. In the missile area, 74 cameras are installed at 15 "listed" facilities. They are mostly used to observe "check points".

64. The Commission, both through its BMVC missile resident teams and its headquarter's staff, evaluates images recorded by the cameras to determine the nature of activities at locations and with equipment under camera surveillance, and to produce estimates of the quantity, quality and usage of components or missiles being produced at these locations. Examples of such locations are specified technological stages in the missile development and production such as flow forming; vacuum brazing; solid propellant mixing, casting, extrusion and curing; gyro balancing; hydrostatic testing; and missile final integration. Remote cameras have a particular value at static test stands for the testing of missile engines. They allow the recording of declared tests as well as the detection of any undeclared test activities at the declared stands. Temporary video cameras were also installed at storage areas to verify non-unauthorised access to such areas and ensure custody control of items in storage.

65. The Commission is planning an upgrade of its existing camera system and the deployment of advanced cameras in the missile area.

Instrumentation

66. As missile related activities progressed in Iraq, the Commission began to put more effort into technical evaluation of Iraq's declared missile systems and their components. At the end of 1997, several specific issues for technical assessment of the Samoud missile were identified. The Commission resorted to additional technical instrumentation for independent and precise appraisal of specific missile parameters both through physical measurement and mathematical modelling. This called for the use of such instrumentation as precision scales and precision volumetric gauges. These were necessary to verify that declared missile characteristics such as weights of individual missile sub-systems and sections, volumes of propellant loads and matching parameters of the missiles actually used in tests. Such data is essential for verification that the declared system as a whole complies in practice with the Plan for OMV.

67. The Commission believes that the deployment in Iraq of its own system to track in-flight tests of missiles would considerably improve monitoring in the missile area. The Commission carried out a survey mission in December 1998 in preparation for the future use of the tracking system.

68. The Commission intends to use new sensors for monitoring activities in the missile area. Examples of emerging useful technologies under study are: remote sensors, real-time analytical samplers and detectors, and recorders of control units for production equipment.

Tags

69. Tamper-proof tags are being used in the missile area for inventory control and to prevent certain activities from being undetected. Their usage assisted in maintaining reliable inventories of dual-use and other equipment and controlling equipment movement. Tamper-proof tags are one of the main tools for verification of non-modification of declared operational missiles under monitoring. Tags are also used to control unauthorized access to some areas and to some items. The use of tags is relatively inexpensive and facilitates a whole range of monitoring activities.

70. Up to now, monitoring sensors including cameras, instrumentation and tags, have been provided by Governments on a "no-cost-basis". The Commission has relied on supporting Governments for necessary maintenance services and logistical support for the monitoring sensors.

Iraq's Declarations

71. The Plan for OMV was designed following the established and proven method in arms control: verification of declarations provided by the party under monitoring. According to the Plan, Iraq undertook to provide, on a regular basis, full, complete, correct and timely declarations and notifications as specified in the Plan or designated by the Commission as well as to respond fully, completely and promptly to questions and requests from the Commission.

72. In the missile area, Iraq is required, under paragraph 43 of the Plan, to submit on a regular semi-annual basis:

> a list of all its missiles designed for use, or capable of being modified for use, in a surface-to-surface role with a range greater than 50 kilometres, specifying various missile parameters, and information on any project and on any site or facility for such missiles;
>
> information on any project and on any site or facility for missile research, development, modification or testing;
>
> information on the development, production, acquisition and other activities related to items and technologies listed in Annex IV.

73. Under paragraph 44 of the Plan, Iraq undertook to notify the Commission of developmental and test launches of any missile.

74. The Commission provided to Iraq formats for these declarations. It has also identified requirements for additional notifications and communications from Iraq in response to developments in missile-related activities in Iraq or through experience the Commission has gained in the implementation of the Plan.

75. Upon receipt of declarations and notifications from Iraq, the Commission assesses them, updates its relevant databases and conducts, through resident and non-resident teams, a verification of their completeness and accuracy. Assessment and verification of Iraq's declarations in the missile area is quite an enormous task. Each time they are submitted, semi-annual declarations alone contain some 1000 pages. Additional declarations and

notifications, including on missile tests and equipment movement, are frequent and require follow-up actions on the part of the Commission.

76. The Commission's confidence in Iraq's compliance depends significantly on the openness, accuracy and completeness of Iraq's declarations. The Commission's experience with Iraq's declarations in the missile area is that they have been generally complete and correct. On several occasions, the Commission has noted Iraq's reluctance to declare, at an early stage, activities which should be under monitoring. An example is Iraq's acquisition of a facility for the production of Ammonium Perchlorate (APC), a missile propellant listed in Annex IV in the Plan for OMV. Iraq began the development for this facility in 1995, without providing a notification to the Commission. Through an on-site inspection of a "non-listed" site, the Commission first detected such activity in early 1996 when it discovered a pilot plant for the production of APC. In late 1997, Iraq notified the Commission that it had begun the construction of a full-scale facility for the APC production. Such delayed disclosures disrupt the smooth functioning of the monitoring system.

77. In a number of cases, Iraq refused to provide the required declarations or to respond fully and promptly to Commission's requests for clarifications. This has handicapped effective monitoring. In most of these cases, Iraq cited national security reasons for its refusals to comply with its obligations under the Plan for OMV.

78. If incomplete or delayed declarations were to become common in the missile area, the Commission will have to increase the intensity of its inspection activities by bringing under the inspection process design and management facilities, and by resorting to the increased use of document and computer searches at "listed" and "non-listed" facilities.

Operational Missiles

79. The Plan for OMV provides for the monitoring of missiles designed for use, or capable of being modified for use, in a surface-to-surface role with a range greater than 50 kilometres. Some such missiles are operational as they are deployed with Iraq's Armed Forces. The objective of monitoring operational missiles is to ensure that they are not modified for proscribed purposes, for example to extend their ranges over the non-prohibited limit of 150 kilometres or to modify them for the delivery of chemical or biological warfare agents. Paragraph 43 (a) of the Plan requires Iraq to provide a list of all missiles with a range greater than 50 kilometres in Iraq, including sites and facilities where such missiles and related equipment are located.

80. At the initiation of the monitoring system, the Commission had established, in cooperation with Iraq, certain modalities for monitoring Iraq's operational missiles. This was done to address security and national defence concerns expressed by Iraq and was motivated by the Commission's decision to operate the least intrusive missile monitoring system in Iraq. For these reasons, the Commission waived an option to inspect missiles and associated facilities at times and locations of its choosing as it has a right to do under the provisions of the Plan for OMV.

81. The established modalities envisioned that after all declared missiles are tagged, the Commission would verify non-modification of the missiles by checking the integrity of the tags

affixed. For this purpose, the Commission would send no more than three teams per year. It would select for each inspection up to 10% of all tagged missiles, a list of which would be provided to Iraq ten days prior to each inspection. Iraq presents the missiles selected by the Commission for inspection at locations of its choosing.

82. Initially, in 1994, the Commission decided not to tag SA2/Volga surface-to-air missiles in Iraq. Although such missiles fall under definitions contained in the Plan for OMV and Iraq attempted, prior to the adoption of resolution 687 (1991), to modify such missiles for a surface-to-surface role, the Commission decided again to resort to less intrusive monitoring procedures for such missiles in order to accommodate, to the maximum, Iraq's stated security concerns. After August 1995, Iraq declared that, after the adoption of resolution 687 (1991), it had secretly conducted modifications of SA2/Volga missiles for a surface-to-surface role without declaring such activities to the Commission. In response, the Commission changed its earlier decision not to tag these missiles. During 1996, these missiles were tagged and added to the list of missiles for annual inspections.

83. Monitoring of SA2/Volga missiles in Iraq presents particular problems. In response to the Commission's attempts to implement the relevant provisions of the Plan for OMV, Iraq raised objections to some inspection procedures and monitoring requirements citing national concerns. In some cases Iraq continues to refuse to accept some of them, including those related to reuse of specific components of these missiles for its programme to develop the Samoud surface-to-surface missile system. These issues remain mostly unresolved.

84. Currently, there are several thousand operational missiles of different types that are declared by Iraq under paragraph 43 (a) of the Plan for OMV. It includes short-range surface-to-surface missiles, surface-to-air missiles and cruise missiles. There are no missiles on the current list that Iraq has produced indigenously.

85. Since 1994, the Commission has carried out 22 inspections related to tagging and checking operational missiles under monitoring. This includes 14 "annual" checks carried out pursuant to the established modalities. The Commission has not identified any evidence of proscribed modification of the tagged missiles.

86. The effectiveness of the established modalities for inspection of declared operational missiles depends on Iraq's cooperation. In particular, the Commission has assumed that Iraq would declare all available missiles subject to monitoring. The Commission has so far been refraining from conducting specialized inspections to verify that all relevant missiles have indeed been declared by Iraq. In the future, the Commission may have to resort to regular inspections with this purpose in order to maintain effective monitoring of the operational missiles. This will be particularly important when Iraq starts to acquire new missiles either through indigenous production or importation.

Headquarters

87. The staff in the Commission's headquarters in New York is responsible for advising the Executive Chairman on the day-to-day operation of the missile monitoring system, improvements

to the system, and results of analysis of Iraq's activities and assessments of Iraq's compliance. The staff assists the Executive Chairman in the preparation of his reports to the Security Council.

88. The headquarters office conducts the assessment, in conjunction with resident teams in the BMVC, of Iraq's declarations and data collected through various inspection efforts. It is engaged in the evaluation of imagery collected by the Commission's aerial surveillance assets provided by supporting Governments and participates in the tasking for these assets in support of the ongoing monitoring in the missile area. The staff carries out, in support of the Joint Export/Import Unit, the technical review of information related to Iraq's importation of dual-use goods. It is responsible for the planning and execution of non-resident inspections. For many of these inspections, assistance is sought from governments in the form of information, personnel, technical and logistical support, and training. Many non-resident inspections include members of the headquarters staff to provide for continuity and leadership.

89. One of the main day-to-day responsibilities of the headquarters staff is overseeing, recruiting, manning, equipping, training and other general management tasks in operation of the missile monitoring system.

90. Currently, there are six officers in the Commission's headquarters in New York responsible both for disarmament and monitoring activities in the missile area.

External Support

91. The Commission has relied extensively on the support of Member States, in the form of personnel, equipment, services and information, to carry out its monitoring activities in the missile area.

92. Governments are the only source of personnel with technical expertise and the inspection skills required. The Commission has approached some 30 Governments with requests to provide experts for resident missile teams. Experts from 16 countries have participated in such teams since 1994. Missile technologies are limited to a few countries, the number of personnel involved in relevant industries is relatively small, generally over-employed, and very well paid. For these reasons, the Commission has found it increasingly difficult to obtain or retain qualified technical experts necessary for the ongoing monitoring in the missile area. Currently, the Commission can reliably depend on only a few Governments to provide, on a "cost-free basis", such personnel. In the future, the Commission will need to find additional sources of recruitment of its missile inspectors and will most probably have to bear considerable costs associated with the recruitment and training of technical experts and other inspection personnel.

93. In the missile area, the Commission's monitoring system requires extensive technical support ranging from the technical assessment of Iraq's missile designs and characteristics, to expert evaluation of development and production activities, to data analysis of both static and flight tests, to computer simulation of missile data, to the development, supply and service of monitoring sensors and technologies. The Commission has relied exclusively on Governments for such support. In the future, requirements for technical support will increase. The Commission is planning to approach a number of Governments with a request to designate

national laboratories and establishments that would be able to provide, upon the Commission's request, technical and analytical support for ongoing monitoring in the missile area.

Current Monitoring System Capabilities: Lessons and Assessments

94. Through more than four years of its monitoring activities, the Commission has identified capabilities and deficiencies of the current monitoring system in the missile area. Based on the provisions of the Plan for OMV, the current system was established and operated on the basis of a number of political, technical, logistical and financial assumptions and considerations. These issues need to be kept under continuing review and scrutiny to maintain the relevance and effectiveness of the missile monitoring system

95. Certain lessons have been learned about what the current monitoring system can do with a high degree of confidence or cannot do in the verification of Iraq's compliance in the missile area. In between these two extreme points, a variety of Iraq's missile related activities could be verified with various degrees of confidence.

What the Current Monitoring System Can Do with a High Degree of Confidence

96. In the Commission's view, the current missile monitoring system can:

reliably monitor activities declared by Iraq related to missile design, development, testing and production.

reliably monitor missile related production capabilities in Iraq using declared or identified equipment, in particular dual-use items and technologies.

follow missile related technological developments in Iraq. The Commission maintains a detailed knowledge of Iraq's declared missile projects, their activities and capabilities. If any unexpected leaps in technological levels were to be detected by the Commission, it could be a clear indicator of undeclared activities.

detect modifications to declared operational missiles. Although the established modalities should deter Iraq from conducting any proscribed modifications and any modifications of the tagged missiles could not occur without detection, the actual discovery by the Commission of such modifications, if done on a small number of missiles, may require up to three years.

What the Current Monitoring System Cannot Do

97. In the Commission's view, the current missile monitoring system cannot:

be relied upon to detect undeclared missile activities on a scale of design or low-level prototype production, even at "listed" facilities. Without a continuous presence of inspectors at such facilities, there would be enough time, before an inspection team's arrival, to remove evidence of undeclared or proscribed activities of such a scale.

Reliable detection could not be achieved without a significant modification of current inspection practices. Larger scale missile production activities leave significant evidence that would require more time to remove. Activities on that scale, declared or not, stand a fair chance of being detected overtime.

be relied upon to detect undeclared activities at an early stage. Much more intensive inspection procedures including document and computer searches at programme management and design facilities in Iraq, would need to be applied on a regular basis to ensure timely detection of such activities at an early stage.

track monetary expenditures in support of missile activities. Early indications of undeclared or proscribed programmes and procurement activities could be detected through access to financial records. Inspections of banks and other financial institutions, and document and computer searches at programme management facilities would be required to detect undeclared or proscribed activities through tracking monetary expenditures and transactions.

be relied upon to detect undeclared importation of proscribed items if they are not notified to the Commission and used by Iraq at "non-listed" facilities or put in storage.

be relied upon to identify proscribed or other missile activities that Iraq might decide to carry out abroad.

98. The ultimate objective of ongoing monitoring in the missile area is to detect in a timely manner and to deter the deployment by Iraq of an operational force of proscribed missiles. Under existing conditions in Iraq, the current monitoring system is deemed able to accomplish this task in relation to indigenous production and deployment of large quantities of missiles required for an operational force of significance. Detection of Iraq’s acquisition of such a force through importation would largely depend on receiving information from a supplier Government. The ability to discover any retained proscribed missiles and their operational assets is questionable at this juncture, as the monitoring system has not been engaged in such efforts. Were this to be attempted, substantial changes in inspection procedures that are being practised under the current monitoring system in the missile area would be required.

Appendix II

THE CHEMICAL MONITORING SYSTEM

INTRODUCTION

1. The Plan for OMV addresses ongoing monitoring and verification of Iraq’s compliance with its unconditional obligation not to use, retain, possess, develop, construct or otherwise acquire any

chemical weapons (CW) or any stocks of chemical warfare agents or any related subsystems or components or any research, development, support or manufacturing facilities.

2. The General objectives for monitoring in the chemical area is to monitor and to verify that activities, sites, facilities, materials and other items, both military and civilian, are not used by Iraq in contravention of its obligations. The system of chemical monitoring was established in Iraq in October 1994.

3. The Goal of the current monitoring system is to monitor dual-capable activities, sites, facilities and materials that have legitimate uses for non-prohibited purposes and have never been used for CW purposes, but which due to their nature could be used for the development, production or acquisition of chemical weapons. To this end, the verification of Iraq's compliance with its obligations not to retain stocks of chemical weapons, their subsystems and components and CW research, development, support and manufacturing facilities has been pursued by the Commission separately in the course of the verification of Iraq's CW programme under paragraphs 8 and 9 of Security Council resolutions 687 (1991) and 707 (1991).

4. The monitoring system is focussed on the verification of:

the total national quantity of the production, processing, consumption or storage of dual-use (declarable) chemicals;

sites and facilities that are involved in the production, processing, consumption or storage of all the above mentioned chemicals;

sites and facilities that are involved in the production, processing or storage of organophosphorus chemicals or are involved in production of organic chemicals by chlorination;

acquisition of equipment or technologies intended for the production and processing of the above mentioned chemicals and sites and facilities that are involved in the production of such equipment; and

sites and facilities that at any time have been involved in the production of munitions intended for CW purposes and/or in providing support to the CW programme.

CONCEPT AND STRUCTURE OF CHEMICAL MONITORING

5. The Concept of chemical monitoring is is based on:

identification of sites, facilities, items, materials and activities to be monitored on the basis of information obtained through the verification of Iraq's CW programme, the declarations provided by Iraq according to the Plan for OMV, baseline inspections and aerial surveillance;

determination of appropriate monitoring and verification activities and procedures to be applied for monitoring and verification of specific sites, facilities, items, materials

and activities;

implementation of inspection rights established by the Plan for OMV; and

development, handling, maintenance and upgrading of the chemical monitoring data-base.

6. Full knowledge of Iraq's CW programme is required for the most effective implementation of the Plan for OMV. This is important to evaluate the level of technical developments achieved by Iraq in the area of research and production of CW, including stability, storage and shelf-life of CW agents, synthetic routes used for their industrial production, equipment and materials used for the production of CW agents and types of munitions filled with these agents. Such knowledge would allow the Commission to assess the complete infrastructure of CW-related activities.

7. Information on the facilities that have been involved at one time in research and development activities and in providing support to the CW programme is of particular importance. While production facilities can be identified independently on the basis of their special features, R&D facilities can only be determined on the basis of Iraq's full disclosure of its CW programme.

8. Chemical monitoring is also enhanced by the export/import monitoring mechanism. The export/import monitoring mechanism covers Iraq's procurement/imports of declarable items. The chemical monitoring system is responsible for the verification of the further use of declarable items at the sites listed as end-users. To date these arrangements work satisfactorily.

Iraq's declarations under the Plan for OMV

9. According to the requirements of the Plan, Iraq shall provide semi-annual declarations detailing: the types, quantities and location of chemicals that could be used for the development, production or acquisition of chemical weapons, but which also have significant uses for non-prohibited purposes, as well as chemicals which have little or no use except CW purposes. Iraq shall also declare sites and facilities that are involved in the production, processing, consumption, storage, import or export of any such chemicals. In addition, Iraq's declarations should comprise any acquisition of equipment and technologies capable for the production and processing of listed chemicals. Lists of declarable items of equipment and chemicals are included in the annexes to the Plan. These lists are broader than the lists in the Convention on the prohibition of chemical weapons, given the fact that they are based on the Commission's knowledge of Iraq's specific actions to develop and produce chemical weapons.

10. Iraq's declarations required under the Plan for OMV have been significantly improved over the period of the last four years. However, they are still not accurate and complete. For example, the Commission has repeatedly found declarable items of equipment and chemicals not included in Iraq's declarations. Each such case is subject to investigation. Under the Plan, the Commission has the right to destroy undeclared items of dual-use equipment and materials. In September 1997, 197 pieces of glass chemical production equipment, originating from the former CW production facility, were destroyed as determined by the Commission.

Baseline process

11. To evaluate special features of sites, facilities, items, materials and activities to be monitored and their potential capability for proscribed use, the Commission conducts baseline inspections in Iraq. These inspections are conducted with non-resident teams of international experts. The process is aimed at developing base line inspection protocols. The protocols outline recommended inspection procedures, including the types and sequence of inspections and the required verification techniques for each facility, depending on its specific parameters and capabilities. An essential part of the protocols is the assessment of the dual-use capability of the facility. The Commission updates these protocols on a regular basis, depending on changes in site configurations and equipment.

Listed monitoring sites

12. As a result of the evaluation of Iraq's declarations, some 166 sites and facilities are included in the list of chemical monitoring sites. These comprise some 120 sites and facilities declared by Iraq and an additional 46 sites and facilities designated by the Commission.

13. The 120 declared sites and facilities include some 100 main facilities declared by Iraq with respect to declarable items and materials. These cover chemical and petrochemical facilities, including production/ formulation/ storage of pesticides and herbicides, production of mineral fertilizers, oil refineries, consumers of declarable chemicals, and the production of declarable equipment. They also cover facilities which are still under construction. Twenty of the 120 sites, are included in the list on the basis of Iraq's declarations of its prior CW activities.

14. Forty-six sites are included in the list on the basis of the Commission's designation. These comprise some 20 sites with research and development capabilities, about 16 military sites such as NBC-training schools, research centers and ammunition depots, and about 10 governmental and private companies involved in the procurement and distribution of declarable items and materials.

15. Some 40 of 166 listed chemical sites are also covered by the monitoring activities in other areas: biological, missile and nuclear. Those sites are mainly chemical complexes for the production of explosives, biochemical and pharmaceutical products, as well as the production of munitions and items of equipment of dual-use character.

16. Listed sites are spread throughout Iraq. About 20 sites and facilities are located in the South of Iraq, some 30 facilities in Iraq's North, the majority of the remaining sites are in central Iraq. Operating from the BMVC in Baghdad, the Commission is able to reach each listed site in Central Iraq within two to three hours, and in the North and in the South of Iraq within five to six hours. However, it takes an average period of two months to inspect all listed chemical sites. The absence of regional monitoring centers or bases in Northern and Southern Iraq, and the non-availability of fixed-wing aerial transportation in Iraq limit the Commission's ability to shorten the early-warning time of inspections. Thus, Iraq has effectively several hours warning of inspections in the North and the South.

CHEMICAL MONITORING RESOURCES AND TOOLS

17. The chemical monitoring system comprises the following resources and tools:

Chemical resident team at the Baghdad Monitoring and Verification Center (BMVC);

support from the other resident teams at the BMVC;

Chemical team in New York;

non-resident teams of experts;

aerial surveillance means;

chemical laboratory at the BMVC;

monitoring cameras and sensors, other inspection equipment and instruments; and

means of transportation in Iraq.

The Resident Team at the BMVC

18. On average, the Chemical team comprises 12 to 14 inspectors and technicians. This includes the chief inspector, deputy chief inspector, operations officer, inspectors, laboratory chemists, one explosive ordnance disposal (EOD) expert and one English/Arabic linguist. Normally, chemists, chemical engineers, NBC-defense officers and laboratory chemists serve with the Chemical monitoring team.

19. The Commission’s requirements cover a broad spectrum of personnel. They range, for military personnel, from Lieutenant Colonel/Major to Sergeant, and, for civilians, from experienced chemists and chemical engineers to freshly graduated analytical chemists. In recruiting personnel for the Chemical monitoring team, the Commission gives preference to experts who have experience in working in Iraq. To date, all members of the resident team have been seconded by their Governments upon the Commission’s request. Their regular duty tour in Iraq is three months.

20. Since October 1994, more than 50 governments have contributed personnel to the Chemical monitoring team at the BMVC. As a result, the Commission was able to recruit the most qualified and experienced personnel to serve as chief inspectors and deputy chief inspectors. These two positions require, top professional expertise and knowledge, management skills to supervise, organize and lead a group of international experts. Furthermore, it requires the ability to interact with the Iraqi counterparts.

21. The short duty tour for personnel in the Chemical monitoring team limits significantly the Commission’s ability to provide a thorough training programme for newly recruited personnel. Personnel recruited only for a three months tour of duty could not be tied up with a training programme of several weeks. Moreover Currently it takes the average inspector some two months to learn "on the job" the infrastructure of Iraq’s chemical activities. As a result, only towards the

end of the duty tour, do the inspectors become really efficient and able to fulfill the requirements of the monitoring process.

22. The main functions of the resident monitoring team are:

to verify and to monitor listed chemical sites in Iraq through: on-site inspections, cameras and sensors, and sampling;

to maintain, update and upgrade the monitoring data base;

to conduct the chemical analysis in the laboratory at the BMVC;

to install, maintain and repair sensors at the listed chemical facilities; and

Support from other resident teams

23. At present, cooperation and coordination between the various disciplines within the monitoring system is well established. For the purpose of chemical monitoring, cooperation with the export/import monitoring team and the aerial inspection team is especially important.

24. The characteristics of listed chemical sites could be changed significantly upon the arrival of declarable items and materials. After their arrival at the site, it is the responsibility of the Chemical monitoring team to certify that notifiable items have been properly delivered to the declared customer site and were consumed or used strictly in accordance with the original notification.

25. Lists of items relevant to the implementation of the monitoring and verification in the chemical area are included in Annex II of the Plan. These lists have also been used in the implementation of the mechanism for export/import monitoring under paragraph 7 of Security Council resolution 715 (1991) with respect to the sale or supply of items to Iraq by other States, covered by the Plan. This requires close interaction with the Export/Import group.

26. The aerial inspection team provides reconnaissance capabilities valuable to the resident team to support the preparation and the conduct of on-site inspections. Aerial surveillance allows the resident team to observe changes in infrastructures and configurations of listed sites in a timely way.

Headquarters

27. The Chemical team in New York is responsible for the development and implementation of the concept and system of chemical monitoring in Iraq. This includes the identification of the scope of monitoring (sites, facilities, items, materials and activities to be monitored) through the evaluation of Iraq's declarations, the results of aerial surveillance and knowledge of Iraq's CW programme. The personnel in the headquarters are also responsible for the strategy and tactics of the implementation of the chemical monitoring system. The Chemical team in New York processes all information and maintains the Commission's chemical data base. The Chemical team in New York also recruits personnel for the resident team in Iraq and experts for non-

resident inspections. In addition, the team provides training for new inspectors and assures the continuous supervision of the daily activities. Furthermore, procurement and maintenance of equipment for the chemical laboratory at the BMVC, monitoring sensors, and verification equipment and materials have to be organized by the Chemical team in New York.

28. At present, the Chemical team in New York comprises three senior chemical experts, one data-base manager who is also responsible for the implementation of various administrative matters, and one data collator. In general, this composition meets the requirements of the current system.

Non-resident Teams

29. The Commission also utilizes non-resident teams of experts. Non-resident teams comprise highly qualified experts for base-lining and assessment type missions. Those teams of specialists operate in Iraq in the format of short missions. This approach also allows the Commission to apply areas of highly specialized scarce expertise, such as ground penetrating radar and special analytical instruments.

The Chemical Laboratory at the BMVC

30. The Commission has had a chemical laboratory at the BMVC since 1995. This laboratory is equipped with suitable analytical instruments (Gas Chromatography, Mass Spectroscopy, Infrared Spectroscopy etc.). Its main task is to analyze air samples taken at various sites by the Commission's automated air samplers. The character of this laboratory is designed to conduct routine analyses of chemical samples taken for verification purposes. The laboratory continues to be upgraded.

Monitoring Cameras, Sensors and other Verification Equipment

31. The Commission has 30 cameras installed at seven chemical sites. The purpose of these cameras is to detect changes in the configuration and use of selected declarable items of equipment and to increase the confidence in Iraq's activities through the use of sensors. The cameras are not designed to and cannot replace on-site inspections.

32. Sensors are always installed in combination with cameras to detect potential tampering of the sensors. The Commission operates 23 air samplers at 15 listed chemical sites which give a picture of chemical activities at the sites. Their magazines have to be exchanged every 4 weeks and be analyzed at the laboratory at the BMVC.

33. During the last two years the Commission undertook to introduce open path infrared technology as an additional tool for the chemical monitoring. This analytical method enables the Commission to establish a chemical profile (fingerprints) of various chemical facilities in Iraq through measuring their emissions. The extended routine use of this method and additional new techniques would enable the Commission to remotely detect changes in chemical activities of any facility without even entering the site. New approaches could also include e.g., physical methods for the non-destructive examination of ammunition for verification purposes and mobile

beam type samplers for sites and activities to be verified. Both instrumental methods would be mounted in special vehicles and would be highly mobile.

34. The Commission also uses other verification equipment and materials. These include chemical agent detectors, protection equipment and decontamination materials. The resident team is responsible for providing chemical, biological and nuclear safety for all resident and non-resident inspection teams in Iraq. The Chemical monitoring team with its explosive ordnance disposal (EOD) specialist is also responsible for providing safe work conditions to all the Commission's activities in Iraq with respect to explosives and conventional ammunition.

ON-SITE INSPECTIONS

35. Despite increased and improved technical monitoring tools, inspections carried out by expert personnel still remain the most important element of the monitoring process. The critical issue for effective chemical monitoring is unrestricted and timely access to any site or facility in Iraq.

36. In comparison with the provisions of the Chemical Weapons Convention, the Commission under the Plan for OMV, has far stricter inspection procedures and rights. Under the Plan the Commission has the right to access to any site or facility with notification provided at a time it considers appropriate, depending on the nature of the inspection site and reasoning for inspection. It has the right to establish special modes for monitoring and verification, including the use of instruments. In the course of the on-site inspection, the Commission has the right to request, copy and examine any information and documentation, to photograph and videotape any items, to conduct interviews with any personnel, to install verification equipment, to take samples for analysis, to tag materials and equipment.

37. Within the scope of the chemical monitoring, the Commission conducts the following types of inspections:

inspections of listed sites to verify current activities;

inspections of listed sites to replace or repair installed cameras and sensors and to verify tagged equipment and materials;

inspections of listed sites to verify documents, records and computer files and to conduct interviews;

base line inspections of newly designated sites to evaluate their capabilities; and

aerial overflight of listed and newly designated facilities.

38. Listed chemical sites in Iraq with dual-use equipment that produce, possess or consume declarable chemicals cannot be used for the production of chemical warfare agents without additional modifications due to their parameters and current configuration of chemical production equipment. However, several such facilities currently do have capabilities to produce precursor chemicals.

39. Iraq also has legitimate industrial facilities which are capable of producing munitions and devices suitable for chemical fill, as well as their components and subsystems, including appropriate fuses and boosters for munitions.

40. The goal of on-site inspections of listed sites is to monitor and verify that these dual-use activities, sites, facilities and items are not used for proscribed purposes and that the infrastructures of these sites are not modified or exceed their legitimate requirements.

41. To achieve this goal within the scope of its rights to establish special modalities for monitoring and verification, the Commission marked critical pieces of dual-use chemical production equipment with tags. There are 833 tagged pieces of equipment located at 20 listed chemical sites and facilities. According to the established procedure, Iraq shall notify the Commission 30 days in advance of the movement of tagged and declarable equipment and chemicals and on their future use. The Commission reviews such proposals for approval.

42. The Chemical team in the Commission's headquarters in New York is responsible for the evaluation and assessment of Iraq's proposals to move or change equipment. The resident team at the BMVC through on-site inspections is responsible for the verification of the implementation of proposals approved by the Commission.

43. In practice, in the period of four years since the chemical monitoring began, the majority of Iraq's proposals on the movement and future use of declarable items were accepted by the Commission. On several occasions Iraq's proposals were rejected by the Commission, on the grounds that the proposed movement and use would result in the creation of infrastructure, which could be used directly for proscribed purposes without even minor modifications.

44. In several cases Iraq proceed with unauthorized movement of dual-use items. All unauthorized activities with dual-use items were stopped by the Commission, when detected. Subsequently, the Commission investigated each such case.

45. One of the most important issues related to the conduct of on-site inspection is to ensure the safety of inspectors. In the course of baseline inspections and daily verification activities, the Commission has developed general safety rules and safety protocols for all major listed chemical facilities. As a result, the Commission has an excellent safety record in its monitoring and verification activities in Iraq.

46. One of the crucial parts of the current chemical monitoring system is Iraq's cooperation with the Commission. In statistical terms, the majority of the chemical inspections have been carried out with acceptable Iraqi cooperation.

ASSESSMENT OF THE CURRENT SYSTEM

47. The Plan for OMV covers all activities, sites, facilities, materials and other items in Iraq and includes detailed inspection procedures to monitor and to verify Iraq's compliance with its obligations. It provides a solid basis for the Commission to fulfill its monitoring mandate.

48. The current system of chemical monitoring has been focussed on the implementation of only

part of the Commission's mandate. It has been focussed on the verification of the remaining dual-use activities, facilities and materials that have legitimate uses for non-prohibited purposes and had never been used for CW purposes. It also covered, but only on a case by case basis, the verification of undeclared activities, and facilities.

49. The chemical monitoring system in its current configuration is able to verify Iraq's compliance with its obligations only at listed facilities declared by Iraq or designated by the Commission. The current system is also able, on a case by case basis, to detect undeclared activities carried out outside the listed sites.

50. Within the scope of the current monitoring system, it is also possible, by using all techniques and resources available to the Commission, including aerial surveillance, on-site inspections and the base-lining process, to detect the construction of new dual-capable facilities in Iraq.

51. The verification of Iraq's compliance with its obligations not to retain stocks of chemical weapons, their subsystems and components and CW research, development, support and manufacturing facilities has been pursued by the Commission separately, in the course of its disarmament activities. Accordingly, the current monitoring system has not been designed to verify unresolved issues from the past programme, including unaccounted for chemical munitions, equipment, related materials, components and documentation.

IMPROVEMENT OF THE CHEMICAL MONITORING SYSTEM

52. Further improvement is required to increase the effectiveness of the current system of chemical monitoring and to meet future necessities. Additional requirements should be considered with respect to two possible options. Firstly, that not all disarmament issues have been solved within the verification of the past CW programme. Secondly, that sanctions could be eased or lifted. Both options would require additional resources and techniques in the field of chemical monitoring.

53. The efficacy of the current chemical monitoring system could be strengthened through personnel augmentation, introduction of new and additional verification equipment and techniques, improvement of the infrastructure and support, shortened access time to the listed sites and refinements with respect to notification requirements.

Personnel

54. Experienced, qualified and knowledgeable personnel in the Commission's headquarters in New York and in the resident team at the BMVC still remain the most important element of the monitoring system. They are the load-bearing pillars of the system. Recruitment procedures for personnel, seconded by supporting governments for a period of three months, do not allow the maintenance of continuity in monitoring operations in Iraq. Both are indispensable to cover the broad spectrum of monitoring requirements.

55. The Commission must seek special arrangements with governments on the extended services of personnel for a duty period of at least six months, with the possibility that those personnel

would be made available again in the future. The Commission should also be able to issue for some personnel in the resident team at the BMVC five to six fixed-term contracts, each for a period of two to three years. The same approach should be applied to personnel in the Chemical team at the Commission's headquarters in New York. The minimum duty tour for personnel in New York should be two years. Such arrangements would enable the Commission to introduce an extensive training programme for the personnel in the Chemical monitoring team and would allow the preparation of highly professional experts familiar with both, the past proscribed programme and current chemical activities.

56. The office space of the resident team at the BMVC should be at least doubled. This is required to meet current requirements, to accommodate the present analytical equipment in the chemical laboratory, to maintain the proper storage of other verification equipment and materials and to assure normal working conditions. Additional space is also necessary to store and handle the Commission's growing collection of demilitarized chemical and biological munitions at the BMVC. These munitions have been gathered by the Commission in Iraq in the course of its activities, and are available at the BMVC for demonstration and training purposes.

57. The office space currently available to the Chemical team in New York does not meet basic necessities. It is seriously inadequate in terms of both handling Iraq's declarations and other monitoring data and the accommodation of personnel, neither in terms of space nor of security.

Equipment

58. Chemical analytical capabilities at the BMVC could be improved, by introducing faster and simpler screening processes. The equipment should be enhanced to identify additional chemicals. Environmental sampling, and mobile analytical capabilities should also be expanded to be used in the course of on-site inspection.

59. To date, supporting governments have provided all analytical instruments and other verification equipment and materials on a no-cost basis. One Government also shouldered responsibility for the complete maintenance, spare parts and repair of the laboratory equipment. The Commission should be able to allocate in its budget sufficient funding for the maintenance of the chemical laboratory at the BMVC, and to have contracts for equivalent services. Additional funding has to be allocated for the procurement of new analytical instruments and other verification equipment. The acquisition and maintenance of such instruments and equipment are very expensive. Due to wear and tear and in response technological advances, the instruments will have to be replaced regularly.

60. The system of cameras and sensors should be upgraded and brought up to the latest state of technical development. The following options could be considered: installation of new digital cameras, introduction of new types of seals (i.e. electronic seals which could be scanned remotely), creation of additional capabilities to handle and transfer information electronically, and new sensor technology. All these improvements have in parallel a direct impact on the infrastructure and general support, which also have to grow in parallel.

Notification requirements

61. List A of Annex II contains chemicals capable of being used for the development, production or acquisition of chemical weapons, but which also are usable for non-prohibited purposes. According to Annex II, the chemicals listed include their chemical forms and mixtures.

62. For improved implementation of the Plan in the chemical area, the Special Commission would need to further clarify the notification requirements with respect to sale and supply to Iraq of relevant items. On the basis of the practical experience gained by the Commission, Iraq and Member States should be informed that the Commission does not require notifications for chemicals from list A of Annex II present in, for example, cosmetics, medicines, soaps and paints.

Additional requirements

63. If disarmament issues are not solved within the verification of Iraq's proscribed CW programme, the chemical monitoring system should be able to compensate in some way for this important gap. Specific requirements would be required would depend on the nature and scope of the unresolved issues.

64. At present, main unresolved issues of Iraq's CW programme include unaccounted for munitions, production equipment and precursor chemicals. To increase the Commission's degree of confidence that there are no chemical weapons, related materials and production equipment retained in Iraq, the Commission would also need, in addition to the chemical monitoring system in its current scope, to cover a large number of undeclared sites, facilities and activities, both military and civilian. This would require additional resources and expertise in the BMVC. The Chemical monitoring team would need to be re-enforced with experts in chemical munitions and chemists specialized in R&D and the production of organophosphorus chemicals. In addition, the Commission would need to apply new verification techniques, including non-destructive equipment to verify types of munitions.

65. The easing or lifting of the sanctions regime could also have a major impact on the resources required for the full implementation of the chemical monitoring system. Iraq's mineral oil industry with its downstream products and Iraq's mineral fertilizer industry are directly influenced by the sanctions. These industries in particular could have an exponential growth rate, after the easing or lifting of the sanctions. This could not only include the significant import of spare parts, but also the expansion of their infrastructures. Refinery downstream products in connection with basic chemicals, such as chlorine and phosphorous could also provide the chemical basis for proscribed activities. In parallel to the growth of Iraq's chemical industry the scope of Iraq's declarations will also increase significantly. Therefore, would need to increase its resources significantly. This includes the number of personnel in the Chemical monitoring team at the BMVC and in New York and additional cameras and sensors.

Appendix III

THE BIOLOGICAL MONITORING SYSTEM

Requirements of the Plan for ongoing monitoring and verification (OMV.) in the biological area

1. The provisions in the Plan for Ongoing Monitoring and Verification (OMV) addresses, inter alia, Iraq's unconditional obligation not to use, retain, possess, develop, construct or otherwise acquire any biological weapons or related items such as stocks of agents or any related subsystems or components or any research, development, support or manufacturing facilities. The Plan established a list of dual-use items for the biological area as found in Annex III.

General objectives for monitoring in the biological area

2. These are to monitor and verify through inspections and through aerial overflights, as well as through the provision of information by Iraq that activities, sites, facilities, material and other items, both military and civilian, are not used by Iraq in contravention of its obligations under Security Council resolutions 687 (1991) and 707 (1991).

Goal of the current monitoring system

3. The current goal is to monitor and verify dual-use activities, sites, facilities and materials that have significant uses for non-prohibited purposes, but which due to their nature could be used for the development or production of biological warfare (BW) weapons. The verification of Iraq's compliance with its obligations not to use, retain or possess stocks of biological weapons, their subsystems and components and BW research, development, support and manufacturing facilities remaining from the past has been pursued by the Commission separately in the course of the verification of Iraq's proscribed biological weapons programme under the applicable resolutions. The scope and detail of the Commission's mandate in the biological area under the Plan are extensive due to the enormity of items with dual-use capability in the biological field in Iraq and necessitates a broad effort in the monitoring of Iraq.

CONCEPT AND STRUCTURE OF BIOLOGICAL MONITORING

4. The current biological monitoring activities are focussed on the verification of:

a) the total national quantity of the production, processing, consumption or storage of dual-use biological items;

b) sites and facilities that are involved in research, development, production, processing, consumption, storage or testing of dual-use biological items or other support or manufacturing facility;

c) acquisition of dual-use equipment, technologies or material;

d) research conducted with, or at facilities capable of exploiting dual-use biological equipment or material and;

e) sites and facilities that at any time have been involved in the proscribed biological programme.

Knowledge of the BW programme

5. A full account of Iraq's planning, R&D, resources, facilities and personnel involved in its

proscribed BW programme is an essential prerequisite to a monitoring system that would have a reasonable level of efficiency and credibility. With the current low level of confidence in the verification of Iraq's proscribed programmes, the confidence in monitoring is greatly diminished. The fact that Iraq's declarations on its biological weapons programmes have been deeply deficient raises serious challenges with respect to OMV in the biological area. On technical, industrial and scientific developments of Iraq's BW programme it has not been possible to compile a comprehensive assessment because Iraq has not been transparent in its FFCD nor in its clarifications of the account of its proscribed BW programme.

6. The implementation of the OMV system for biology is different from OMV work in the nuclear, missile and chemical fields. The resources and facilities needed for proscribed biological research or production can be relatively small in size and simple in technology and therefore more difficult to detect. As an example, Iraq has declared that it produced 2,200 litres of Aflatoxin, using various small volume glass jars. Iraq states it had weaponized this biological warfare agent.

7. The monitoring system described can be effective at best, at sites declared by Iraq, to deter relevant equipment and activities from being diverted to proscribed purposes. This requires Iraq to make full disclosures of all sites, governmental and non-governmental, that possess equipment and facilities capable of dual-use biological activities.

Iraq's declarations under the Plan for OMV

8. *Semi-annual declarations*: According to the requirements of the Plan, Iraq shall provide semi-annual declarations. Iraq is obliged to declare its holdings of dual-use materials and equipment. The information provided by Iraq is a comprehensive statement of a site's overall activities, resources and capabilities. The lists of declarable items of equipment and materials are included in the annexes to the Plan. This includes, for example: production equipment; microorganisms; biohazard containment equipment and decontamination equipment; equipment for the release and/or dispersal; equipment for breeding of vectors of human, animal or plant diseases; and munitions, rockets or missile warheads capable of disseminating biological warfare agents. Due to the nature of biological dual-use equipment and raw materials, the size and scope of the semi-annual formal declarations is much larger than for the other disciplines.

9. Reviews of semi-annual declarations are carried out following the receipt of the declarations every January and July. The declarations are analysed and verified through on-site inspection and comparative examination. The verification takes place in the period directly following the submission of the declaration, in an attempt to determine the completeness and accuracy of the data submitted and to confirm the information included in the declaration.

10. The Commission's assessments, coupled with inspection, have repeatedly shown that the declarations have been incomplete, inaccurate, or both. On numerous occasions, discrepancies have been noted between reports submitted by sites to the Commission through Iraq's National Monitoring Directorate (NMD), and the originals maintained at the sites. This has been a recurrent problem. Several years after the initiation of OMV, the biological team continues to find declarable equipment, materials and even whole sites that should have been declared by

Iraq, but were not.

11. *Monthly declarations*: Through bilateral discussions with Iraq the Commission generated a number of specific elements unique to the facilities, termed 'monitoring parameters'. These varied across a wide spectrum of items and included elements such as changes in numbers and types of personnel, research and production activities, water and electrical power usage, inventory of microorganisms types, animal usage, materials received, products generated. The objective was to establish a more dynamic mechanism which could measure change from the baseline established through declarations and on-site inspections. Some key facilities are required to submit updated reports on a scheduled (monthly) basis along with supporting documents which are then verified by resident monitoring teams.

Baseline process

12. Protocol building or baseline inspections of sites in Iraq were undertaken during the summer of 1994. Prior to April 1995, an interim monitoring process was put in place. This process was in preparation for biological monitoring, which began in April 1995. The Commission evaluated dual purpose technologies, activities, materials, items and equipment which could contribute to a biological warfare capability and identified those sites or facilities that through possession of such characteristics could contribute to such a capability. Protocols outline the basic facts of the site, the reason for OMV, a general description of areas, equipment, technologies and activities of interest under OMV, site diagrams, maps, previous inspection findings and inspection procedures and assessment of the dual-use capability of the facility. These protocols are continuously updated by the Commission.

On-site inspections

13. The main and indispensable tool for monitoring has been continued on-site inspections. The knowledge gained by physical inspections of sites and workplace interviews with site personnel is essential.

14. Non-resident inspection teams are also an integral part of the monitoring system. A non-resident team is a short term team which can be staffed with issue specific personnel and devote all their attention to a single issue or task.

15. *Listed sites:* Under the current monitoring system, listed sites have been identified based on Iraq's declaration and as designated by the Commission. There are currently over 250 listed sites and Iraq is required to provide semiannual declarations for 91 of them.

16. The range of possible sites encompassed by biological monitoring needs to be broad because of the dual-use nature of biological technology and the ease with which civilian facilities can be converted for biological weapons purposes. Many civilian enterprises maintain dual use equipment with legitimate function such as in dairy, food and drink industries, storage depots, heavy engineering, manufacturing and production facilities. Additionally, organizations that conduct research where technical expertise is found such as universities, colleges, disease control centers, breweries/distilleries, agricultural facilities, import and supply agencies and

hospitals are included in the monitoring system.

17. Listed sites are categorized according to: their technical capability; the capability to be converted; the present field of activity; and the known former involvement of the site in prohibited activities. The frequency of inspection is determined according to their category.

18. *Non-listed sites:* Inspections of non-listed sites have been performed and have led to the discovery of undeclared dual use equipment.

Equipment:

19. Certain key dual-use equipment has been inventoried and tagged by the Commission. This inventory was established through tagging missions in which items of dual-use biological equipment were physically labeled with a tamper-indicating, bar-coded tags. At the time of tagging, the location, source, history of use and other essential descriptive details were obtained for subsequent insertion into the equipment inventory data base. The Commission's biological database lists currently 1,334 items of tagged equipment.

20. *Sampling*: Sampling of dual-use equipment, weapons and weapons material has been undertaken. This was mainly performed by non-resident inspection teams, because of the specific expertise required, for example shipping and handling capabilities; and, their respective analysis capabilities in supporting countries. Although biological samples are not taken on a routine basis by the resident team, the capability of doing so in a manner which fulfils forensic requirements does exist. New sampling systems are under development. Consideration is given to include portable detection capabilities. This would increase overall understanding of activities on a site and would increase the deterrent effect of monitoring.

The Biological Monitoring Team at the BMVC

21. The resident team is based at the BMVC and is composed of 8 to 10 experts provided by governments, generally for a three month tour of duty. Due to the broad spectrum of sites and activities under biological monitoring, a range of expertise and a diversity of background is required in the resident team. The team has benefitted greatly by engaging highly qualified personnel with a diversity of expertise. Inspectors are recruited with backgrounds in fields of biology, veterinary science, pharmacology, medicine, bio-process and genetic engineering.

The task for the resident monitoring teams are the following:

planning, preparation and conducting inspections;

interviewing Iraq's personnel;

performing spot-checks, checking inventoried items of equipment and end- product therefrom and inventorying of new items of equipment upon import into Iraq;

taking samples and packaging for transport;

checking records on site;

conducting an inventory of production equipment and microorganism stocks;

debriefing members after inspections and assess results of those inspections;

assessing information gathered by monitoring inspections. This necessitates inter alia, the filling in of questionnaires and equipment identification data sheet, the inclusion of results from samples or other types of analysis, additional conclusions from monitoring inspections or evaluations of reports by Iraq made pursuant to the site protocol;

making recommendations and provide advice on new sites, on any relevant changes in activities at sites (constructions, expansions, change of focus, export or import of items of interest, know-how) and on corresponding monitoring actions to be taken and their modalities and;

interacting with other disciplines at the BMVC, for example, providing biological input to teams, in particular chemical, missile and export-import on activities or other observations that may have biological implications.

Support from other monitoring teams

22. The Biological Team has performed cross-discipline inspections with all of the other disciplines. Teams have discovered considerable amounts of declarable equipment. The inclusion of inspectors from other disciplines should continue to be a part of future biological monitoring.

23. The review of goods to be imported by Iraq by the Joint Export/Import Unit in New York is a valuable tool in identifying activities that may require further on-site inspection. Notifiable dual-use equipment and expendable supplies are tracked to the end-user and inspections are conducted to verify receipt and record stated purpose. The availability in Iraq of inspectors to supplement the Export/Import monitoring system has also proven valuable.

Support through aerial surveillance

24. The Aerial inspection team provides support to the biological monitoring team on an increasing basis. Aerial inspections obtain new information on changes in sites and new structures or equipment. The recent addition of digital photography capabilities has allowed for faster transmission to New York of imagery for analysis.

25. Imagery provided by U2 and Mirage aircraft are useful in the identification of changes in the external site structure and building configuration at certain facilities. This information has been used for follow-up inspections. The continued availability of these resources are seen as an important part of future monitoring.

Monitoring Cameras, Sensors and other Verification Equipment

26. Although important in other areas, cameras are only a secondary tool in the biological area.

Information acquired via cameras is not in itself sufficient, in the biological area to determine whether proscribed activities are taking place at that location. Some sites such as facilities with fermentation equipment have been equipped with remote camera monitoring systems. The tapes from camera surveillance are reviewed regularly by members of the resident teams to assess the validity and appropriateness of activities within video monitored facilities.

27. Increased use of remote sensors are planned to measure and log a range of process parameters such as: temperature; motion/movement; and, light change. They can be used to monitor key processes, equipment or locations. Alarms can be set to alert the monitoring team to operations which are outside the normal parameter range. These alarms can then be linked to cameras or directly to the BMVC if deemed necessary. The sensors provide data on the frequency and duration of production runs which can be used to assess declared production quantities.

Headquarters

28. The biological team at the headquarters in New York identifies the monitoring scope (sites, facilities, items, materials and activities to be inspected). The team is required to assess, process, store and retrieve large amounts of data in various forms. All the incoming information (site inspection reports, monitoring parameters, declaration, aerial photography and NMD correspondence) is reviewed and assessed. Based on the assessment, the activities of the resident team can be focused on certain aspects or tasked to follow up particular issues. It does therefore require not only the latest information handling technology but also adequate secure document storage facilities. The team must have access to secure modes of communication with the resident team at the BMVC. The personnel at headquarters also recruit personnel for the resident teams in Iraq and experts for non-resident inspections. In addition, the team provides training for new members of the resident team and supervises the daily activities of the resident monitoring teams in Baghdad.

29. At present, the biological team in New York comprises four experts and one data base manager and one administrative data entry clerk. In general, this composition meets the requirements of the current system.

FURTHER IMPROVEMENT OF THE BIOLOGICAL SYSTEM

30. Full disclosure by Iraq of its BW programme would provide a solid baseline for biological OMV. The verification of Iraq's compliance with its obligations under resolutions 687 (1991) and 707 (1991) has been pursued by the Commission, separately, through the verification of Iraq's proscribed biological weapons programme. The monitoring system has been focussed on dual-use activities, facilities and materials in order that they are not converted for proscribed activities. It was not designed to uncover undisclosed elements of the proscribed BW programme and was predicated on the successful elimination of existing proscribed items. If disarmament issues related to the verification of Iraq's proscribed BW programme are not resolved, the biological monitoring system should be expanded.

31. Continuing support from governments is critical to the operation of OMV. In the Biological

area, support is provided in the form of personnel, technical, analysis and information. The Commission must seek special arrangements with governments for an extended tour of duty period for at least four months, with the option to be made available in the future. Several governments have provided essential sample analysis services which will also be needed in the future. The Commission is kept informed by governments of certain technological advances that may be of use to the Commission's monitoring activity. The Commission is also supported by many governments in the provision of information related to Iraq's compliance with the Council's resolutions.

32. The effectiveness of the monitoring system is proportional to Iraq's cooperation and transparency, to the number of monitored sites, the number of inspectors, quantity and capability of inspection support elements. Monitoring in the biological area can be at best a deterrent at sites undergoing inspections. The monitoring system substantially increases the risk to Iraq that proscribed biological activity can be detected.

Appendix IV

INFRASTRUCTURE AND OPERATIONAL SUPPORT

1. The Commission's monitoring operations in Iraq rely heavily on the availability to all disciplines of common infrastructure and support services for their operational use. These services include such things as Export/Import monitoring, aerial support, remote camera monitoring system, personnel, transport and facilities.

Export/Import Monitoring Mechanism

2. The Export/Import monitoring mechanism, which was approved by Security Council resolution 1051 (1996), was designed to provide for timely information about any sale or supply to Iraq by other States of items listed in the Commission's and the IAEA's Annexes to the Plans for OMV.

3. The mechanism is a support element, albeit an important one, in the overall OMV system in Iraq. The central feature of the mechanism is the provision of information by the Government of Iraq and by Governments of exporters on imports by Iraq, and intended and actual exports to Iraq of relevant items. The other significant feature of the mechanism is inspection.

4. In New York the system is operated by a Joint Unit, composed of personnel from the Commission and the IAEA. The Joint Unit has an Export/Import Group which operates in Iraq, inspecting newly arrived items subject to monitoring, as well as conducting inspections at facilities throughout the country, checking for undeclared imported notifiable items. The Group works in conjunction with relevant experts from the other resident monitoring teams (chemical, missile and nuclear), as it relies heavily on their expertise in assessing identified items. Once newly imported goods have been inspected by the Group, they become subject to monitoring by the relevant resident teams in each discipline.

5. The items listed in the Annexes to the Plans for OMV are, in some cases, extensive and some of the items are not necessarily contained in any other arms control regimes. This presents some States with difficulties in understanding what should be notified. In addition, practice has shown that in some instances the description of items to be notified is not sufficiently clear to allow precise interpretation.

6. In order for the system to be effective in the future, it is recommended that the current lists of notifiable items be studied with a view to providing increased specificity and clarification. Once that is done, it will be possible to increase awareness about the requirements of the system. It will also give Governments a more practical basis on which to base national legislation. A further recommendation is to consider strengthening Export/Import Monitoring at points-of-entry to Iraq, thereby ensuring that goods required to be reported under the mechanism are immediately incorporated into the overall monitoring system.

7. The resources, including personnel and infrastructure, required to support the system in the future will be dependent on the number of relevant items being exported to Iraq. This, in turn, will derive from the contents of the lists of notifiable items and the status of the sanctions regime. The same considerations will apply to the number of personnel in the Joint Unit in New York and its group at the BMVC.

Aerial Operations and Support

8. In respect of aerial operations, the Plan for OMV includes the right of the Commission to overfly any area, location, site or facility in Iraq and to operate its own aircraft with appropriate sensors from such airfields in Iraq as its deems most appropriate for this work.

9. The Commission currently employs four types of aircraft:

One high altitude surveillance aircraft (U2)

One medium altitude surveillance aircraft (Mirage IV)

Five UH-1H helicopters

One L-100 transport aircraft

10. The U-2 and Mirage IV aircraft are dedicated imagery collection platforms. The UH-1H helicopters are used as a platform for imagery collection by an Aerial Inspection Team (AIT). The helicopters are also used for transportation, as is the L-100.

11. The prime function of the Commission’s aerial surveillance activities is to take photography of "listed sites". This imagery is used to: detect changes and activities at "listed sites"; deter Iraq from undertaking prohibited, or non-declared dual-use activities which could be detected from aerial surveillance; and, assist resident and non-resident inspection teams by providing a tool from which line diagrams of sites can be drawn.

12. The U2 and Mirage aircraft are also used to take imagery of "non-listed" sites of possible

relevance to the Commission's mandate. If, after analysis, on-site inspection is required, the imagery is then used for ground inspections teams to prepare inspections. Helicopters cannot be used for this purpose as their presence would alert the Government of Iraq in advance to a potential inspection at the site, thereby eroding the credibility of the inspection.

13. The U2, Mirage IV and helicopters can be used for site security surveillance during ground inspections. The U2 has a maximum endurance of some 12 hours flight time, equating to some 2,500 nautical miles coverage. This permits an extended "loiter" time over sites. The Mirage can fly for 40 minutes, covering some 300 nautical miles. The helicopters can remain in situ almost indefinitely as they can be rotated out when refuelling is required.

14. The Commission currently has no ability to conduct aerial surveillance at night but has been investigating the acquisition of such a capability.

15. The L-100 is currently used exclusively for the transport of inspectors and materials between Bahrain and Iraq. The aircraft is capable of carrying up to 92 passengers, or a mix of up to two vehicles and passengers.

16. Currently, the Commission operates only light helicopters which are not able to carry all the required verification equipment and tools to listed sites. The helicopters can be used in a limited transport role; they can carry ten passengers for very short distances, thereafter the number of passengers decreases in relation to the requirement to carry additional fuel. There is no capability for carrying vehicles, nor the required verification and tools to listed sites. The current flight arrangements also require 12 hours notification to Iraq. Therefore, four-wheel drive vehicles are the main transportation means in Iraq for the Commission's team. This does not meet the Commission's air transport requirements.

17. Over the years, the Commission's use of its aerial assets for surveillance purposes and transportation have been restricted.

18. Since the inception of aerial inspection missions in 1992, modalities governing the operation of the Commission's helicopters require the Commission to provide Iraq with a geographically defined "box" within which aerial activity will take place. This box is provided to the National Monitoring Directorate some 12 hours before the helicopter mission. The use of the boxes where sites are isolated, or some distance from Baghdad, degrades the element of surprise (and thus credibility) achieved during aerial inspections. Iraq claims that it requires the boxes in order to warn the air defence of the operating area of the Commission's aircraft. Under current modalities, the Commission is unable to fly unrestricted aerial missions over Baghdad.

19. On a number of occasions, Iraq has prevented the Commission's helicopters from overflying sites which it declared sensitive. The means by which such flights have been prevented include physical interference with the conduct of the flight and threats to shoot the aircraft down.

20. Iraq has refused to allow the Commission to exercise its rights to land helicopters throughout Iraq, by restricting the number of landing sites. It has also refused to allow the Commission to land the L-100 aircraft at any site in Iraq except Habbaniyah Air Base some 80 miles from Baghdad and the BMVC. Thus the aircraft cannot be used for inspection purposes.

21. The operational constraints on the Commission's aerial activities, have a clear derogatory impact on the ability of the Commission to conduct credible aerial missions. Iraq must honour all its obligations under the Plan for OMV, particularly with respect to aerial operations.

22. Aerial requirements for the OMV system in the future, desirably, should include:

- A high/medium altitude imagery collection capability, under the control of the Commission. It must be able to operate day and night to collect imagery and undertake surveillance at sufficient height to prevent the Government of Iraq from detecting what is being observed. The Commission also needs the capability for prolonged loiter time. To be effective, the product from all such missions should be made available to the Commission in real time, or shortly after the mission is completed.

- "UH-1H" type helicopters to collect high quality, low altitude imagery, undertake surveillance, provide transport for small groups of inspectors and provide medical evacuation capability. These helicopters will also be used as platforms for other forms of airborne sensors which the Commission may choose to employ.

- "CH 53G" type helicopters. Primarily for the transport of large inspection teams and vehicles throughout Iraq, thereby obviating the requirement to rely on ground transport.

- The ability to use various forms of Infra-red imagery collection.

- Access to high resolution commercial satellite imagery to provide an unobtrusive and undetectable means of collecting imagery.

Cameras and Sensor Monitoring Systems

23. The video and sensor monitoring system (Remote Monitoring System – RMS) is employed in Iraq as a tool to support the Commission and IAEA in their monitoring activities. The system provides electronic on-site surveillance of designated sites located throughout Iraq. Surveillance is conducted through real-time viewing and the collection of recorded images by video equipment in conjunction with supporting communications equipment. It is also conducted through the collection of air samples and power data through special sensor equipment. The system allows the inspectors to detect unusual activities in real time to allow for a quick response to inspect sites as required. The RMS has proved to be capable of assisting the inspectors but it should not be interpreted as an effective stand-alone system. It has to be employed in conjunction with all other OMV assets to be useful and effective.

24. The current RMS has been operating for over four years. During this time it has undergone some improvements in its design and communications links to ensure the system remains functional, and also to extend the life of its components. Its effectiveness has been enhanced through the use of video review stations (Multi Optical Review Equipment – MORE) in the BMVC to support the review and analysis process.

25. A number of technical teams were sent to Iraq to work on the system during its implementation and additional technicians with specific skills have been employed on a case by case basis to enhance the system.

26. The RMS supports real time viewing, time-lapse videotape recording and sensor recording. Time-lapse recording is done through a system of image retrieval by camera and recorded to a videotape. The images can be transmitted via radio frequency links from the site to the BMVC where the result can be seen as an image on a computer screen as a "near" real time view. Data of power usage at sites is recorded via sensor on data cards that can be down loaded to a computer for review.

27. The RMS system operates under the existing maintenance regime and environmental conditions. The system has, however, its operational limitations. Disadvantages of the system are that; the cameras are limited in their capability; the system has required a significant amount of manpower to maintain and adapt; some sites cannot be accessed through communications links because of the type of communications employed; and, communications links suffer degradation primarily due to the environmental conditions.

28. The system’s components may no longer be logistically sustainable, as the manufacturers of the components may no longer be willing to support repair or replacement other than at considerable cost. Consequently, there is a requirement to address issues with upgrading the system as it stands in order for it to be robust and supportive of the mandated monitoring.

29. The current technology uses a mix of digital and analogue techniques to deliver an adequate image for review. Depending on the inspection requirements, this standard can be improved by upgrading analogue and digital technology or by using purely digital technology. The areas that need to be upgraded include: cameras; power supply sub-system; communications links; image storage, retrieval, and review mechanisms; and improved sensors. The upgrade would need to be done as a complete system rather than on a piece-meal basis. This level of technology should be flexible to allow for easy component upgrades as required.

30. Initial outlay for improving the system to meet current needs could be between $4-5 million with ongoing costs being approximately $900,000 per year. These figures incorporate equipment upgrades, commercial communications costs, manpower and logistic support resources. The system is supported by one operator and five technicians in the field, as well as through management and coordination from the headquarters in New York. Manpower support (operational and technical) may need to be increased to operate and maintain the existing or an upgraded system.

Personnel

31. Since the establishment of the monitoring system in mid-1994, the Commission has had a requirement for staff to support its monitoring operations in Iraq. This staff is currently composed of personnel from a number of governments as well as a small group of United Nations staff stationed in New York, Baghdad and Bahrain.

32. The Commission will have to increase the number of its personnel, in all locations, in direct relation to projected increases in the size of the monitoring activity. If regional monitoring sub-centres are established in Iraq it will result in a further increase in the Commission's staff.

33. The Commission's resident teams depend on a high degree of technical expertise to conduct monitoring inspections. Hitherto, the Commission has depended almost exclusively on personnel provided by governments, serving on a three month basis. The Commission has identified several problems with this arrangement. Continuity of operations are impacted severely by the short-term presence of experts. Additionally, training of short-term personnel in the methods and techniques of monitoring, as well as Iraq's activities, is very difficult to do.

34. The Commission is considering using a mixture of long and short-term personnel. Long term personnel would be technical experts employed by the Commission on United Nations established posts supported by the budget of the Commission. Short-term personnel would be supplied by supporting governments.

35. The long term personnel would provide continuity to the Commission's operations and could be trained in the technical details of both Iraq's current activities and its past proscribed programmes.

36. The Commission will still require the provision of short term technical experts from governments. Short term personnel bring technical skills and knowledge that can not generally be obtained on a long term basis. These personnel would be recruited for specific tasks which would not require the longer training period. The Commission will likely have to reimburse the supporting governments for the cost of such highly technical personnel.

37. In addition to expert personnel, the Commission will require: medical; communication; administrative; logistical; operational; maintenance, aerial and technical support services to all resident and non-resident monitoring teams. Monitoring teams will be further supplemented with specialised linguists and computer experts.

Training

38. The Commission's most powerful and valuable tool in its monitoring system is inspectors. The Commission has relied on the technical knowledge and inspection skills of personnel provided by Governments on a short-term basis. Over the past four years of operation of the monitoring system, this has generally served the Commission's objectives.

39. In the future, improvements would be required to maintain efficient inspection teams, in particular resident teams in the BMVC. As mentioned above, the Commission is considering the use of a mixture of short and long-term technical experts and support personnel for its monitoring teams. If this is to be implemented, the Commission will have to dramatically alter the training of its inspectors.

40. For long-term inspectors, the Commission would need to create a specialized training programme. The Commission is considering a training programme of several weeks in duration in which a cadre of long-term inspectors would receive training on a variety of general and

specialized subjects, and practical exercises. The Commission would be able to recruit from this cadre its inspectors. Such a system would provide for both Commission's guaranteed access to appropriate experts trained as international inspectors, and a continuity in the Commission's inspection operations in Iraq and in its assessments of Iraq's compliance over time.

41. The training programme will need to include, inter alia, the Commission's mandate, inspection procedures and practices, activities under monitoring in Iraq, export/import regulations for Iraq, Iraq's proscribed weapons programmes, Iraq's technology level, etc. The trainees would require a thorough familiarization with specific inspection techniques and tools, the operation of the Commission's remote camera/sensor systems, lists of facilities and dual-use equipment and other elements of other monitoring system architecture.

42. For short-term inspectors, the Commission intends to create an abridged training programme containing many of the subjects from the longer duration training programme and suited for specific tasks that they are expected to perform during their term of duty. The programme for each inspector or a small group would begin on their joining the Commission's inspection team. It will need to include a preparatory period and the on-job training.

Facilities

43. The Commission currently operates facilities in Baghdad, in Bahrain, and at the headquarters in New York. The facility in Baghdad is designed to house all of the services required by the resident and non-resident inspection teams for both the Commission and the IAEA, including, inter alia, office space, transportation, computer support, medical services, communications (including remote camera monitoring), storage, training, vehicle maintenance and administration. The Baghdad Monitoring and Verification Centre (BMVC) has been in operation since August 1994. The BMVC is located in the Canal building along with several other United Nations organizations. On several occasions since October 1994, the Commission has been forced to expand its use of the facility, at the expense of these other United Nations organizations, in order to meet its mission requirements. The BMVC's current office space in the Canal building is barely meeting the Commission's and the IAEA's requirements.

44. In the future, the Commission expects it will require space nearly double of that of its current requirements. This will either require the dedication of the Canal building to the Commission's mission or the construction or refurbishment of a new facility to meet its requirements. This will have substantial budgetary implications. The future annual operating cost of the BMVC cannot be estimated at this time until decisions on the future size and structure of the Commission have been made.

45. Additionally, the Commission is considering the establishment of regional monitoring sub-centres in Mosul and Basrah, in order to limit the notification time for inspections in those regions. This would provide an additional deterrent to Iraq for using such outlaying facilities for undeclared or proscribed purposes. This would require the strengthening of the coordination infrastructure, a review of operational procedures, and the placement of staff to effect the coordination. The establishment of such sub-centres would require a variety of support services similar to those provided at the BMVC, however, on a smaller scale. It is possible that these

centres could be operated only during certain periods each year to reduce the overall cost. Construction or refurbishment of facilities to house such sub-centres would have a significant budgetary impact. Annual operating costs of such facilities cannot be estimated at this time until decisions on the future size and structure of the Commission have been made.

46. In order to support the Commission's and IAEA's resident and non-resident teams, the Commission maintains a large number of logistical, technical, communications and transportation equipment necessary to conduct operations in both Bahrain and Baghdad. The Commission's logistical support includes, inter alia, office supplies and equipment; field support equipment such as camping equipment, trailers, generators; and protective clothing as required to support each team. The Commission's technical equipment includes computers and computer support, global positioning system receivers, chemical sensors, video and still cameras, two-way radios, and other equipment as required. The Commission maintains a fleet of vehicles in both Baghdad and Bahrain in order to support the Commission's and IAEA's teams. These vehicles include sedans, four-wheel drive vehicles, mini-buses, and trucks.

47. As stated earlier, the Commission's projected increase in size will require a corresponding increase in the size of the logistical, technical, communications and transportation equipment. The Commission expects that much of this equipment will have to be upgraded or replaced to support the projected expansion of the Commission's and IAEA's monitoring operations.

48. The Commission's new facility, currently under construction in Bahrain, will provide office space, computer services, storage, logistical support, training, and administration for the Commission's and IAEA's resident and non-resident teams as well as for its Bahrain Field Office support staff. The new facilities are expected to provide for the Commission's long term needs.

49. The Commission's headquarters in New York provides for the management operation, and administration of all of its activities. The Commission has constantly experienced severe space limitations in the headquarters. In the future, the Commission would require an increase in its headquarters staff with a consequent need for expansion of its office space. This is expected to have substantial budgetary considerations for both initial refurbishment and annual operating costs.

- - - - -

|RETURN TO MAIN MENU|