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(UNMOVIC)

Compendium

Interlinks between Iraq's Weapons Programmes

CHAPTER VII

INTERLINKS BETWEEN IRAQ'S WEAPONS PROGRAMMES

The centralized management of all Iraq's weapons programmes and projects under the supervision of SOTI (and later in 1987, the MIC), provided the opportunity for Iraq to maximize the use of its expertise and the capabilities of individual establishments, factories and research centres for the purpose of specific programmes and projects. With good managers within SOTI, this also allowed Iraq to concentrate maximum resources on identified state priorities. In addition, the central management assured the continuity in technical policies and utilization of early developments for newly established projects.

This pattern of operations also applied to Iraq's organizations and institutions involved in the implementation of Iraq's chemical and biological warfare programmes and missile projects. Often, these organizations provided certain services and support to each other and, thus, the activities of these organizations frequently intertwined. Under the command type economy, these organizations also benefited from the support and services provided by other establishments within the network of military industries and beyond. The integration of the management of Iraq's proscribed programmes prior to 1991 is illustrated in Figure VII.I below.

Examples of support provided to weapons programmes:

Construction of facilities and sites:

Iraq's state construction company, Al Fao General Establishment, was involved in the construction of all dedicated sites and facilities involved in CW and BW programmes as well as critical missile-related installations, including:

- The Samarra site of the State Establishment for Pesticide Production, later known as the Muthanna State Establishment, Iraq's prime CW research, production and storage facility

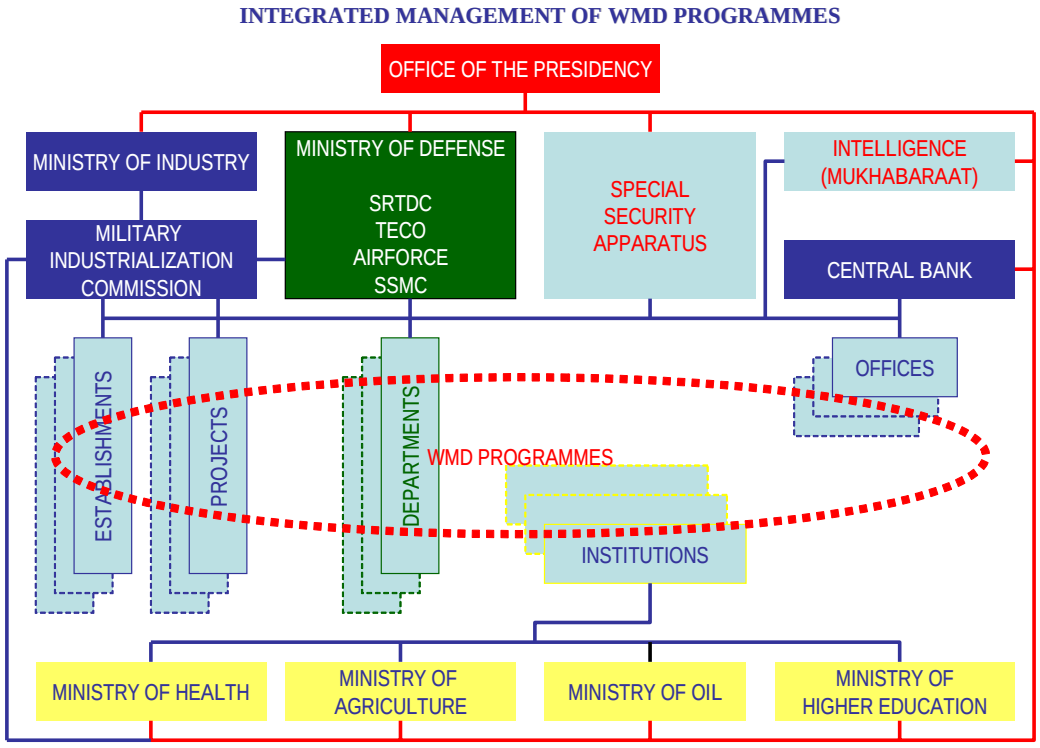
- The site of Al Hakam, Iraq's dedicated BW research and production facility

- Installations of Project 144 at Al Taji, Iraq's missile facility involved in the modification of the SCUD-B missile into the Al Hussein missile, including support facilities and launch sites

- Installations of Project 1728 involved in the indigenous production of missile parts and components, including various test stands

Al Fao General Establishment was also involved in the construction of nuclear facilities in Iraq. Legitimate commercial agencies and organizations under the guidelines from MIC also provided support to weapons programmes in the procurement of items and materials from foreign suppliers.

Figure VII.I The Integrated Management of Iraq's Proscribed Programmes



Examples of the procurement support:

- The State Organization for Gas and Oil Refineries supervised by the Ministry of Oil arranged for the procurement of hundreds of pieces of chemical process and general purpose equipment for Iraq's CW programme, as well as for the procurement of thousands of tonnes of precursors for the production of CW agents

- The Ministry of Health and the Ministry of Science and Higher Education were involved in the procurement of equipment and materials, including bacterial isolates, for Iraq's BW programme, including bacterial isolates

- Equipment and materials for the BW programme were also procured by Iraq's CW programme

- Ministry of Industries covered the procurement requirements of Iraq's missile projects

- Iraq's military industrial facilities were involved in the design and production of equipment and munitions for Iraq's chemical and biological weapons programmes.

Examples of equipment and munitions supplied:

The Nasr State Establishment was involved in the design, reverse engineering and production of munitions for CBW purposes, including:

- Prototypes of binary chemical munitions

- R-400 chemical and biological bombs

The State Establishment for Mechanical Industries, supervised by the Ministry of Agriculture and Irrigation, reverse engineered several aircraft drop tanks and supplied Iraq's CW programme with DB-0 and DB-2 aerial bombs

Project 144, Iraq's missile establishment, was involved in the production of special warheads for the Al Hussein missile for Iraq's CW and BW programmes, as well as warheads for 122mm rockets

The State Establishment for Heavy Engineering produced storage and mixing tanks and mobile storage tanks for Iraq's BW programme as well as equipment for Iraq's CW programme

In addition, there was considerable interaction between the chemical, biological, nuclear and missile programmes, which allowed the sharing of available expertise, resources and capabilities.

Examples of interactions:

- The Muthanna State Establishment, Iraq's prime CW facility not only encompassed the BW research group but also provided personnel, equipment and infrastructure for the initial stage of BW work

- At a later stage, it provided munitions for biological tests and filling facilities for weaponization of BW agents

- The Technical Research Centre involved in the BW work accomplished specific studies on the design of binary munitions for Iraq's CW programme

- The Toxicological evaluation section of the R&D department of the Muthanna State Establishment, conducted toxicological evaluation of ricin toxin produced by Iraq's BW programme

- The Muthanna State Establishment was involved in the development of the technology for the production of UDMH, a missile fuel, for Iraq's missile project, Project 1728

- The Muthanna State Establishment cooperated with two facilities under the auspices of the Iraqi Atomic Energy Commission on the issue of the production of precursor chemicals at the Petrochemical complexes 2 and 3

- Iraq's missile projects were tasked to develop a delivery vehicle to carry a nuclear device in coordination with the Iraqi Atomic Energy Commission

- On request of the Iraqi Atomic Energy Commission, MIC authorized the Muthanna State Establishment to produce casings for a radiological bomb

Interlinks between Iraq's WMD programmes is shown in Figures VII.II, within the structure of MIMI, and VII.III below.

Figure VII.II

Organizational structure of Iraq's military industries under MIMI

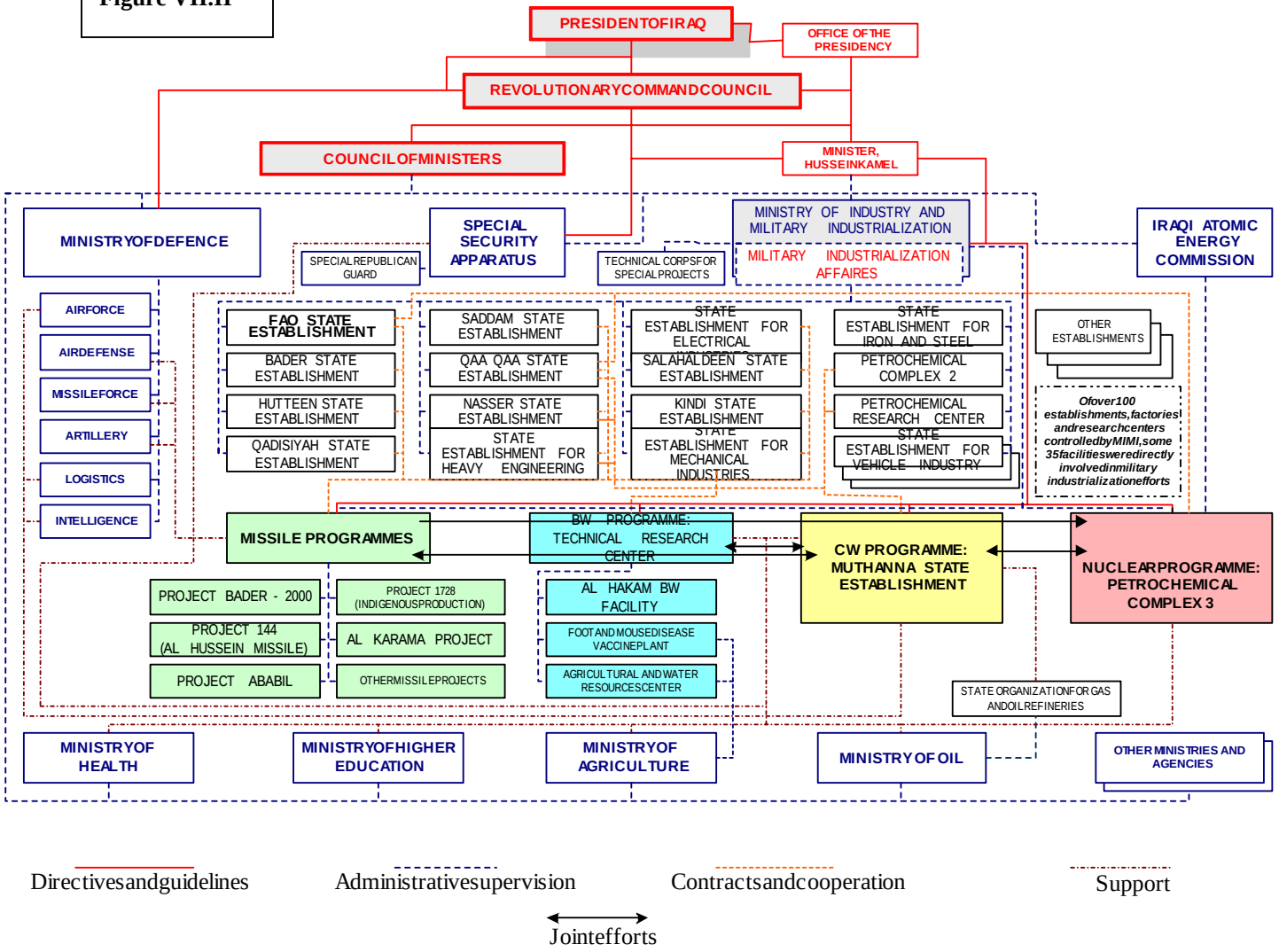
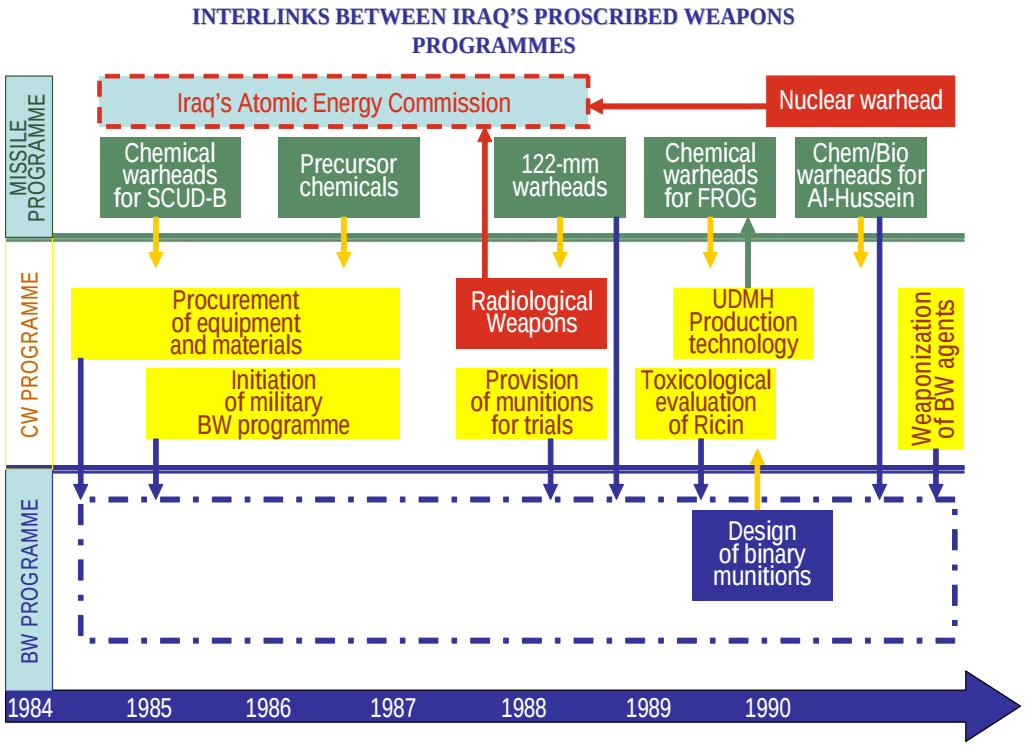


Figure VII.III Interlinks between Iraq's WMD Programmes



The last issue, relating to the development and production by the MSE of radiological bombs is less known and deserves additional explanations.

Radiological bombs

Muthanna-4 and Qaa Qaa-28 radiological bombs
In 1984, with the intent of developing a greater level of self-reliance in the production of chemical munitions, SEPP decided to create an indigenous capability for the manufacture of aerial bombs.

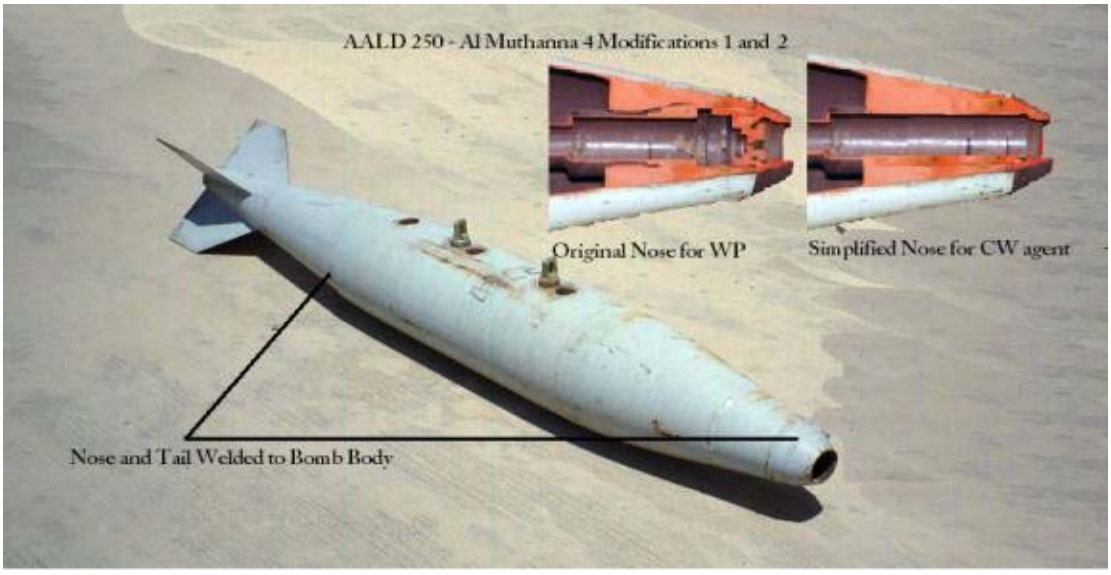
SEPP procured technical documentation, equipment and raw materials for the construction of an aerial bomb production workshop, from a foreign company. This facility was designed for the manufacture of AALD-250 and AALD-500 low drag general-purpose aerial bombs, to be modified and filled with CW agents. Raw materials included semi finished metal plates, un-machined forged parts, and a set of moulds to form bomb components. The aerial bomb production workshop at the Samarra site of SEPP, also known as the "Nasser Factory", was ready to start production by 1986.

Trial production, to assemble 2000 AALD-250 bombs, started at the beginning of 1986, and was used to train Iraqi technicians on production and assembly procedures; however, the mass production of LD-250s did not start until the first quarter of 1987.

Several modifications, to the production process, were introduced during the course of the bombs manufacture. The first modification was to simplify the nose section, by dispensing with the silver welding operation. Additionally, the steel booster cover was welded directly to the nose.

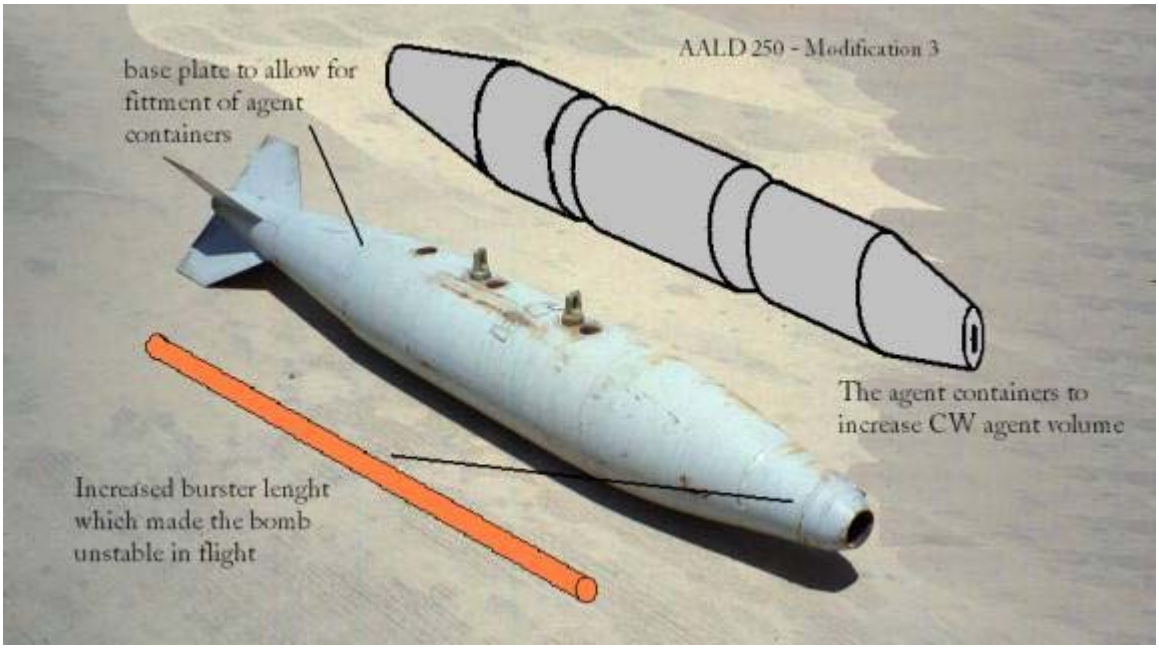
The second modification involved reducing the number of parts for the nose assembly to a single unit. The fin was welded directly to the bomb body because of some problems with tail during flight. These modifications are shown in Figure VII.IV below.

Figure VII.IV: AALD-250 Modifications 1 and 2



The third modification was initiated by Iraq to combat two further problems: those of corrosion, and munitions efficiency and effectiveness. Iraq sought to remedy the issue of corrosion by modifying the AALD-250 so it could be fitted with three aluminium agent containers, similar in construction materials to those used in the Al Hussein missile and other munitions. The use of agent containers not only addressed the corrosion problem, by isolating the agent from the steel skin of the bomb body but the capacity of the bomb increased by utilizing the area in the tail section of the bomb, which is usually a void. The third modification is illustrated in Figure VII.V below.

Figure VII.V: AALD-250 Modification 3



The agent containers were manufactured in the State Establishment for Mechanical Industries (SEMI). In 1988, four AALD-250 bombs were modified at the aerial bomb workshops at the MSE. The modifications included the introduction of a base plate, which would enable the fitment of the agent containers to the bomb, and the lengthening of the burster tube through to the tail section. These modifications proved to adversely affect the stability of the bomb during flight, and the modifications were cancelled.

At around the same time that Iraq was establishing the capability to manufacture AALD-250 bombs, a project was underway to produce a bomb filled with irradiated material. From the initial feasibility studies into this project a bomb was selected that, once fitted with lead shielding and irradiated material, weighed more than 1400 kg. This in itself was problematic, as the only aircraft in the Iraqi Air Force that could take off and land with such a weight were the TU-16 or TU-22.

In anticipation of an order for bombs to replace the 1400 kg bomb under consideration by the Air Weapons Directorate, the MSE aerial bomb workshops produced 100 AALD-250 bombs based on the AALD-250 version 3, renamed the Al Muthanna-4. In total 75 bombs were sent to Al Qaa Qaa for completion, and inclusion of a shortened burster tube, a base plate and lead containers for the storage of the irradiated material. The specification for the bomb included the requirement to be fitted with existing aerial bomb fuses, including both impact and proximity types which would be later used in the R-400 chemical and R-400A biological bombs.

The total weight of the Al Muthanna-4 was approximately 400 kg, and it was designed to expel between 0.5 and 1 kg of irradiated material on initiation of either the proximity or impact fuse.

Iraq declared that it unilaterally destroyed 25 Al Muthanna bombs in 1991, and that the remaining 71 bombs at Al Qaa Qaa were sent, in 1992, to the Badr State Establishment as scrap metal.

In December of 1987, the Directorate of Air Weapons carried out four sorties from a Mirage F-1 aircraft to test the Al Qaa Qaa-28 version 02, which was based on the Nasr-28. A total of four bombs, two inert and two live, were configured to detonate on impact and airburst mode. The four bombs were dropped with the results recorded accordingly. These bombs were significantly larger than the Al Muthanna-4. The empty bomb weighed 510 kg, and when fitted with a lead covered aluminium container, was 1026 kg total weight, plus the weight of the irradiated material. The bomb was based on the body of a conventional munition. The Nasr-28, an 880 kg high explosive bomb was nearly four metres in length, and could be nose and or tail fused. Apart from the dynamic tests detailed above no further information exists as to the number of bombs that were produced. The Nasr-28 bomb is shown in Figure VII.VI below.

Figure VII.VI Nasr-28 Conventional Bomb

The exact number of radiological bombs Iraq produced cannot be verified, however it is known that they manufactured at least three types of radiological weapon: a 400 kg, 1000 kg and 1400 kg version.

Comment

Iraq's development of an indigenous conventional munitions production capability created a knowledge base for the production of chemical weapons. Once established, this knowledge and experience was transferred directly to the biological and nuclear weapons programmes. Since no information exists regarding the use of the Nasr 28 for chemical purposes, it is assumed that it was modified for use with radiological materials: although, perhaps it had the potential to be used at a later date for chemical warfare agents.

PERSONNEL IN PAST PROSCRIBED PROGRAMMES

Throughout the 1970s and 1980s it appears like there were increased opportunities for Iraqi graduates to pursue further studies in a broad spectrum of areas, but particularly in the scientific and technical fields. Interviews suggest that numerous engineers, chemists, physicists, biologists, veterinarians, mathematicians, doctors and pharmacists pursued post-graduate studies at foreign universities. Only a few of these were recruited into the proscribed programs.

Personnel in the CW Programme

In the late 1970's and early 1980's, the core staff of Iraq's CW programme consisted of the Chemical Corps military officers educated and trained in the USA, the former USSR and Egypt. With the foundation of the Project 922, the State Establishment for Pesticide Production transformed later to the Muthanna State Establishment, graduates of chemical schools and colleges joined the work force, including chemical engineers and analytical chemists, of the programme. Technicians and workers were transferred to the programme from other agencies such as the State Organization for Gas and Oil Refineries and a variety of factories constituting Iraq's petrochemical complex.

Iraq's CW programme was given a freedom to recruit scientists and engineers from the civilian sector as well as a labour force, including foreigners. In addition, other categories of military staff were recruited by the CW programme, including weapons specialists from the air force and logistics and supplies department, who constituted the weaponization section. Military toxicologists, from the medical directorate, were recruited for toxicological evaluation of CW agents.

From Iraq's declarations, interviews, documents and records found during inspections in Iraq, it was established that about 1,000 staff was employed by Iraq's prime CW complex at the Samarra site in the period from 1987 to 1989. The total number of personnel directly involved in the CW programme in its active phase, from 1981 to 1991, is estimated at between 1,500 and 2,000.

In addition, hundreds of employees of other establishments were involved in the activities in support to the CW programme in the areas of munitions design and production, production and acquisition of precursors and raw materials and the construction work at CW-related sites.

About 200 individuals were declared by Iraq as personnel involved in the CW programme and their names were given. Another 1,400 names were identified from documents provided by Iraq and found by the inspectors. These include a telephone directory of the former Muthanna State Establishment, scientific, production and financial reports prepared by the CW programme over the period of its existence, records of Ba'ath party meetings and correspondence.

With regard to the professional composition of the 1,500 to 2,000 employees of the CW programme, there were about 60 PhD specialists, some 200 engineers and about 600 technicians who operated equipment. About 80% of the PhD specialists and 40% of the engineering force were either educated or trained in foreign countries.

Personnel in the Missile Programme

Since missile activities were not proscribed *per se*, it is more difficult to estimate the numbers specifically involved in those missile projects. Project 144 at Al Taji probably had a workforce in the hundreds with smaller workforces at Karama and Ibn Al Haitham. Since the proscribed missile programme was also supported by the missile maintenance battalion and other deployed field units, actual numbers involved in the proscribed programme becomes a matter for conjecture. As in the chemical and biological warfare programmes, it seems that a few key figures (such as Generals Sa'adi, Ra'ad, Amin, Rashid and Modher) played crucial managerial and supervisory roles.

In addition, probably hundreds of employees of other establishments were involved in the activities in support of the proscribed missile programme in areas such as design, acquisition of components and raw materials, and in related construction work.

Personnel in the BW Programme

During the course of the late 1970s and early 1980s, with the development of more technologically advanced manufacturing and the policy of increasing self-reliance, Iraq's industrial base expanded. Industries such as vaccine production, pharmaceutical facilities, agricultural processing and food and beverage plants, were established. This provided a potential workforce who had at least familiarity with pilot and bulk production of biomass material. Iraq developed experience in working with fermenters on an industrial scale. The 450 litre fermenter at the single cell protein facility at Al Taji was installed in the late 1970s and personnel were trained on its operation. An imported vaccine line was installed at Al Kindi in the early 1980s with supporting training from the supplier. Dr Taha was therefore able to draw on expertise gained at these and other facilities to produce the agents chosen for the BW programme in bulk.

Comment
Perhaps it was the practical experience gained by the toxicological group at Muthanna and Al Taji that brought about the difference in results or lack thereof, obtained by the team led by Dr Taha compared with the Al Hazen Institute team.

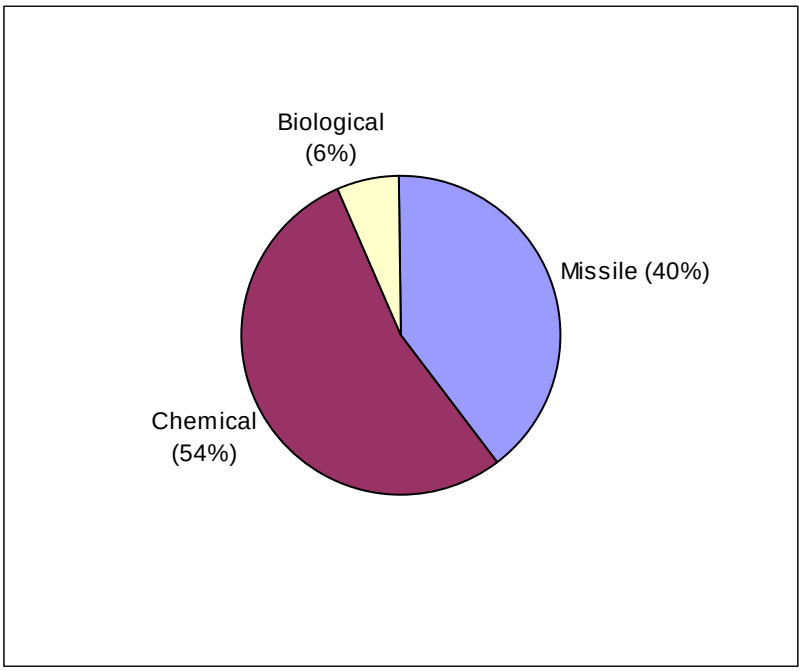
The concurrent expansion in university research in areas such as medicine, agriculture and biotechnology provided a pool of academically qualified personnel available for the proscribed programme. Iraq had declared and UN interviews has confirmed that a number of people involved in the past Iraqi BW program had been educated at the PhD level at universities outside Iraq. There was a nucleus of such personnel who either played or appear to have played leading roles in the BW agent research, bulk agent production and weaponisation. Although only a very rough approximation, from data

derived from declarations and interviews, it appears that about 100 people were involved directly in the BW programme. Of these perhaps only about 25 or so were key personnel involved in research, production, field-testing or weaponisation. The biological programme, being the smallest and also the last one to be pursued in Iraq's WMD programme, also consumed a relatively small share of over-all resources.

RELATIVE SIZE OF THE WMD PROGRAMMES

For illustrative purposes only (given relevant financial data is incomplete and imprecise and that Iraq's supply of data for each of the programmes varied considerably), Figure VII.VII below provides some rough approximation of the relative sizes of the chemical, missile and biological programmes. It is presented merely to illustrate, from available information, the small size of the BW programme compared with the other WMD programmes. The illustration refers only to the construction of facilities, the acquisition of production-related equipment and the running costs, which can be assigned to the WMD programmes. As many different companies were involved in each programme at various times, and some facilities which were dual-use also supported WMD programmes, it is almost impossible to determine exactly the specific costs of the proscribed missile, chemical or biological programmes. In addition, it is extremely difficult to compute cost of the various components associated with each programme. As an example, Iraq imported Scud missiles and the cost of these missiles has not been taken into account even though it was these missiles, which were modified to achieve proscribed ranges. Thus, given the softness and incompleteness of the data, caution must be applied when interpreting the pie chart in Figure VII.VII below.

Figure VII.VII Comparison of funding for WMD programs. A 1990 average exchange rate for conversion into USD has been used, except for converting IQD into USD when it has been assumed that 1 IQD equals 3 USD.



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According to ISG, the nuclear program comprised several thousand staff. Thus, the program probably was larger than the chemical program.