

**IRAQ'S FULL, FINAL AND COMPLETE DISCLOSURE ("FFCD")
REGARDING CHEMICAL WEAPONS**

TO

**THE UNITED NATIONS
SPECIAL COMMISSION ("UNSCOM")**

1998

(pursuant to U.N. Security Council Resolution 687, dated 3 April 1991)

(((INTRODUCTION)))

This document titled Full Final and Complete Disclosure (henceforth referred to as FFCD) of Iraq's past Chemical programme was compiled by the specialists and other personnel who worked in various capacities over the years in the programme .

It is submitted in compliance with the Security Council resolutions 687(1991) and 707(1991) . The first version of the FFCD was submitted four years earlier, in June 1992. That document contained the essential information's answering para 3(i) of resolution 707(1991) . It gave a brief description of the important historical development of the programme which was later to be encompassed in the facilities known as Al-Muthana State Establishment (MSE) .

That document also contained an account of the research and development activities on chemical agents which led to actual bulk production of agents and weaponization into munitions . The production figures for bulk agents produced given in the June 1992 FFCD however, did not reflect the actual quantities filled into munitions which were disposed of during the period prior to August 1988 . The reasons for those and other omissions are explained in this final document .

The overriding consideration from Iraq's viewpoint as far as the June 1992 FFCD was the essential fact, which remained unchanged since then, that the chemical programme had been totally destroyed, removed , or rendered harmless in accordance with para 8 of SCR 687(1991) .

UNSCOM, however, after a period of two years spent in destroying stocks of munitions, production materials and facilities etc, with the full cooperation and participation of Iraqi personnel required more and more details about the past programme . The informations required widened with time to include history of the programme from its very beginning including false starts and failed attempts, personnel and organizations involved . Production records and inventories, all details of research and development efforts, informations about procurement activities, supplier companies and agents, their names and their countries , financial and commercial records, material balances going back many years ,structures, organizations and authorities involved in decision making and their participation in the programme in any way . The requirement for more and more details resulted in the revision and resubmission of six draft FFCD's since the first document of June 1992 .

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The discovery in August 1995 of the chicken farm documentations hidden by Hussain Kamel and their immediate handing over to UNSCOM without any review or filtering

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illustrates the Iraqi side confidence that the discovered documents will essentially substantiate Iraq's disclosures based on recollections and whatever documentation, direct or indirect, found by the Iraqi side and submitted within this FFCD .

It is hoped that this last FFCD which gives the most comprehensive account of Iraq's past chemical programme provides all the answers UNSCOM seeks . Be that as it may, the fact remains that since end of 1991 Iraq's chemical weapons programme was totally and absolutely neutralized .

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***** CHAPTER I *****

1. HISTORY OF IRAQ'S PAST CHEMICAL WARFARE ACTIVITIES

1.1 The period from 1971 & Al-Hassan Ibn-Al-Haitham:-

1.1.1. In 1971, a group of about five chemical corps officers, suggested to conduct chemical synthesis of some CW agents (Mustard, Tabun, CS) in laboratory scale for the purpose of familiarization and acquisition of some experience in CW agents. Their suggestion was approved and they were assigned to work at a site called Al Rashad village near Baghdad where they established some Laboratories.

1.1.2 In 1974 Al-Hassan Ibn Al-Haitham organization was established, the objective of the CW group was to conduct research on synthesizing chemical warfare agents like Mustard, Sarin, Tabun, Cs & Pesticides. The group began its activities at Al-Rashad site after adding more labs to what existed at that time and also adding technical lab. equipments (UV, IR, GC, CHN & NMR). This Organization succeeded in synthesizing Mustard, Tabun and Pesticides like 2,4 D, Malathion and Parathion in a lab. scale (few grams from each). The Organization put the foundation stone for a new site at Samara (Al-Muthanna State Establishment site later), meanwhile it imported scientific glassware necessary for synthesis in a pilot plant scale, two multipurpose pilot units one unit with glass reactor of (200) liter from Evis Co./ France, another unit with glass reactor of 500 liter from pilot plant Co. to be installed at two separate buildings established at the site of Samara especially for them (P7 & Ahmed).

These equipments were not used and they were in the boxes until they were received by 922 Project in 1981. One could see that there was no idea, within the planning of the establishment authorities, concerning chemical weapon production as they had not foreseen within the project stores, munition production, and filling facilities necessary for weaponization. The Organization was dissolved at the end of 1978 due to administrative reasons.

There was no relationship between Al-Hassan Ibn Al-Haitham and the previous group mentioned in item (1.1.1) except that some of the personnel in both activities were from the chemical corps, and they used the same facilities at Al-Rashad site.

The CW group of AL-Hassan Ibn Al-Haitham Organization conducted its activities at Al-Rashad site, which consisted of the following:

One building for analytical department equipped with UV, IR, GC, CHN & NMR and other simple lab. equipments. One building containing four labs. for the synthesis of Mustard, Tabun, Sarin, Cs & Pesticide, equipped with glassware and lab. equipments like rota-evaporator 500 ml volume, vacuum pumps, small chillers, heating mantles, stirrers and other simple ordinary lab. equipments.

Small mechanical workshop for maintenance.

Chemical store for the chemical reagents.

Store for equipments and glassware.

1.1.3 In 1978 Al-Hassan Ibn-Al-Haitham Organization was liquidated for failure in achieving their objectives and other reasons connected with mismanagement and fraud. The assets which consisted of unfinished buildings and equipment still in boxes became the property of SOTI without the obligation to complete the project or to achieve its objectives. Work was suspended until in 1981 a decision was taken to reactivate the project in accordance with a new plan worked out by the director of the chemical corps at the time Gen. Nizzar Al-Attar with direct link to MOD minister and administrative and commercial support from SOTI. Thus project 922 was initiated.

1.1.4 At the end of 1979, a chemical research lab. for chemical corps was established and occupied Al-Rashad site, one of its activities was to synthesize chemical agents in a lab. scale for the purpose of testing the protective clothes and also for the calibration of detection equipment and chemical reconnaissance activity, literature survey was done also at that time on the way how to synthesize nerve agents (e.g. Sarin & Tabun) in addition to that this laboratory conducted analysis and tests related to protection and decontamination for the chemical corps duties. The time frame of the chemical research lab. was from 1979-1981. The research lab of the chemical corps with Al-Rashad site was affiliated to the Research Center 922 with all its staff. After some months Samara site was handed over to project 922 a few months later Al-Rashad site was closed (Summer 1983).

1.1.5 In June 8, 1981, the CW programme was established represented by project 922. The objectives of the chemical programme were to produce chemical warfare agents and chemical munition & production of WP smoke munition because the chemical munition are designed for WP filling (Aerial bomb 250, 500 and Artillery shell 155 mm). From the beginning of the programme it was planned to produce Mustard, Tabun, Sarin & VX agents in addition to produce CS. The program succeeded in the production of Mustard, Tabun and Sarin agents in addition to CS but did not succeed in the production of VX in lab scale due to difficulty in preparing this agent. However, some VX precursors like MPS, the monoester and choline were prepared in the lab during the period 1985-1987 but the final product was elusive. That was the case until 1987. In 1987 Vx and it's precursors were synthesized successfully in lab. scale and their yields, stability, and Vx potency were determined. Accordingly reports of the success were transmitted to MIC requesting that measures for procurement of materials for production phase be undertaken. In 1988 efforts to produced VX using a multi- purpose pilot plant met with difficulties connected with yield, purity and stability. Efforts to overcome these problems were not successful and production was stopped after five trial batches. After Aug. 1988 all production of CW agents at Al-Muthana was stopped. In 1990 CW production activities were resumed for Mustard, Sarin, and Sarin derivatives in addition to their precursors. Another attempt was made to produce Vx as Vx HCl salt in order to overcome the earlier problems of yield, purity and above all stability. Two trial batches were made. The results were negative and the production ceased in order to preserve the intermediate chemicals which were in short supply, mainly TMP which was also needed for Sarin and derivatives. The chemical programme was connected to the Minister of Defense directly and under SOTI director general from the technical aspect. Project 922 was given the name State Establishment for Pesticide Production (SEPP) was established and affiliated to the State Organization for Chemical Industries / Ministry of Industry, but the code name in relation to its connection with Minister of Defense was research center 922 (R.C.922). In 1987 SEPP was renamed as Al-Muthana State Establishment which became part of MIC and the connection with the Minister of Defense ceased.

1.1.6 In the last quarter of 1988 & 1989 Al-Muthana production activities were mainly directed towards civil production of chemicals for pesticides and pharmaceuticals in addition to project implementations. (see doc. III.2 annual report covering Al-Muthana activity in the first half of 1989.)

1.2 Aims of the chemical programmes: The main aim of the chemical programmes was to produce chemical weapons, and WP munitions. Due to the nature of this weapon and lack of experience among the Army units in the field of handling it properly, the CW programs took other additional duties to maintain the main aim:-

1.2.1 Storing of the chemical munitions and agents.

1.2.2 Transportation of the chemical munitions.

1.2.3 Giving consultations on the chemical munitions dispersion.

1.2.4 In 1983 another objective was added to project 922 which was to initiate the BW research and development without elaborating further objectives as with the CW programme. However no steps were taken to implement the BW R & D activity until 1985.

1.2.5 Secondary Aims for the CW programme:

1.2.5.1 Conducting research to produce pesticides for agricultural purposes (during the period 1984-1987), to be ready for shifting to the civil production in case of no need for chemical warfare agents.

1.2.5.2 Production of casing for chemical munitions (aerial bombs) which were within the capabilities of the programmes.

1.2.5.3 Production of key Precursors for CW agents.

1.2.6 Further Duties:

To implement the main and secondary aims of the programmes, the following tasks were taken into consideration:-

1.2.6.1 Research and development for all aspects of CW programmes.

1.2.6.2 Production of CW agents and Precursors.

1.2.6.3 Filling of chemical munitions and WP munition.

1.2.6.4 Storing of chemical munitions and agents.

1.2.6.5 Transportation of chemical munitions.

1.2.6.6 Establishing of technical workshop that would be able to cover all maintenance and construction of the production units.

1.2.6.7 Establishing workshop for aerial bombs production.

1.2.6.8 Establishing of medical center to treat ordinary and chemical injuries and to conduct bioassay test in the bio-chemical lab. in the medical center.

1.3. The financial allocations:

1.3.1 The approximate total expenditures of the programmes was as follows:-

1.3.1.1 The civil engineering works, which include production, residential and administrative sites 160,095,000 DM, 8,722,341 \$, 70,999,181 Fr.F and the cost of bunkers 80,000,000 \$.

1.3.1.2. The production equipment, machinery for the aerial bomb workshop and chemical materials 346,206,243 DM, 3,900,400 STG ,11,534,000 Fr.F,13,763,500 DFL, 102,422,200 \$, 4,200,000 BFr, 187,908,000 ASH, 37,884,000 SF, 11,766 KD, 217,530,400 JY,1,284,641 SHC, 109,650 DC.

1.3.1.3. Munition 189,000,000 \$.

1.3.2 The above mentioned expenditures did not include the following:

1.3.2.1 Cost of Samara site establishing up to date of affiliation to SOTI.

1.3.2.2 Cost of the imported equipment by Al-Hassan Ibn Al- Haitham received by SOTI.

1.3.2.3 Cost of land of Samara site.

1.3.2.4 Cost of Al-Rashad site, supplies and labs.

1.3.2.5 Salaries and administrative services and local procurement.

1.3.3 Mechanism of financial resources allocations for the programmes.

1.3.3.1 The programmes was exempted from the normal fixed budget. This mode stopped when Al-Muthana became part of MIC from 1987 till it's liquidation in 1991.

1.3.3.2 During 1981-1987 the programmes financial allocations were allocated according to a proposal submitted by the project manager to cover the financial requirements to implement the programmes activities during a named period.

1.3.3.3 After obtaining the approval on the proposal of allocation the amount will be transferred to the programmes account at the central bank of Iraq. From 1987 till 1991 the financial allocation followed the practice of state establishments of MIC which meant a fixed budget submitted and approved for each year.

1.4. References:-

1.4.1 The American publications on:-

- 1.4.1.1 Chemical weapons capabilities.
- 1.4.1.2 Tactical use for chemical weapons.
- 1.4.1.3 Meteorology.
- 1.4.1.4 Tables of chemical weapons using.
- 1.4.1.5 Evaluation of the chemical situations.
- 1.4.1.6 The Technical manual Ammunition.

1.5 The priorities in executing the chemical programmes.

1.5.1 The priority in implementing the chemical programmes in general was as follow:

1.5.1.1 Research and development enhancement during the whole programmes execution period.

1.5.1.2 Construction of stores for chemical ammunitions during 1982 and 1983.

1.5.1.3 Construction of production unit buildings during the whole programme execution period.

1.5.1.4 Providing the suitable production means during 1982 and 1987.

1.5.1.5 Providing empty chemical munition during the whole programme execution.

1.5.1.6 Providing the filling and handling requirements for the chemical agents and munitions during the whole programme execution period.

1.5.1.7 Providing the main chemical materials (precursors) for the programmes during the whole programmes execution period.

1.5.1.8 Providing the pesticide production requirements from 1986 to the present time.

1.5.2 Research and Development capability enhancement:

1.5.2.1 Al-Rashad labs were received with some furniture and equipment for synthesis and analytical works. The main analytical equipments received were: GC, UV, IR while NMR and a CHN were out of order. A limited quantity of scientific literature were also received.

1.5.2.2 The labs at Samara site were completed and equipped with the necessary synthesis and analytical

equipments, in the middle of 1983. Annex (A) shows the list of the analytical equipments. The toxic evaluation department was also developed.

An inhalation chamber and a number of inhalation boxes for small animals were also installed. In addition, the animals house was provided with necessary equipments and animals.

1.5.2.3 Central library at Al-Muthana was established at the end of 1983, in addition to the books, references and periodicals, the library procured microfilm and microfiche with readers for documentation purposes some of the microfilm and microfiche was destroyed during the bombardment of the library, other were evacuated, and the rest now exist in the library Falluja/III.

1.5.3 Chemical Bunkers

1.5.3.1 At the beginning of the programmes there were no chemical stores in Iraq, therefore, store no. 53 in Al-Akhather ammunition stores was allocated for the purposes of storing the first batches of the produced mustard and 130 mm caliber ammunition filled with mustard. While ammunitions filled with CS were stored in Al-Rashad site. This procedure continued until stores at Samara site were completed, where munitions and materials were transferred from store no. 53 to the chemical stores at Samara site at the end of 1983.

1.5.3.2 The Army stores at Al-Khamysia, air bases stores and the chemical proving ground of the chemical corps (annex B) were used for storing the chemical munitions (in Jan. 1991) for the purpose of dispersion of the munition during the war. Then

part of the ammunition were destroyed by the establishment while the remaining part returned back to Samara site and destroyed there under the supervision of UNSCOM.

1.5.3.3 In 1987 Al-Mohamadyat stores were allocated to Al- Muthana in addition to the bunkers.

1.5.4 The Production units Buildings:

1.5.4.1 The production units that were used at Al-Rashad site installed in a normal and small halls which lack industrial safety regulations, using rotary capacity 50 L (two units).

1.5.4.2 In Samara site, the production sites (Ahmed) plant for DF production, (P 8) for Mustard production, (P 7) for Sarin & Tabun production, (Mohammed) plant for D4 and MPC, (Maleik) plant for Tabun, DMMP and MPC, (DIHAA) plant for Vx, MPS and herbicides during the period of the programmes.

1.5.4.3 In 1982 a contract was signed with (HEBERGER Co.) to construct four production buildings. Glass pilot units which were purchased from Pilot Plant Co. were installed in two buildings, while in the third building a 1 m³ monel reactor was installed, in the 4th building an inhalation chamber was installed.

1.5.4.4 A contract was signed at the end of 1983 with (HEBERGER Co.) to construct another four production buildings, Mohammed, Malik and DIHAA (Dihaa consisted of two buildings) 1.5.4.5 A contract was signed in the end of 1985 with WTB Co., to construct three integrative production sites which were Faluja 1, 2 and 3, to install the production equipment which were imported in the beginning of 1987.

1.5.5 Providing the Production Means

1.5.5.1 The production units at Al-Rashad site were simple and comprised of two rotating reactors (Buchi) for Mustard agent production with 50 liter capacity for both. There was also a small reactor for the production of CS in addition to a simple CS filling unit.

A reactor with 100 liter capacity was installed at Al- Rashad site to increase the production of mustard.

1.5.5.2 An agreement was reached with Pilot Plant Co. in 1982 to supply us with two glass pilot units of 100 liter for each. Later on they were changed with 200 liter capacity then with a 400 liter capacity reactor (HASTALLOY) installed in H1 and H2.

<u>ITEM</u>	<u>CHEMICAL</u>	<u>L/C No.</u>	<u>QTY.TON</u>	<u>SUPPLIER</u>
13	KF	Protocol 84/1	275	ABO ZA'BAL
<u>ITEM</u>	<u>CHEMICAL</u>	<u>L/C No.</u>	<u>QTY.TON</u>	<u>SUPPLIER</u>
14	DIMETHIL AMIN	86/3/476	5	COMPANIES
<u>ITEM</u>	<u>CHEMICAL</u>	<u>L/C No.</u>	<u>QTY.TON</u>	<u>SUPPLIER</u>
15	CHLOROE- THANOL	86/3/1145	192	EXOMIT
<u>ITEM</u>	<u>CHEMICAL</u>	<u>L/C No.</u>	<u>QTY.TON</u>	<u>SUPPLIER</u>
16	NaF	84/3/1093	52.8	WET
		84/3/1401	20	REINING HAUS
		84/3/1323	22.5	REINING HAUS
		84/3/1450	20	REINING HAUS
		84/3/850	2	REINING HAUS
		84/3/862	17.6	REINING HAUS
		84/3/1349	54	WET

			188.9	

<u>ITEM</u>	<u>CHEMICAL</u>	<u>L/C No.</u>	<u>QTY.TON</u>	<u>SUPPLIER</u>
17	O.CHLORO BENZALD- EHYDE	82/3/900 88/3/811	10 50	HOGEST WECO
			60	
		82/3/34	---	MELCHEMI Probably supplied
		82/3/898	7	KBS Probably supplied

<u>ITEM</u>	<u>CHEMICAL</u>	<u>L/C No.</u>	<u>QTY.TON</u>	<u>SUPPLIER</u>
18	MALONON- ITRIL	84/3/429	14.4	KBS

<u>ITEM</u>	<u>CHEMICAL</u>	<u>L/C No.</u>	<u>QTY.TON</u>	<u>SUPPLIER</u>
19	DIMENDELIC- ACID	84/3/1379	2	KBS

<u>ITEM</u>	<u>CHEMICAL</u>	<u>L/C No.</u>	<u>QTY.TON</u>	<u>SUPPLIER</u>
20	DIISOPROPYL- AMIN	86/3/1145	200	KIM AL- KHALLEEJ

<u>ITEM</u>	<u>CHEMICAL</u>	<u>L/C No.</u>	<u>QTY.TON</u>	<u>SUPPLIER</u>
21	p2S5	86/3/1145	250	EXOMIT
<u>ITEM</u>	<u>CHEMICAL</u>	<u>L/C No.</u>	<u>QTY.TON</u>	<u>SUPPLIER</u>
22	Morpholine	87/3/1874	15	KIM AL-KHALLIEJ
<u>ITEM</u>	<u>CHEMICAL</u>	<u>L/C No.</u>	<u>QTY.TON</u>	<u>SUPPLIER</u>
23	Triethy-lamin	87/3/1874	48	KIM AL-KHALLIEJ

UNKNOWN MATERIALS L/C

<u>ITEM</u>	<u>L/C No.</u>	<u>CHEMICAL</u>	<u>QTY.TON</u>	<u>SUPPLIER</u>
1	83/3/335		KBS	
2	83/3/689		TAFESA	
3	83/3/854		TAFESA	
4	84/3/1251		MELCHEMIE	
5	84/3/1490		KBS (CANCELED)	
6	84/3/1612		KBS	
7	84/3/1637		MELCHEMIE	
8	84/3/105		AL-HADDAD	
9	86/3/569		KBS	
10	86/3/949		COMPANIES	
11	86/3/1534		GANSSEN (CANCELED)	
12	87/3/219		TAFESA	

UNIMPORTANT MATERIALS

ITEM	L/C No.	CHEMICAL	QTY.TON	SUPPLIER
1	83/3/824	NaOH+DCM+WP		MELCHEMIE
2	83/3/1122	ETHYL ALCOHOL		KBS
3	84/3/197	BLEACHING POWDER		PRUSSAG
4	87/3/526	LAB. CHEMICALS		FLUKA
5	88/3/46	Zn POWDER	7	WECO
6	88/3/2648	CHEMICALS FOR PESTICIDES		WECO
7	88/3/1746	PHENOL FORMALDEHYDE		KBS
8	84/3/39	LAB. CHEMICALS		FLUKA
9	10/65718	HgCl2		WECO
10	10/65733	XYELNE		HIP
11	88/3/2880	CHEMICALS FOR PESTICIDES		WECO
12	85/3/494	3-HYDROXY METHYL	0.6	FLUKA
13	85/3/238	PIPYRIDENE		FLUKA
14	85/3/424	LAB. CHEMICALS	2	KBS
15	85/3/444	CH3I	2	WET
16	85/3/747	CH3I		FLUKA
17	85/3/783	KI		FLUKA
18	85/3/1114	LAB. CHEMICALS		FLUKA
19	86/3/260	LAB. CHEMICALS KI + CH2CL2 + CHLORAMIN T	600	MELCHEMIE
20	86/3/479	LAB. CHEMICALS		FLUKA
21	86/3/726	LAB. CHEMICALS		FLUKA
22	86/3/1049	LAB. CHEMICALS		BDH

23	86/3/1365	CHLOROAMINE	0.361	KBS
24	86/3/266	LAB. CHEMICALS		PHARMACIA
25	86/3/257	LAB. CHEMICALS		FLUKA
26	86/3/899	LAB. CHEMICALS		BDH
27	86/3/913	LAB. CHEMICALS		FLUKA
28	10/65756	LAB. CHEMICALS		SIGMA
29	82/3/924	MONOCHLOROBENZENE		KBS
30	84/3/517	CH3I	2	KBS
31	84/3/121	CHLORAMINE		RIDEL DEHEIN
32	84/3/1113	CHLOROBENZENE	50	KBS
33	84/3/1080	CH2CL2	600	MELCHEMIE
34	84/3/1349	KI	0.268	WET
35	86/3/918	KI	3	WET
36	86/3/474	Dichloro Methane	58	WET
37	85/3/771	Isopropyl amine	10	WET (Reining Hause)
38	82/3/979			KBS
39	83/3/357	LAB. CHEMICALS		MERK
40	83/3/371	LAB. CHEMICALS		RIDEL DE HEIN
41	84/3/1346	LAB. CHEMICALS		FLUKA
42	84/3/1534	Maleic anhydride		KBS
43	87/3/142	LAB. CHEMICALS		SIGMA

*In August 1987 Exomat Company was requested to submit an offer for Pinacolyl Alcohol, no offer was submitted, and the matter was abandoned.

*In 1987 an attempt to procure 10 tons of choline chloride (free base) from Degussa Company no offer was submitted and the matter was abandoned.

*In October 13, 1987 Mr. Frans was requested to offer for Pinacolyl alcohol, choline and some precursors for V agent (P2S5, Diisopropylamine and chloroethanol), no offer was submitted and the matter was abandoned.

*In March 1988 attempts were carried out to procure chemicals (TDG, HF, TMP & Pinacolyl alcohol,) from Montodson, Monteflor, Carmel, Bayer and Montedson Egypt Branch, no offer was obtained.

*Mr. Kasim Abbas (Euromac Co.) Mr. Bell (Boneventure Co.), Mr. Cantori and Mr. Ameen Shereen (Turkish Citizen) were requested to procure precursors chemicals, no offers were obtained.

*An attempt was carried with Saudia Arabia to procure ethylene oxide from Sabic Company in 1987, and found unsuitable because of the percentage of ethylene oxide was 15% and the matter was neglected.

*16 ton of ethylene glycol was procured from Sabic Company in 1987.

*An attempt to procure TDG, TMP and ethylene oxide from Exomit in 1987 but the offer was not submitted and the matter was neglected.

*An attempt with U.K. to procure HF and malononitrile but this was not materialized due to high price.

*An attempt with ICI Company (U.K.) to procure insecticide in 1982 but this was not materialized.

*In Oct. 1987 a request to Herberger Co. to supply chemical as shown below :-

- Pinacolyl alcohol	250 T
- Triethyl amine	50 T
- Diisopropyl thio ethanol amine	250 T
- Diisopropyl amino ethanol	200 T
- Diisopropyl amino ethyl chloride	200 T
- Cyclohexanol	200 T

No offer was submitted and nothing materialized .

* In 1987 a request to HIP Co. through Mr. Lucas to supply chemicals:-

- P2S5 100 T
- Diisopropyl amine 5 T
- Benzen 50 T
- Acetone 50 T
- Trisodium phosphate 10 T
- Cyclohexanol 10 T
- Morphaline 5 T
- Chloro - hydrine 100 T

No offer was submitted and nothing Supplied.

* An attempt to procure pinacolyl alcohol (10 T) from syprus company (servan) in 1987 an offer was submitted but not materialized

III-A : TYPES & QUANTITIES OF PRODUCTION EQUIPMENT PROCURED FOR CW - PROGRAMM 1996

NO.	DESCRIPTION OF ITEM	EXPORTER	YEAR OF EXP.	ANUFACT.	LC NO.	STATUS	YEAR OF MANF	PRESENT LOCATION	TAG NO.	PROJECT
1	REACTORS 4M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	USED BEFORE	1987	DMPH plant	1637	General for
2	REACTORS 4M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	PARTIALLY DES.	1987	Amongst broken equip. in storage *	1688	Falluja 1,2,3
3	REACTORS 4M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	IN SERVICE	1985	Xylen dist. area behind building	1012	
4	REACTORS 4M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	IN SERVICE	1987	Brake fluid formulation building	1585	
5	REACTORS 4M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	IN SERVICE	1985	Production building 3	1746	
6	REACTORS 4M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	PARTIALLY DES.	1986	Aniline plant /Falluja 3	1936	
TOTALLY 6										
7	REACTORS 2.5M3 GLASS LINED	DEDIETRICH	1985	DEDIETRICH	567/3/84	IN SERVICE	1985	Storage area south of phenol plant (used before in Muatasim 4 as a buffer)	1700	General

8	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	IN SERVICE	1985	production building 3	1573	General
9	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	IN SERVICE	1985	production building 3	1574	General
10	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	IN SERVICE	1985	Castor oil plant(used before in Muatasim 4 / 1986) PCI3 distillation	1717	General
11	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	USED BEFORE	1985		1642	General
12	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	USED BEFORE	1985	PCI3 distillation	1643	General
13	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	USED BEFORE	1985	Stam plant (DMMP) Dihaa	1666	General
14	REACTORS 2.5M3 GLASS LINED	DEDIETRICH	1985	DEDIETRICH	567/3/84	USED BEFORE	1985	Stam plant (DMMP) Dihaa	1667	General
15	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	IN SERVICE	1985	production building 4	1582	General
16	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	IN SERVICE	1985	production building 4	1583	General

17	REACTORS 2.5M3 GLASS LINED	I.T	1985	DEDIETRICH	1651/3/84	IN SERVICE	1985	Ferric chloride (used before in Muatasim 4 / 1985)	1904	General
18	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	PARTIALLY DES.	1984	Sto.area at eastern corner of site	1679	General
19	REACTORS 2.5M3 GLASS LINED	I.T	1985	DEDIETRICH	1651/3/84	BROKEN	1985	D4 Plant (Muatasim 3)	1877	General **
20	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	BROKEN	1985	D4 Plant (Muatasim 3)	1878	General
21	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	BROKEN	1985	D4 Plant (Muatasim 3)	1879	General
22	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	BROKEN	1985	Thionyl plant (Al-Mamun)	1827	General
23	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	BROKEN	1985	MPC Plant (Bin Hayan 2)	--	General
24	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	BROKEN	1985	Mustard gas (Bin Hayan 1)	--	General
25	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	BROKEN	1985	Mustard gas (Bin Hayan 1)	1848	General

26	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	BROKEN	1985	Mustard gas (Bin Hayan I)	1849	General
27	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	BROKEN	1985	Mustard gas (Bin Hayan I)	--	General
28	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	BROKEN	1985	Thionyl plant (Al-Mamun)	--	General
29	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	490/3/84	IN SERVICE	1985	AL-QAQA	1613	General
30	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	490/3/84	IN SERVICE	1985	AL-QAQA	1614	General
31	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	490/3/84	IN SERVICE	1985	S.E.FOR VEGETABLE OIL	--	General
32	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	490/3/84	IN SERVICE	1985	S.E.FOR VEGETABLE OIL	--	General
33	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	490/3/84	PARTIALLY DES.	1985	AL-QAQA	--	General
TOTALLY27										
34	GLASS LINED REACTORS 1.6M3 GLASS LINED	Q.T.L	1985	DEDIETRICH	1250/3/84	IN SERVICE	1985	Production building 4	1580	Mohamd

35	REACTORS 1.6M3 GLASS LINED	Q.T.L	1985	DEDIETRICH	1250/3/84	BROKEN	1984	MPC Plant (Bin Hayan 2)	1838	Mohamd
36	REACTORS 1.6M3 GLASS LINED	Q.T.L	1985	DEDIETRICH	1250/3/84	BROKEN	1984	MPC Plant (Bin Hayan 2)	1839	Mohamd
37	REACTORS 1.6M3 GLASS LINED	WET	1985	PFAUDLER	770/3/85	BROKEN	1985	Stam Plant (Dihaa)	--	General
38	REACTORS 1.6M3 GLASS LINED	WET	1985	PFAUDLER	770/3/85	BROKEN	1985	Stam Plant (Dihaa)	--	General
39	REACTORS 1.6M3 GLASS LINED	WET	1985	PFAUDLER	770/3/85	BROKEN	1985	Tahadi(used in Jaber S.Est./1995)	1621	General
40	REACTORS 1.6M3 GLASS LINED	PILOT PLANT	1984	PFAUDLER	1073/3/83	USED BEFORE	1983	DMPH plant	1501	Ani
41	REACTORS 1.6M3 GLASS LINED	PILOT PLANT	1984	PFAUDLER	1073/3/83	USED BEFORE	1983	DMPH plant (used before in DF(6)	1503	Ani
42	REACTORS 1.6M3 GLASS LINED	PILOT PLANT	1984	PFAUDLER	1073/3/83	BROKEN	1983	Muatasim 2) Work shop (used before in Tahadi)	1853	Mohamad
43	REACTORS 1.6M3 GLASS LINED	PILOT PLANT	1984	PFAUDLER	1073/3/83	BROKEN	1983	Work shop (used before in Tahadi)	1854	Mohamad

44	REACTORS 1.6M3 GLASS LINED	PILOT PLANT	1984	PFAUDLER	1073/3/83	BROKEN	1983	Thionyl plant (Al-Mamun)	--	Mohamad
45	REACTORS 1.6M3 GLASS LINED	PILOT PLANT	1984	PFAUDLER	1073/3/83	IN SERVICE	1983	AL-QAQA TARIK FACTORY	1617	Mohamad
	TOTALLY 12		-	-	-					
46	REACTORS 2M3 GLASS LINED	PILOT PLANT	1984	SOMMER	1073/3/83	PARTIALLY DES.	1983	Beside workshop used before in	1020	Mohamad
47	REACTORS 2M3 GLASS LINED	PILOT PLANT	1984	SOMMER	1073/3/83	PARTIALLY DES.	1983	Beside workshop Mutasim 3/85- 1986	1021	Mohamad
	TOTALLY 2									
48	REACTORS 1M3 HC	PILOT PLANT	1983	QUAST	869/3/82	BROKEN	1982	DF plant (6) (Muatasim 2)	--	Ahmed / 1
49	REACTORS 1M3 HC	PILOT PLANT	1983	QUAST	869/3/82	BROKEN	1982	DF plant (6) (Muatasim 2)	--	Ahmed / 1
50	REACTORS 1M3 HC	PILOT PLANT	1983	QUSAT	869/3/82	BROKEN	1982	DF plant (7) (Muatasim 2)	--	Ahmed / 2
51	REACTORS 1M3 HC	PILOT PLANT	1983	QUAST	869/3/82	BROKEN	1982	DF plant (7) (Muatasim 2)	--	Ahmed / 2
	TOTALLY 4									
52	REACTORS 1.4M3 MONEL	W.E.T	1985-86	N.A	185/3/85	BROKEN	1985	PILOT plant 3 (Muatasim 1)	--	General
53	REACTORS 1.4M3 MONEL	W.E.T	1985-86	N.A	185/3/85	IN SERVICE	1985	IBNBAYTAR	1757	General
54	REACTORS 1.4M3 MONEL	W.E.T	1985-86	N.A	185/3/85	IN SERVICE	1985	S.E.FOR VEGETABLE OIL	--	General

55	REACTORS 1.4M3 MONEL	W.E.T	1985-86	N.A	185/3/85	IN SERVICE	1985	S.E.FOR VEGETABLE OIL	--	General
	TOTALLY 4									
56	MONEL REACTORS 3M3 TEFEZEL	PILOT PLANT	1984	GERMANY	31/3/84	DESTROYED	1984	Hydrolysis Plant(Muatasi m4)	1533	Iesa
57	REACTORS 3M3 TEFEZEL	PILOT PLANT	1984	GERMANY	31/3/84	DAMAGED	1984	In castor oil plant Falluja 3 (used before in Muatasim4/19 87)	1935	Iesa
	TOTALLY 2									
58	TEFEZEL REACTORS PTFE(TEFL ON)1.5M3	--	--	--	--	IN SERVICE	--	IBN BAYTAR	1764	General
59	REACTORS PTFE(TEFL ON)1.5M3	--	--	--	--	IN SERVICE	--	IBN BAYTAR	1758	General
	TOTALLY 2									
60	TEFLON HEAT EXCHANG ERS 0.5X0.5X3 M ,15M2 GRAPHITE	NEUBURGE R	1987	SIGRIE	315/3/87	IN SERVICE	1987	Brake fluid building,behin d far end of storage inside container	1707	General
61	HEAT EXCHANG ERS 0.5X0.5X3 M ,15M2 GRAPHITE	NEUBURGE R	1987	SIGRIE	315/3/87	IN SERVICE	1987	Brake fluid building, behind far end of storage inside container	1708	General

62	HEAT EXCHANGERS 0.5X0.5X3M .15M2 GRAPHITE	NEUBURGER	1987	SIGRIE	315/3/87	BRAND NEW	1987	Scrap yard	1725	General
63	HEAT EXCHANGERS 0.5X0.5X3M .15M2 GRAPHITE	NEUBURGER	1987	SIGRIE	315/3/87	BRAND NEW	1987	Scrap yard	1727	General
64	HEAT EXCHANGERS 0.5X0.5X3M .15M2 GRAPHITE	NEUBURGER	1987	SIGRIE	315/3/87	BRAND NEW	1987	Scrap yard	1728	General
65	HEAT EXCHANGERS 0.5X3.5M, 25M2 GRAPHITE	W.E.T	1984-86	LA CARBONNE, LORRANA	1187/3/84	IN SERVICE	1984	Brake fluid formulation building	1703	General
66	HEAT EXCHANGERS 0.5X4M, 25M2 GRAPHITE	W.E.T	1984-86	LA CARBONNE, LORRANA	1187/3/84	BRAND NEW	1984	Storage area 10m east of phenol plant	1570	General
67	HEAT EXCHANGERS 0.5X6M, 50M2 GRAPHITE	W.E.T	1984-86	LA CARBONNE, LORRANA	1187/3/84	IN SERVICE	1984	Brake fluid formulation behind the end of storage area inside container	1705	General

68	HEAT EXCHANG ERS 25M2	W.E.T	1984-86	LA CARBONNE, LORRANA	1187/3/84	BRAND NEW	1984	Scrap yard	1729	General
69	GRAPHITE HEAT EXCHANG ERS 25M2	W.E.T	1984-86	LA CARBONNE, LORRANA	1187/3/84	BRAND NEW	1984	Scrap yard	1734	General
70	GRAPHITE HEAT EXCHANG ERS 25M2	W.E.T	1984-86	LA CARBONNE, LORRANA	1187/3/84	USED BEFORE	1984	DMPH Plant	1502	General
71	GRAPHITE HEAT EXCHANG ERS 25.3M2	W.E.T	1984-86	ARATEBAN	1187/3/84	USED BEFORE	1984	Stam plant(DMMP) (Dihaa)	1669	General
72	GRAPHITE HEAT EXCHANG ERS 10M2	W.E.T	1984-86	VICARB	1187/3/84	BRAND NEW	1984	Scrap yard	1737	General
73	GRAPHITE HEAT EXCHANG ERS 10M2	W.E.T	1984-86	VICARB	1187/3/84	BRAND NEW	1984	Scrap yard	1738	General
74	GRAPHITE HEAT EXCHANG ERS 10M2	W.E.T	1984-86	VICARB	1187/3/84	PARTIALLY DEST	1984	Scrap yard (used before in Dihaa in 85- 1988)	1739	General
75	GRAPHITE HEAT EXCHANG ERS 10M2 GRAPHITE	W.E.T	1984-86	VICARB	1187/3/84	PARTIALLY DEST	1984	Scrap yard (used before in Dihaa in 85- 1988)	1740	General

76	HEAT EXCHANG ERS 10M2	W.E.T	1984-86	VICARB	1187/3/84	PARTIALLY DEST	1984	Scrap yard	1741	General
77	GRAPHITE HEAT EXCHANG ERS 10M2	W.E.T	1984-86	VICARB	1187/3/84	PARTIALLY DEST	1984	Scrap yard	1742	General
78	GRAPHITE HEAT EXCHANG ERS 25M2	W.E.T	1984-86	LA CARBONNE, LORRANA	1187/3/84	USED BEFORE	1984	Incinerator plant & used before in	1017	General
79	GRAPHITE HEAT EXCHANG ERS 25M2	W.E.T	1984-86	LA CARBONNE, LORRANA	1187/3/84	USED BEFORE	1984	Incinerator plant 1	Tahadi 1991 1018	General
80	GRAPHITE HEAT EXCHANG ERS 25M2	W.E.T	1984-86	LA CARBONNE, LORRANA	1187/3/84	USED BEFORE	1984	Incinerator plant(used before in	1019	General
81	GRAPHITE HEAT EXCHANG ERS 0.5X3.5M	W.E.T	1984-86	DUKER	1187/3/84	BROKEN	1984	(Muatasim 1 / H3 D4 plant (Muatasim 3)	1834	General
82	GRAPHITE 25 M2 HEAT EXCHANG ERS 0.5X3.5M GRAPHITE 25 M2	W.E.T	1984-86	RICHTER	1187/3/84	BROKEN	1984	MPC plant (Bin Hayan 2)		General

83	HEAT EXCHANG ERS 0.5X6 M	W.E.T	1984-86	PFAUDLER	1187/3/84	BROKEN	1984	Mustard gas (Bin Hayan I)	1850	General
	GRAPHITE 50 M2									
84	HEAT EXCHANG ERS 0.5X6 M	W.E.T	1984-86	PFAUDLER	1187/3/84	BROKEN	1984	Nerve gas (Muatasim 4)	1537	General
	GRAPHITE 50 M2									
85	HEAT EXCHANG ERS 0.6X1.5M	W.E.T	1984-86	PFAUDLER	1187/3/84	BROKEN	1984	Thionyl plant (Al-Mamun)		General
	GRAPHITE 15 M2									
	TOTALLY 26									
86	GRAPHITE HEAT EXCHANG ERS 0.4X3M, 20M2	WET	1987	CABOT	7/3/87	IN SERVICE	1986	Storage area 50 m south west of phenol plant	1567	General
	HC									
87	HEAT EXCHANG ERS 0.4X3M, 20M2	WET	1987	CABOT	7/3/87	IN SERVICE	1986	phenol plant(used before in Tahadi	1568	General
	HC									
88	HEAT EXCHANG ERS 0.4X3M, 20M2 HC	WET	1987	CABOT	7/3/87	USED BEFORE	1986	1990) DMPH Plant	1645	General

89	HEAT EXCHANG ERS 0.3X1M HC ~1.5 M2	WET	1987	QUAST	7/3/87	BROKEN	1987	D4 plant (Muatasim3)	General
90	HEAT EXCHANG ERS 0.3X1.2M HC ~1.5 M2	WET	1987	QUAST	7/3/87	BROKEN	1987	MPC plant (Bin Hayan 2)	General
91	HEAT EXCHANG ERS 0.3X1.6M HC~2 M2	WET	1987	QUAST	7/3/87	USED BEFORE	1987	Stam plant (Dihaa)	General
92	HEAT EXCHANG ERS 0.3X1.6M HC~2 M2	WET	1987	QUAST	7/3/87	BROKEN	1987	Stam plant (Dihaa)	General
93	HEAT EXCHANG ERS 0.3X2M HC ~ 2.5 M2	PILOT PLANT	1983	QUAST	869/3/82	BROKEN	1982	Mustard gas (Bin Hayan 1)	Ahmed
94	HEAT EXCHANG ERS 0.4X1.5M HC ~ 7.5 M2	PILOT PLANT	1983	QUAST	869/3/82	BROKEN	1982	Nerve gas (Muatasim 4)	Ahmed

95	HEAT EXCHANG ERS 0.4X3 M HC 20 M2	PILOT PLANT	1983	QUAST	869/3/82	DESTROYED	1982	DF Plant (Muatasim 2)	1517	Ahmed
96	HEAT EXCHANG ERS 0.4X3 M HC 20 M2	PILOT PLANT	1983	QUAST	869/3/82	DESTROYED	1982	DF Plant (Muatasim 2)	1518	Ahmed
97	HEAT EXCHANG ERS 0.4X3 M HC 20 M2	PILOT PLANT	1983	QUAST	869/3/82	DESTROYED	1982	DF Plant (6) (Muatasim 2)	1519	Ahmed 1
98	HEAT EXCHANG ERS 0.3MX1M C HC ~ 1.5 M2	PILOT PLANT	1983	QUAST	869/3/82	DESTROYED	1982	DF Plant (6) (Muatasim 2)	1520	Ahmed 1
99	HEAT EXCHANG ERS 2.5M2 HC	PILOT PLANT	1983	QUAST	869/3/82	DESTROYED	1982	DF Plant (7) (Muatasim 2)	1521	Ahmed 2
100	HEAT EXCHANG ERS 2.5M2 HC	PILOT PLANT	1983	QUAST	869/3/82	BROKEN	1982	DF Plant (7) (Muatasim 2)		Ahmed
101	HEAT EXCHANG ERS 2.5M2 HC	PILOT PLANT	1983	QUAST	869/3/82	BROKEN	1982	DF Plant (6) (Muatasim 2)		Ahmed
102	HEAT EXCHANG ERS 2.5M2 HC	PILOT PLANT	1983	QUAST	869/3/82	BROKEN	1982	DF Plant (6) (Muatasim 2)		Ahmed

103	HEAT EXCHANG ERS 5 M2 HC	PILOT PLANT	1983	QUAST	869/3/82	BROKEN	1982	Thionyl plant (Al-Mamun)	Ahmed
	TOTALLY 18								
104	HEAT EXCHANG ERS 4M2 GLASS LINED	I.T	1984	PFAUDLER	1651/3/84	BRAND NEW	1984	Scrap Yard	General
105	HEAT EXCHANG ERS 8M2 GLASS LINED	I.T	1984	PFAUDLER	1651/3/84	BRAND NEW	1984	Scrap Yard	General
106	HEAT EXCHANG ERS 8M2 GLASS LINED	I.T	1984	PFAUDLER	1651/3/84	BRAND NEW	1984	Scrap Yard	General
107	HEAT EXCHANG ERS 12M2 GLASS LINED	I.T	1984	PFAUDLER	1651/3/84	BRAND NEW	1984	Scrap Yard	General
108	HEAT EXCHANG ERS 12M2 GLASS LINED	I.T	1984	PFAUDLER	1651/3/84	BROKEN	1984	D4 Plant (Muatasim 3)	General
109	HEAT EXCHANG ERS 12M2 GLASS LINED	I.T	1984	PFAUDLER	1651/3/84	USED BEFORE	1984	Storage area /Falluja2	General
	TOTALLY 6								

110	CONDENS ER 20 M2 GLASS LINED	WET	1984-86	PFAUDLER	1187/3/84	BROKEN	1984	Thionyl plant (Al-Mamum)	General
111	CONDENS ER 20 M2 GLASS LINED	WET	1984-86	PFAUDLER	1187/3/84	BROKEN	1984	Thionyl Plant (Al-Mamum)	General
	TOTALLY 2 GLASS LINED								
112	CONDENS ER 5 M2 HC	WET	1987	CABOT	7/3/87	IN SERVICE	1986	Phenol plant	General
113	CONDENS ER 5 M2 HC	WET	1987	CABOT	7/3/87	IN SERVICE	1986	Phenol plant	General
114	CONDENS ER 5 M2 HC	WET	1987	CABOT	7/3/87	IN SERVICE	1986	Phenol plant	General
115	CONDENS ER 20 M2 HC	WET	1987	GERMANY	7/3/87	USED BEFORE	1986	DMPH plant	General
116	CONDENS ER 7.5M2 HC	LENHARDT	1984	GERMANY	1315/3/84	USED BEFORE	1983	DMPH plant(from Muatasim 2/1987)	General
117	CONDENS ER 20 M2 HC	NEUBUGER	1985	GERMANY	250/3/85	INSERVICE	1985	Production plant(used before in	General
118	CONDENS ER 20 M2 HC	NEUBUGER	1985	GERMANY	250/3/85	USED BEFORE	1985	Tahadi 1990) PCL3 Distillation	General
119	CONDENS ER 20 M2 HC	WET	1987	GERMANY	7/3/87	USED BEFORE	1986	Stam plant (Dihaa)	General
120	CONDENS ER 20 M2 HC	WET	1987	GERMANY	7/3/87	USED BEFORE	1986	Stam plant (Dihaa)	General

121	CONDENS ER 20 M2 HC	WET	1987	CABOT	7/3/87	IN SERVICE	1986	Phenol plant(used before in	1003	General
122	CONDENS ER 20 M2 HC	WET	1987	GERMANY	7/3/87	USED BEFORE	1986	Tahadi 1990) PCI3 Distillation	1646	General
123	CONDENS ER 7.5 HC	PILOT PLANT	1983	QUAST	869/3/82	BROKEN	1982	DF plant (Muatasim 2)		Ahmed
124	CONDENS ER 7.5 HC	PILOT PLANT	1983	QUAST	869/3/82	BROKEN	1982	DF plant (Muatasim 2)		Ahmed
125	CONDENS ER 20 M2 HC	IT	1985	GERMANY	1651/3/84	BROKEN	1984	MPC plant (Bin Hayan 2)		Mohamed
126	CONDENS ER 20 M2 HC	IT	1985	GERMANY	1651/3/84	BROKEN	1984	MPC plant (Bin Hayan 2)		Mohamed
127	CONDENS ER 7.5 HC	PILOT PLANT	1983	QUAST	869/3/82	BROKEN	1982	DF plant(Muatasi m2)(used in H3)		Ahmed
128	CONDENS ER 5 M2 HC	PILOT PLANT	1983	QUAST	869/3/82	BROKEN	1982	Thionyl plant (Al-Mamun)		Ahmed
129	CONDENS ER 20 M2 HC	PILOT PLANT	1983	QUAST	869/3/82	DESTROYED	1982	Sarin plant (Muatasim 4)	1534	Ahmed
130	CONDENS ER 20 M2 HC	NEUBURGE R	1985	GERMANY	250/3/85	BROKEN	1985	Stamp plant (Dihaa)		General
131	CONDENS ER 1.5M2 HC(Trap)	PILOT PLANT	1983	QUAST	869/3/82	BROKEN	1982	DF plant (Muatasim 2)		Ahmed
132	CONDENS ER 1.5M2 HC(Trap)	PILOT PLANT	1983	QUAST	869/3/82	BROKEN	1982	DF plant (Muatasim 2)		Ahmed

133	CONDENS ER 20 M2 HC	NEUBURGE R	1986	GERMANY	250/3/85	BROKEN	1985	Stamp plant (Dihaa)	General
134	CONDENS ER 20 M2 HC	WET	1987	GERMANY	7/3/87	BROKEN	1986	Thionyl plant (Al-Mamun)	
135	CONDENS ER 20 M2 HC	PILOT PLANT	1983-84	QUAST	869/3/82	DESTROYED	1982	Incinerator(us ed before in	Ahmed
136	CONDENS ER 5 M2 HC	PILOT PLANT	1983	QUAST	869/3/82	BROKEN	1982	Tahadi 1990) Thionyl plant (Al-Mamun)	Ahmed
	HC	TOTALLY 25							
137	CONDENS ER 25M2 G	PILOT PLANT	1984	SCHOUT	1073/3/83	BROKEN	1982	D4 plant (Muatasim 3)	Mohamed
138	CONDENS ER 25M2 G	PILOT PLANT	1984	SCHOUT	1073/3/83	BROKEN	1982	D4 plant (Muatasim 3) ***	Mohamed
139	CONDENS ER 25M2 G	PILOT PLANT	1984	SCHOUT	1073/3/83	BROKEN	1982	D4 plant (Muatasim 3)	Mohamed
140	CONDENS ER 10M2 G	PILOT PLANT	1983	QUAST	869/3/82	BROKEN	1982	Pilot Plant / H3(Muatasim 1)	Ahmed
	G	TOTALLY 4							
141	COLUMNS 0.35X5M GLASS LINED	PILOT PLANT	1984	DEDIETRICH	1073/3/83	USED BEFORE	1983	DMPH plant	Ani
142	COLUMNS 0.35X3.5M GLASS LINED	PILOT PLANT	1984	DEDIETRICH	1073/3/83	IN SERVICE	1983	Phenol plant	Ani

143	COLUMNS 1X3 M GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	BRAND NEW	1988	Storage area, South of Phenol plant	1554	General
144	COLUMNS 1X1 M GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	BRAND NEW	1988	Storage area, South of Phenol plant	1555	General
145	COLUMNS 0.45X3MGL ASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	BRAND NEW	1988	Storage area, South of Phenol plant	1556	General
146	COLUMNS 0.8X3M GLASS LINED	I.T	1985	PFAUDLER	1651/3/84	USED BEFORE	1984	PCI3 distillation	1644	General
147	COLUMNS 0.8X3M GLASS LINED	I.T	1985	PFAUDLER	1651/3/84	USED BEFORE	1984	PCI3 distillation	1647	General
148	COLUMNS 0.35X4M GLASS LINED	PILOT PLANT	1984	DEDIETRICH	1073/3/83	USED BEFORE	1983	Stam plant (DMMP) (Dihaa)	1664	Ani
149	COLUMNS 0.35X5M GLASS LINED	PILOT PLANT	1983	SCHOUT	1073/3/83	USED BEFORE	1983	Stam plant (DMMP) (Dihaa)	1665	Mohamed
150	COLUMNS 0.8X3.5M GLASS LINED	PILOT PLANT	1983	SCHOUT	1073/3/83	BRAND NEW	1983	West of first storage building	1685	Mohamed
151	COLUMNS 0.6X3M GLASS LINED	PROTIC	1987	DEDIETRICH	2517/3/87	BRAND NEW	1987	West of first storage building	1686	General
152	COLUMNS 0.6X3M GLASS LINED	PROTIC	1987	DEDIETRICH	2517/3/87	BRAND NEW	1987	West of first storage building	1687	General

153	COLUMNS 0.8X3M GLASS LINED	PROTIC	1987	DEDIETRICH	2517/3/87	BRAND NEW	1987	W- stor.area,10m south of ph.plant	1690	General
154	COLUMNS 0.8X3.5M	PROTIC	1987	DEDIETRICH	2517/3/87	BRAND NEW	1987	W- stor.area,10m south of ph.plant	1691	General
155	GLASS LINED COLUMNS 0.8X3.5M	PROTIC	1987	DEDIETRICH	2517/3/87	BRAND NEW	1987	W- stor.area,10m south of ph.plant	1692	General
156	GLASS LINED COLUMNS 0.8X2.6M	PROTIC	1987	DEDIETRICH	2517/3/87	BRAND NEW	1987	W- stor.area,10m south of ph.plant	1693	General
157	GLASS LINED COLUMNS 0.8X2.6M	PROTIC	1987	DEDIETRICH	2517/3/87	BRAND NEW	1987	W- stor.area,10m south of ph.plant	1694	General
158	GLASS LINED COLUMNS 0.8X3.5M	PROTIC	1987	DEDIETRICH	2517/3/87	BRAND NEW	1987	W- stor.area,10m south of ph.plant	1695	General
159	GLASS LINED COLUMNS 0.8X2.5M	PROTIC	1987	DEDIETRICH	2517/3/87	BRAND NEW	1987	W- stor.area,10m south of ph.plant	1696	General

160	COLUMNS 0.8X2.5M	PROTIC	1987	DEDIETRICH	2517/3/87	BRAND NEW	1987	W- stor.area, 10m south of ph.plant	1697	General
161	GLASS LINED COLUMNS 0.8X3M	PROTIC	1987	DEDIETRICH	2517/3/87	IN SERVICE	1987	Brake fluid formulation building (storage area)	1701	General
162	GLASS LINED COLUMNS 0.8X3.5M	PROTIC	1987	DEDIETRICH	2517/3/87	IN SERVICE	1987	Brake fluid formulation building (storage area)	1702	General
163	GLASS LINED COLUMNS 0.6X2.5M	PROTIC	1987	DEDIETRICH	2517/3/87	IN SERVICE	1985	Brake fluid formulation building Behind the end of storage area	1704	General
164	COLUMNS 0.6X2.5M	PROTIC	1987	DEDIETRICH	2517/3/87	IN SERVICE	1985	Brake fluid formulation building Behind the end of storage area	1706	General
165	GLASS LINED COLUMNS 0.8X9.5M	PROTIC	1987	DEDIETRICH	2517/3/87	BRAND NEW	1987	South of multi purpose building	1711	General
166	GLASS LINED COLUMNS 0.5X1.8M	PROTIC	1987	DEDIETRICH	2517/3/87	BRAND NEW	1987	South of multi purpose building	1713	General

167	COLUMNS 0.6X2.5M GLASS LINED	PROTIC	1987	DEDIETRICH	2517/3/87	BRAND NEW	1987	South of multi purpose building	1714	General
168	COLUMNS 0.5X1.8M GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	BRAND NEW	1987	South of multi purpose building	1715	General
169	COLUMNS 0.4X3M GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	BRAND NEW	1985	Scrap Yard	1723	General
170	COLUMNS 0.4X3M GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	BRAND NEW	1985	Scrap Yard	1724	General
171	COLUMNS 0.6X2.5M GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	BRAND NEW	1985	Scrap Yard	1730	General
172	COLUMNS 0.3X3M GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	BRAND NEW	1985	Scrap Yard	1735	General
173	COLUMNS 0.3X3M GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	BRAND NEW	1985	Scrap Yard	1736	General
174	COLUMNS 0.4X4M GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	BRAND NEW	1987	Scrap Yard	1747	General
175	COLUMNS GLASS LINED 0.8X3M	IT	1985	PFAUDLER	1651/3/84	BROKEN	1984	MPC PLANT (Bin Hayan 2)	1843	General

176	COLUMNS GLASS LINED 0.8X3M						BROKEN		MPC PLANT (Bin Hayan 2)			
177	COLUMNS GLASS LINED 0.4X4M						BROKEN		STAM PLANT (Dihaa)			
178	COLUMNS GLASS LINED 0.4X4M						BROKEN		STAM PLANT (Dihaa)			
179	COLUMNS GLASS LINED 0.35X4M						Thionyl Plant (Al-Mamun)	BROKEN				
180	COLUMNS GLASS LINED	1988	DEDIETRICH	2517/3/87	1985	INSERVIC			IBN BYTAR	1761	General	
181	COLUMNS GLASS	1984	SCHOUT	1073/3/83	1983	DESTROYED			PILOT PLANT (Muatasim I)	1678	PILOT PLANT	
182	COLUMNS GLASS	1984	SCHOUT	1073/3/83	1983	DESTROYED			PILOT PLANT (Muatasim I)	1541	PILOT PLANT	
183	COLUMNS GLASS	1984	SCHOUT	1073/3/83	1983	DESTROYED			PILOT PLANT (Muatasim I)	1542	PILOT PLANT	
184	COLUMNS GLASS	1984	SCHOUT	1073/3/83	1983	DESTROYED			PILOT PLANT (Muatasim I)	1543	PILOT PLANT	
185	COLUMNS GLASS LINED 0.4X4M								(Muatasim I) STAM PLANT (Dihaa)			
186	COLUMNS GLASS 0.4X4M	1985	SCHOUT	1073/3/83	1983	BROKEN			D4 Plant (Muatasim 3)		Mohamad	

187	COLUMNS 0.4 X4M G	NEUBURGE R	1988	SCHOUT	315/3/87	BROKEN	1987	D4 plant (Muatasim 3)	General
	GLASS LINED	TOTALLY 47	-	-					
188	COLUMNS HC 0.3X3.5M	PILOT PLANT	1983	GERMANY	869/3/82	USED BEFORE	1982	DMPH Plant (from Muatasim 2 1987)	Ahmed
189	COLUMNS HC 0.3X3.5M	PILOT PLANT	1983	GERMANY	869/3/82	DESTROYED	1982	DF plant (Muatasim 2)	Ahmed
190	COLUMNS HC 0.3X3.5M	PILOT PLANT	1983	GERMANY	869/3/82	BRAND NEW	1982	scrapyard Falluja /3	Ahmed
191	COLUMNS HC 0.3X3.5M	PILOT PLANT	1983	GERMANY	869/3/82	DESTROYED	1982	DF plant (Muatasim 2)	Ahmed
192	COLUMNS HC 0.3X3.5M	PILOT PLANT	1983	GERMANY	869/3/82	USED BEFORE	1982	DMPH PLANT (from Muatasim 2 1987)	Ahmed
		TOTALLY 5	-	-					
193	COLUMNS 0.5X6M R.L	NEUBURGE R	1988	GERMANY	315/3/87	BROKEN	1987	MPC plant (Bin Hayan 2)	General
		TOTALLY 1	-	-					
194	COLUMNS 0.35X3.5M HALLAR	NEUBURGE R	1988	GERMANY	315/3/87	BRAND NEW	1987	Storage area 10m south of phenol plant Falluja/2	General
195	COLUMNS 0.35X3.5M HALLAR	NEUBURGE R	1988	GERMANY	315/3/87	BRAND NEW	1987	Ditto	General
196	COLUMNS 0.35X3.5M HALLAR	NEUBURGE R	1988	GERMANY	315/3/87	BROKEN	1987	Tahadi	General

197	COLUMNS 0.35X3.5M HALLAR	NEUBURGIE R	1988	GERMANY	315/3/87	BRAND NEW	1987	Storage area 10m south phenol plant	1699	General
198	COLUMNS 0.35X3.5M HALLAR	NEUBURGIE R	1988	GERMANY	315/3/87	BRAND NEW	1987	Storage area south phenol plant	1577	General
199	COLUMNS 0.35X3.5M HALLAR	NEUBURGIE R	1988	GERMANY	315/3/87	BRAND NEW	1987	Storage area south phenol plant	1560	General
200	COLUMNS 0.35X3.5M HALLAR	NEUBURGIE R	1988	GERMANY	315/3/87	BRAND NEW	1987	west of first storage building	1684	General
201	COLUMNS 0.45X3 M HALLAR	NEUBURGIE R	1986	GOOD BROT	666/3/86	BRAND NEW	1986	Storage area south phenol plant	1558	General
202	HALLER TANKS 0.5 M3 GLASS LINED	TOTALLY 8 PROTIC	-	-	-	BRAND NEW	1985	W- sto. area 1,10m south of ph. plant	1689	General
203	TANKS 0.5 M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	USED BEFORE	1987	phenol plant	1551	General
204	TANKS, RE C V.1.4M3	PROTIC	1988	DEDIETRICH	2517/3/87	USED BEFORE	1987	PC13 distillation plant	1638	General
205	GLASS LINED TANKS, RE C V.1.4M3	PROTIC	1988	DEDIETRICH	2517/3/87	USED BEFORE	1987	PC13 distillation plant	1639	General
206	GLASS LINED TANKS, RE C V.1.4M3	PROTIC	1988	DEDIETRICH	2517/3/87	USED BEFORE	1987	PC13 distillation plant	1640	General
	GLASS LINED									

207	TANKS,RE C.V.1.4M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	USED BEFORE	1987	PCI3 distillation plant	1641	General
208	TANKS 1.4 M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	USED BEFORE	1987	phenol plant	1548	General
209	TANKS 1.4 M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	USED BEFORE	1987	phenol plant	1549	General
210	TANKS 1.4 M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	USED BEFORE	1987	phenol plant	1552	General
211	TANKS 2 M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	BRAND NEW	1987	W- sto. area 1,10m south of ph. plant	1698	General
212	TANKS 2 M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	BRAND NEW	1987	Str. area 10m south of phenol plant	1562	General
213	TANKS 0.5 M3 GLASS LINED	NEUBURGE R	1987	DEDIETRICH	315/3/87	BROKEN	1987	Thionyl Plant (Al-Mamun)	1958	General
214	TANKS 2 M3 GLASS LINED	PROTIC	1988	DEDIETRICH	1217/3/87	BROKEN	1987	MPC PLANT (Bin Hayan 2)		General
215	TANKS 2 M3 GLASS LINED	PROTIC	1988	DEDIETRICH	1217/3/87	BROKEN	1987	MPC PLANT (Bin Hayan 2)		General
216	TANKS 2 M3 GLASS LINED	PROTIC	1988	DEDIETRICH	1217/3/87	BROKEN	1987	Thionyl Plant (Al-Mamun)		General
217	TANKS 0.5 M3 GLASS LINED	-	1983-85	-	N.A	USED BEFORE		Stam PLANT(DM MP) (Dihaa)	1658	N.A
218	TANKS 0.8 M3 GLASS LINED	NEUBURGE R	1986	DEDIETRICH	666/3/86	USED BEFORE	1985	Stam PLANT(DM MP) (Dihaa)	1659	General

219	TANKS 1.4 M3 GLASS LINED	NEWBURGE R	1986	DEDIETRICH	666/3/86	USED BEFORE	1985	DMPH Plant	1511	General
220	TANKS 0.8 M3 GLASS LINED	PROFIC	1988	DEDIETRICH	2517/3/87	BROKEN	1987	Nerve gas (Muatasim 4)		General
221	TANKS 0.8 M3 GLASS LINED	-	1983-85	-	N.A	BROKEN		Thionyl Plant (Al-Mamun)		N.A
222	TANKS 10 M3 GLASS LINED	-	1983-85	-	N.A	BROKEN		Thionyl Plant (Al-Mamun)		N.A
223	TANKS 0.8 M3 GLASS LINED	-	1983-85	-	N.A	BROKEN		PILOT PLANT 3 (Muatasim 1)		N.A
224	TANKS 0.5 M3 GLASS LINED	NEW BURGER	1986	DEDIETRICH	666/3/86	USED BEFORE	1985	Stam PLANT (Dihaa)	1660	General
225	TANKS 0.8 M3 GLASS LINED	NEU BURGER	1986	DEDIETRICH	666/3/86	USED BEFORE	1985	Stam PLANT (Dihaa)	1663	General
226	TANKS 1.4 M3 GLASS LINED	NEU BURGER	1986	DEDIETRICH	666/3/86	BROKEN	1985	DMMP PLANT		General
227	TANKS 1.4 M3 GLASS LINED	NEU BURGER	1985	DEDIETRICH	250/3/85	BROKEN	1985	DMMP PLANT		General
228	TANKS 1.4 M3 GLASS LINED	NEU BURGER	1985	DEDIETRICH	250/3/85	BROKEN	1985	DMMP PLANT		General
229	TANKS 2 M3 GLASS LINED	NEU BURGER	1985	DEDIETRICH	250/3/85	BROKEN	1985	DMMP PLANT		General
230	TANKS 0.5 M3 GLASS LINED	NEU BURGER	1985	DEDIETRICH	250/3/85	BROKEN	1985	Thionyl Plant (Al-Mamun)		General

231	TANKS 0.5 M3 GLASS LINED	NEW BURGER	1985	DEDIETRICH	250/3/85	BROKEN	1985	Thionyl Plant (Al-Mamun)	General
	GLASS LINED	TOTALLY 30	-	-	-	-	-	-	-
232	TANKS 2M3	PROTIC	1988	DEDIETRICH	2517/3/87	USED BEFORE	1987	Dichloro Benzen	General
233	TANKS 3M3	PROTIC	1988	DEDIETRICH	2517/3/87	BROKEN	1987	D4 plant (Muatasim 3)	General
234	TANKS 3M3	PROTIC	1988	DEDIETRICH	2517/3/87	BROKEN	1987	MPC plant(Bin Hayan 2)	General
235	TANKS 3M3	QTL	1985	DEDIETRICH	1250/3/84	BROKEN	1984	Stam plant(Dihaa)	Mohamad
236	TANKS 3M3	PROTIC	1988	DEDIETRICH	2517/3/87	BROKEN	1987	Thionyl Plant (Al-Mamun)	General
	GLASS LINED	TOTALLY 6	-	-	-	-	-	-	-
237	TANKS 4M3	PROTIC	1988	DEDIETRICH	2517/3/87	IN SERVICE	1986	Phenol PLANT ****	
	GLASS LINED							1009/1553 General	
238	TANKS 4M3	PROTIC	1988	DEDIETRICH	2517/3/87	BROKEN	1988	D4 PLANT (Muatasim 3)	General
	GLASS LINED								

239	TANKS 4M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	BROKEN	1988	D4 PLANT (Muatasim 3)	General
240	TANKS 4M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	BROKEN	1988	D4 PLANT (Muatasim 3)	General
241	TANKS 4M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	BROKEN	1988	MPC PLANT (Bin Hayan 2)	General
242	TANKS 4M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	BROKEN	1988	MPC PLANT (Bin Hayan 2)	General
243	TANKS 4M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	USED BEFORE	1988	Stam PLANT (Dihaa)	General
244	TANKS 4M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	BROKEN	1988	Thionyl plant (Al-Mamun)	General
245	TANKS 4M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	BROKEN	1988	Thionyl Plant (Al-Mamun)	General
246	TANKS 4M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	BROKEN	1987	Thionyl Plant (Al-Mamun)	General
247	TANKS 4M3 GLASS LINED	NEUBURGE R	1987	DEDIETRICH	315/3/87	BROKEN	1987	Pilot PLANT 3 (Muatasim I)	General
248	TANKS 4M3 GLASS LINED	NEUBURGE R	1987	DEDIETRICH	315/3/87	USED BEFORE	1987	DMPH Plant	General

249	TANKS 4M3 GLASS LINED	NEUBURGE R	1987	DEDIETRICH	315/3/87	USED BEFORE	1987	DMPH Plant	1515	General
250	TANKS 4M3 GLASS LINED	NEUBURGE R	1987	DEDIETRICH	315/3/87	IN SERVICE	1987	Production Building 3	1576	General
251	TANKS 4M3 GLASS LINED	NEUBURGE R	1987	DEDIETRICH	315/3/87	IN SERVICE	1987	Production Building 3	1577	General
252	TANKS 4M3 GLASS LINED	NEUBURGE R	1987	DEDIETRICH	315/3/87	USED BEFORE	1987	Stam PLANT (Dihaa)	1671	General
253	TANKS 4M3 GLASS LINED	NEUBURGE R	1987	DEDIETRICH	315/3/87	IN SERVICE	1987	AL-QAQA	1907	MC1
254	TANKS 4M3 GLASS LINED	NEUBURGE R	1987	DEDIETRICH	315/3/87	IN SERVICE	1987	AL-QAQA		MC1
255	TANKS 4M3 GLASS LINED	NEUBURGE R	1987	DEDIETRICH	315/3/87	IN SERVICE	1987	AL-QAQA		MC1
		TOTALLY 19	-	-						
256	TANKS 6M3 GLASS LINED	PROTIC	1987	DEDIETRICH	2517/3/87	USED BEFOR	1987	PCI3 distillation	1648	General
257	TANKS 6M3 GLASS LINED	PROTIC	1987	DEDIETRICH	2517/3/87	BROKEN	1987	D4 PLANT (Muatasim 3)		General

258	TANKS 6M3 GLASS LINED	I.T	1985	PFAUDLER	1651/3/84	BROKEN	1984	MPC PLANT(Bin Hayan 2)	General
259	TANKS 6M3 GLASS LINED	I.T	1985	PFAUDLER	1651/3/84	BROKEN	1984	Thionyl Plant (Al-Mamun)	General
	TOTALLY 4		-	-					
260	GLASS LINED TANKS 10M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	BROKEN	1987	Tahadi	General
261	TANKS 10M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	BROKEN	1987	Muster plant (Bin Hayan 1)	General
262	TANKS 10M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	USED BEFORE	1987	DMPH PLANT	General
263	TANKS 10M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	BRAND NEW	1987	Stor.area at eastern corner of site	General
	TOTALLY 4		-	-					
264	GLASS LINED TANKS 20M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	BROKEN	1987	Mustard PLANT (Bin Hayan 1)	General
265	TANKS 20M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	BROKEN	1987	Production building/4	General

266	TANKS 20M3 GLASS LINED	NEU BURGER	1985	DEDIETRICH	250/3/85	BROKEN	1985	PCI3 production PLANT(use in mustard plant)	General
	GLASS LINED	TOTALLY 3	-	-					
267	VESSEL 2 M3 HC	LENHARDT	1984	QUAST	1315/3/84	IN SERVICE	1984	Pesticide PLANT (Falluja 3)	General
268	VESSEL 6 M3 HC	PILOT PLANT	1983	QUAST	869/3/82	BROKEN	1982	DF PLANT(muata sim 2)	Ahmed
269	VESSEL 8 M3 HC	NEUBURGE R	1985	QUAST	250/3/85	IN SERVICE	1985	Production PLANT (Falluja 3)	General
270	VESSEL 8 M3 HC	LENHARDT	1984	QUAST	1315/3/84	IN SERVICE	1984	Production building / 3	General
271	VESSEL 2 M3 S.S	TOTALLY 4 LENHARDT	1984	QUAST	1315/3/84	BROKEN	1984	DF PLANT (Muatasim 2)	General
272	VESSEL 2 M3 S.S	LENHARDT	1984	QUAST	1315/3/84	BROKEN	1984	DF PLANT (Muatasim 2)	General
273	VESSEL 2 M3 S.S	LENHARDT	1984	QUAST	1315/3/84	BROKEN	1984	DF PLANT (Muatasim 2)	Ahmed
274	VESSEL 2 M3 S.S	PILOT PLANT	1983	QUAST	899/3/82	BROKEN	1982	DF PLANT (Muatasim 2)	Ahmed
275	VESSEL 5 M3	TOTALLY 4 WET	1987	GERMANY	423/3/86	USED BEFORE	1986	DMPH Plant	PCI3&POCI3
276	HALLAR VESSEL 3 M3	WET	1987	GERMANY	423/3/86	IN SERVICE	1986	FeCl3 PLANT Falluja 2	PCI3&POCL3
277	HALLAR VESSEL 5 M3	NEWBURGE R	1986	GERMANY	666/3/86	BROKEN	1985	Thionyl Plant (Al-Mamun)	General
278	HALLAR VESSEL 5 M3	WET	1986	N.A	N.A	BROKEN	N.A	Thionyl Plant (Al-Mamun)	N.A

279	VESSEL 5 M3 HALLAR	NEWBURGE R	1986	GERMANY	666/3/86	BROKEN	1986	DMPH Plant	General
280	VESSEL 2.6 M3 HALLAR	N.A	N.A	LITTECL FRANCE N.A	1987	Storage Area Falluja 2	NEW	1681	N.A
281	VESSEL 5 M3 HALLAR	NEWBURGE R	1986	GERMANY	666/3/86	NEW	1986	Storage Area Falluja 3	General
282	VESSEL 5 M3 HALLAR	NEWBURGE R	1986	GERMANY	666/3/96	NEW	1986	Storage Area Falluja 3	General
283	VESSEL 5 M3 HALLAR	NEWBURGE R	1986	GERMANY	666/3/86	NEW	1986	Storage Area Falluja 3	General
284	VESSEL 5 M3 HALLAR	NEWBURGE R	1986	GERMANY	666/3/86	NEW	1986	Storage Area Falluja 3	General
285	VESSEL 5 M3 HALLAR	N.A	N.A	N.A	N.A	BROKEN	N.A	Sarine PLANT (Muatasim 4)	N.A
286	VESSEL 0.8 M3 TEFZEL	PILOT PLANT	1985	N.A	N.A	BROKEN	N.A	MPC PLANT (Bin Hayan-2)	N.A
287	VESSEL 0.8 M3 TEFZEL	PILOT PLANT	1985	N.A	N.A	BROKEN	N.A	MPC PLANT (Bin Hayan-2)	N.A
288	VESSEL 0.8 M3 TEFZEL	PILOT PLANT	1985	N.A	N.A	BROKEN	N.A	MPC PLANT (Bin Hayan-2)	N.A
289	VESSEL 0.8 M3 TEFZEL	PILOT PLANT	1985	N.A	N.A	BROKEN	N.A	MPC PLANT (Bin Hayan-2)	N.A
290	TEFZEL VESSEL 3 M3 GLASS LINED	QTL	1985	DEDIEERICH	1250/3/84	IN SERVICE	1984	IBN BAYTAR	Mohamad
291	VESSEL 2 M3 GLASS LINED	PROTIC	1988	DEDIEERICH	2517/3/87	IN SERVICE	1987	IBN BAYTAR	General

292	VESSEL 2 M3 GLASS LINED	PROTIC	1988	DEDIEERICH	2517/3/87	IN SERVICE	1987	IBN BAYTAR	1763	General
293	VESSEL 1.4 M3 GLASS LINED	NEUBURGE R	1986	DEDIEERICH	666/3/86	IN SERVICE	1985	IBN BAYTAR	1760	General
294	VESSEL 0.8 M3 GLASS LINED	NEUBURGE R	1987	DEDIETRICH	315/3/87	BROKEN	1987	D4 PLANT (Muatasim 3)	1853	General
295	VESSEL 0.8 M3 GLASS LINED	NEUBURGE R	1987	DEDIETRICH	315/3/87	BROKEN	1987	D4 PLANT (Muatasim 3)	1836	General
296	VESSEL 0.8 M3 GLASS LINED	NEUBURGE R	1987	DEDIETRICH	315/3/87	BROKEN	1987	D4 PLANT (Muatasim 3)		General
297	VESSEL 0.8 M3 GLASS LINED	NEUBURGE R	1987	DEDIETRICH	315/3/87	BROKEN	1987	D4 PLANT (Muatasim 3)		General
	GLASS LIND	TOTALLY 8	-	-						
298	TANK 6 M3 PVDF	LENHARDT	1984	GERMANY	1315/3/84		1984	DF plant (Muatasim 2)		General
299	TANK 2 M3 PVDF	LENHARDT	1984	GERMANY	1315/3/84		1984	DF plant (Muatasim 2)		General
300	TANK 2 M3 PVDF	LENHARDT	1984	GERMANY	1315/3/84		1984	DF plant (Muatasim 2)		General
301	TANK 4 M3 PVDF	PILOT	1983	GERMANY	1073/3/83		1982	Falluja-2		Ani
302	TANK 4 M3 PVDF	PILOT	1983	GERMANY	1073/3/83		1982	Falluja-2		Ani
303	TANK 6 M3 PVDF	PILOT	1983	GERMANY	899/3/82		1982	DF plant (Muatasim 2)		Ani
304	TANK 6 M3 PVDF	PILOT	1983	GERMANY	899/3/82		1982	DF plant (Muatasim 2)		Ani
305	TANK 6 M3 PVDF	PILOT	1983	GERMANY	869/3/82		1982	DF plant (Muatasim 2)		Ahmed
306	TANK 6 M3 PVDF	PILOT	1983	GERMANY	869/3/82		1982	DF plant (Muatasim 2)		Ahmed
307	TANK 6 M3 PVDF	PILOT	1983	GERMANY	869/3/82		1982	DF plant (Muatasim 2)		Ahmed

328	TANK 6 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982	Falluja /3	Ahmed
329	TANK 6 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982	Falluja /3	Ahmed
330	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982	Pilot Plant/H3 (Muatasim 1)	Ahmed 1852
331	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982	Pilot Plant (Muatasim 1)	Ahmed
332	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982	Pilot Plant (Muatasim 1)	Ahmed
333	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982	Stam Plant (Dihaa)	Ahmed
334	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982	Stam Plant (Dihaa)	Ahmed
335	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982	Stam Plant (Dihaa)	Ahmed
336	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982	Nerve Gas(Muatasim 4)	Ahmed
337	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982	Nerve Gas(Muatasim 4)	Ahmed
338	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982	Pilot Plant (Muatasim 1)	Ahmed
339	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982	Pilot Plant (Muatasim 1)	Ahmed
340	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982	Pilot Plant (Muatasim 1)	Ahmed
	TOTALY 43 PVDF	-	-	-	-			

* : Used before in Thionyl plant & damaged during construction Thionyl chloride plant consist three unites, Thionyl chloride , MPC and MPF unites were used to produced same batches only from these precursors.

** : Reactor 2.5 M3 (item 19) was used as a buffer in D4 Plant (Muatasim3).

*** : Sparc parts for plant.

**** : Two Tag No. on the same tank.

Note : Status (BROKEN) means that the equipments are under debris.

TYPES & QUANTITIES OF PRODUCTION EQUIPMENT PROCURED FOR CW - PROGRAMME 5 FEBRUARY 1996 I.Ahmed Project

NO.	DESCRIPTION OF ITEM	EXPORTER	YEAR OF EXP	MANUFA CT.	I.C NO.	YEAR OF MANF.	STATUS	PRESENT LOCATION	TAG NO.
1	REACTORS IM3 HC	PILOT PLANT	1983	QUAST	869/3/82	1982	BROKEN	DF plant (6)	1650
2	REACTORS IM3 HC	PILOT PLANT	1983	QUAST	869/3/82	1982	BROKEN	DF plant (6)	1655
3	REACTORS IM3 IIC	PILOT PLANT	1983	QUSAT	869/3/82	1982	BROKEN	DF plant (7)	--
4	REACTORS IM3 HC	PILOT PLANT	1983	QUAST	869/3/82	1982	BROKEN	DF plant (7)	--
5	HEAT EXCHANGERS 0.3X2M HC 2.5 M2	PILOT PLANT	1983	QUAST	869/3/82	1982	BROKEN	Mustard gas	
6	HEAT EXCHANGERS 0.4X1.5M HC 7.5 M2	PILOT PLANT	1983	QUAST	869/3/82	1982	IN SERVICE	Phenol plant	1005
7	HEAT EXCHANGERS 0.4X3.5M HC 20 M2	PILOT PLANT	1983	QUAST	869/3/82	1982	Destroyed	DF Plant	1517
8	HEAT EXCHANGERS 0.4X3.5M HC	PILOT PLANT	1983	QUAST	869/3/82	1982	Destroyed	DF Plant	1518
9	HEAT EXCHANGERS 0.4X3.5M HC	PILOT PLANT	1983	QUAST	869/3/82	1982	Destroyed	DF Plant (6)	1519

10	HEAT EXCHANGERS 0.3MX1M C HC	PILOT PLANT	1983	QUAST	869/3/82	1982	Destroyed	DF Plant (6)	1520
11	HEAT EXCHANGERS HC 2.5M2	PILOT PLANT	1983	QUAST	869/3/82	1982	Destroyed	DF Plant (7)	1521
12	HEAT EXCHANGERS HC 2.5M2	PILOT PLANT	1983	QUAST	869/3/82	1982	BROKEN	Thionyl plant	
13	HEAT EXCHANGERS HC 2.5M2	PILOT PLANT	1983	QUAST	869/3/82	1982	BROKEN	Thionyl plant	
14	HEAT EXCHANGERS HC 2.5M2	PILOT PLANT	1983	QUAST	869/3/82	1982	BROKEN	Thionyl plant	
15	HEAT EXCHANGERS HC	PILOT PLANT	1983	QUAST	869/3/82	1982	IN SERVICE	Phenol plant	1006
16	CONDENSER 7.5 HC	PILOT PLANT	1983	QUAST	869/3/82	1982	BROKEN	D4 plant	
17	CONDENSER 7.5 HC	PILOT PLANT	1983	QUAST	869/3/82	1982	BROKEN	D4 plant	
18	CONDENSER 7.5 HC	PILOT PLANT	1983	QUAST	869/3/82	1982	BROKEN	Stam plant	
19	CONDENSER 7.5 HC	PILOT PLANT	1983	QUAST	869/3/82	1982	BROKEN	Stam plant	
20	CONDENSER HC 20M2	PILOT PLANT	1983	QUAST	869/3/82	1982	DESTROYED	Sarin plant	1534
21	CONDENSER HC	PILOT PLANT	1983	QUAST	869/3/82	1982	BROKEN	DF plant	
22	CONDENSER HC	PILOT PLANT	1983	QUAST	869/3/82	1982	BROKEN	DF plant	
23	CONDENSER HC	PILOT PLANT	1983	QUAST	869/3/82	1982	BROKEN	Pilot Plant	

24	CONDENSER HC	PILOT PLANT	1983-84	QUAST	869/3/82	1982	DESTROYED	Incinerator	
25	CONDENSER HC	PILOT PLANT	1983	QUAST	869/3/82	1982	BROKEN	Thionyl plant	
26	COLUMNS 0.3X3.5M HC	PILOT PLANT	1983	GERMANY	869/3/82	1982	USED BEFORE	DMPH Plant 1505	
NO.	DESCRIPTION OF ITEM	EXPORTER	YEAR OF EXP.	MANUFACT.	I.C. NO.	YEAR OF MANF.	STATUS	PRESENT LOCATION	TAG NO.
27	COLUMNS HC 0.3X3.5M	PILOT PLANT	1983	GERMANY	869/3/82	1982	Destroyed	DF plant	1522
28	COLUMNS HC 0.3X3.5M	PILOT PLANT	1983	GERMANY	869/3/82	1982	BRAND NEW	scrap yard Falluja /3	1933
29	COLUMNS HC	PILOT PLANT	1983	GERMANY	869/3/82	1982	Destroyed	DF plant	1523
30	COLUMNS HC	PILOT PLANT	1983	GERMANY	869/3/82	1982	USED BEFORE	DMPH PLANT	1506
31	VESSEL 5 M3 HC	PILOT PLANT	1983	QUAST	869/3/82	1982	IN SERVICE	DF PLANT	
32	VESSEL 2.8 M3 HC	LENHARDT	1984	QUAST	1315/3/84	1984	BROKEN	DF PLANT	
33	VESSEL 2 M3 HC	PILOT PLANT	1983	QUAST	899/3/82	1982	BROKEN	DF PLANT	
34	TANK 5 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982			
35	TANK 5 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982			
36	TANK 5 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982			
37	TANK 5 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982			
38	TANK 5 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982			

39	TANK 5 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982
40	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982
41	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982
42	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982
43	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982
44	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982
45	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982
46	TANK 5 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982
47	TANK 5 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982
48	TANK 5 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982
49	TANK 5 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982
50	TANK 5 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982
51	TANK 5 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982
52	TANK 5 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982
53	TANK 5 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982
54	TANK 5 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982
55	TANK 5 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982
56	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982
57	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982

58	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982
59	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982
60	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982
61	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982
62	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982
63	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	869/3/82	1982

2. Mohammed Project

NO.	DESCRIPTION OF ITEM	EXPORTER	YEAR OF EXP.	MANUFACT.	LC NO.	YEAR OF	STATUS	PRESENT LOCATION	TAG NO.
1	REACTORS 1.6M3 GLASS LINED	Q.T.L	1985	DEDIETRICH	1250/3/84	MANF. 1985	IN SERVICE	Production building 4	1580
2	REACTORS 1.6M3 GLASS LINED	Q.T.L	1985	DEDIETRICH	1250/3/84	1984	BROKEN	MPC plant	--
3	REACTORS 1.6M3 GLASS LINED	Q.T.L	1985	DEDIETRICH	1250/3/84	1984	BROKEN	MPC plant	--
4	REACTORS 1.6M3 GLASS LINED	PILOT PLANT	1984	PFAUDLER	1073/3/83	1983	BROKEN	DF plant (7)	--
5	REACTORS 1.6M3 GLASS LINED	PILOT PLANT	1984	PFAUDLER	1073/3/83	1983	USED BEFORE	Ferric chloride	1275
6	REACTORS 1.6M3 GLASS LINED	PILOT PLANT	1984	PFAUDLER	1073/3/83	1983	BROKEN	Thionyl plant	--
7	REACTORS 1.6M3 GLASS LINED	PILOT PLANT	1984	PFAUDLER	1073/3/83	1983	IN SERVICE	AL-QAQA ,TARIK FACTORY	1617
8	REACTORS 2M3 GLASS LINED	PILOT PLANT	1984	SOMMER	1073/3/83	1983	PARTIAL LY DES.	Beside workshop	1020
9	REACTORS 2M3 GLASS LINED	PILOT PLANT	1984	SOMMER	1073/3/83	1983	PARTIAL LY DES.	Beside workshop	1021
10	CONDENSER HC 20M2	IT	1985	GERMANY	1651/3/84	1984	USED BEFORE	PCL3 DISTILLATI ON PLANT	1645
11	CONDENSER HC 20M2	IT	1985	GERMANY	1651/3/84	1984	BROKEN	MPC plant	
12	CONDENSER G 25M2	PILOT PLANT	1984	SCHOUT	1073/3/83	1982	BROKEN	D4 plant	
13	CONDENSER G 25M2	PILOT PLANT	1984	SCHOUT	1073/3/83	1982	BROKEN	Thionyl plant	

14	COLUMNS 0.35X5M GLASS	PILOT PLANT	1983	SCHOUT	1073/3/83	1983	USED BEFORE	Stam plant (DMMP)	1665
15	COLUMNS 0.8X3.5M GLASS	PILOT PLANT	1983	SCHOUT	1073/3/83	1983	BRAND NEW	West of first storage building D4 PLANT	1685
16	COLUMNS GLASS LINED 0.4X4M	PILOT PLANT	1985	DEDIETRICH	1073/3/83	1983	BROKEN		
17	COLUMNS GLASS	PILOT PLANT	1984	SCHOUT	1073/3/83	1983	DESTRO YED	PILOT PLANT	1678
18	COLUMNS GLASS	PILOT PLANT	1984	SCHOUT	1073/3/83	1983	DESTRO YED	PILOT PLANT	1541
19	COLUMNS GLASS	PILOT PLANT	1984	SCHOUT	1073/3/83	1983	DESTRO YED	PILOT PLANT	1542
20	COLUMNS GLASS	PILOT PLANT	1984	SCHOUT	1073/3/83	1983	DESTRO YED	PILOT PLANT	1543
21	TANKS 3M3 GLASS LINED	PROTIC	1985	DEDIETRICH	2517/3/87	1984	USED BEFORE	STORAGE AREA FALLUJA 3 IBN BAYTAR	1925
22	VESSEL 3 M3 GLASS LINED	QTL	1985	DEDIETRICH	1250/3/84	1984	INSERVI C		1759
23	TANK 6 M3 PVDF	PILOT PLANT	1983	GERMANY	1073/3/83	1983			
24	TANK 6 M3 PVDF	PILOT PLANT	1983	GERMANY	1073/3/83	1983			
25	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	1073/3/83	1983			
26	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	1073/3/83	1983			
27	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	1073/3/83	1983			
28	TANK 2 M3 PVDF	PILOT PLANT	1983	GERMANY	1073/3/83	1983			

3. Ani Project

NO	DESCRIPTION OF ITEM	EXPORTER	YEAR OF EXP.	MANUFACT.	LC NO.	YEAR OF MANF.	STATUS	PRESENT LOCATION	TAG NO.	NOTE
1	REACTORS 1.6M3 GLASS LINED	PILOT PLANT	1984	PFAUDLER	1073/3/83	1983	USED BEFORE	DMPH plant	1501	
2	REACTORS 1.6M3 GLASS LINED	PILOT PLANT	1984	PFAUDLER	1073/3/83	1983	USED BEFORE	DMPH plant	1503	
3	COLUMNS 0.35X5M GLASS LINED	PILOT PLANT	1984	DEDIETRICH	1073/3/83	1983	USED BEFORE	DMPH plant	1504	
4	COLUMNS 0.35X3.5M GLASS LINED	PILOT PLANT	1984	DEDIETRICH	1073/3/83	1983	IN SERVICE	Phenol plant	1550	
5	COLUMNS 0.35X4M GLASS LINED	PILOT PLANT	1984	DEDIETRICH	1073/3/83	1983	USED BEFORE	Stam plant (DMMP)	1664	
6	VESSEL 0.5 M3 TEFZEL	PILOT PLANT	1985	GERMANY	1073/3/83	1983	BROKEN	DMMP PLANT		
7	VESSEL 0.5 M3 TEFZEL	PILOT PLANT	1985	GERMANY	1073/3/83	1982	BROKEN	DMMP PLANT		
8	VESSEL 0.5 M3 TEFZEL	PILOT PLANT	1985	GERMANY	1073/3/83	1982	BROKEN	DMMP PLANT		
9	VESSEL 0.5 M3 TEFZEL	PILOT PLANT	1985	GERMANY	1073/3/83	1982	BROKEN	DMMP PLANT		

10	TANK 4 M3 PVDF	PILOT PLANT	1983	GERMANY	1073/3/83	1982			
11	TANK 4 M3 PVDF	PILOT PLANT	1983	GERMANY	1073/3/83	1982			
12	TANK 6 M3 PVDF	PILOT PLANT	1983	GERMANY	1073/3/83	1982			
13	TANK 6 M3 PVDF	PILOT PLANT	1983	GERMANY	1073/3/83	1982			

4. MC1 PROJECT

NO.	DESCRIPTION OF ITEM	EXPOR TER	YEAR OF EXP.	MANUFACT.	LC NO.	YEAR OF MANF.	STATUS	PRESENT LOCATION	TAG NO.
1	HEAT EXCHANGERS 0.5X0.5X3M ,15M2 GRAPHITE	NEUBU RGER	1987	SIGRIE	315/3/87	1987	IN SERVICE	Brake fluid building, behind far end of storage inside container	1707
2	HEAT EXCHANGERS 0.5X0.5X3M ,15M2 GRAPHITE	NEUBU RGER	1987	SIGRIE	315/3/87	1987	IN SERVICE	Brake fluid building, behind far end of storage inside container	1708
3	HEAT EXCHANGERS 0.5X0.5X3M ,15M2 GRAPHITE	NEUBU RGER	1987	SIGRIE	315/3/87	1987	BRAND NEW	Scrap yard	1725
4	HEAT EXCHANGERS 0.5X0.5X3M ,15M2 GRAPHITE	NEUBU RGER	1987	SIGRIE	315/3/87	1987	BRAND NEW	Scrap yard	1727

5	EXCHANGERS 0.5X0.5X3M ,15M2 GRAPHITE HEAT EXCHANGERS 0.5X0.5X3M ,15M2 GRAPHITE HEAT EXCHANGERS 0.4X3M, 20M2 HC HEAT EXCHANGERS 0.4X3M, 20M2 HC HEAT EXCHANGERS 0.4X3M, 20M2 HC HEAT EXCHANGERS 0.3X1M HC HEAT EXCHANGERS 0.3X1.2M HC HEAT EXCHANGERS 0.3X1.6M	RGER NEUBU RGER WET WET WET WET WET WET WET	1987 1987 1987 1987 1987 1987 1987 1987	SIGRIE CABOT CABOT CABOT QUAST QUAST QUAST	315/3/87 7/3/87 7/3/87 7/3/87 7/3/87 7/3/87 7/3/87	1987 1986 1986 1986 1987 1987 1987	BRAND NEW IN SERVICE IN SERVICE USED BEFORE INSERVICE INSERVICE USED BEFORE	Scrap yard Storage area 50 m south west of phenol plant phenol plant DMPH plant. Phenol plant Phenol plant Stam plant (DMMP)	1728 1567 1568 1510 1004 1007
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12	HC HEAT EXCHANGERS 0.3X1.6M HC	WET	1987	QUAST	7/3/87	1987	BROKEN	Stam plant	
13	CONDENSER T 5M2 HC	WET	1987	CABOT	7/3/87	1986	IN SERVICE	Phenol plant	1008
14	CONDENSER T 5M2 HC	WET	1987	CABOT	7/3/87	1986	IN SERVICE	Phenol plant	1903
15	CONDENSER T 5M2 HC	WET	1987	CABOT	7/3/87	1986	IN SERVICE	Phenol plant	1905
16	CONDENSER T 20M2 HC	WET	1987	GERMANY	7/3/87	1986	USED BEFORE	Stam plant(DMMP)	1508
17	CONDENSER T 20M2 HC	WET	1987	GERMANY	7/3/87	1986	USED BEFORE	Stam plant (DMMP)	1656
18	CONDENSER T 20M2 HC	WET	1987	GERMANY	7/3/87	1986	USED BEFORE	Stam plant (DMMP)	1657
19	CONDENSER T 20M2 HC	WET	1987	CABOT	7/3/87	1986	IN SERVICE	Phenol plant	1003
20	CONDENSER 20M2 HC	WET	1987	GERMANY	7/3/87	1986	USED BEFORE	PC13 Distillation	1646

NO.	DESCRIPTION OF ITEM	EXPOR TER	YEAR OF EXP.	MANUFACT.	LC NO.	YEAR OF MANF.	STATUS	PRESENT LOCATION	TAG NO.
21	CONDENSER HC COLUMNS	WET	1987	GERMANY	7/3/87	1986	BROKEN	Thionyl plant	
22	0.35X3.5M HALLAR	NEUBU RGER	1988	GERMANY	315/3/87	1987	USED BEFORE	Storage area Falluja 2	1557

0099

23	COLUMNS 0.35X3.5M HALLAR	NEUBU RGER	1988	GERMANY	315/3/87	1987	BRAND NEW	Storage area 10m south of phenol plant Falluja/2	1572
24	COLUMNS 0.35X3.5M HALLAR	NEUBU RGER	1988	GERMANY	315/3/87	1987	BRAND NEW	Ditto	1571
25	COLUMNS 0.35X3.5M HALLAR	NEUBU RGER	1988	GERMANY	315/3/87	1987	BROKEN	Pilot plant	
26	COLUMNS 0.35X3.5M HALLAR	NEUBU RGER	1988	GERMANY	315/3/87	1987	BROKEN	D4 plant	
27	COLUMNS 0.35X3.5M HALLAR	NEUBU RGER	1988	GERMANY	315/3/87	1987	BRAND NEW	Stor. area 10m south phenol plant	1699
28	COLUMNS 0.35X3.5M HALLAR	NEUBU RGER	1988	GERMANY	315/3/87	1987	BRAND NEW	Storage area south phenol plant	----
29	COLUMNS 0.35X3.5M HALLAR	NEUBU RGER	1988	GERMANY	315/3/87	1987	BRAND NEW	Storage area south phenol plant	1560
30	COLUMNS 0.35X3.5M HALLAR	NEUBU RGER	1988	GERMANY	315/3/87	1987	BRAND NEW	west of first storage building	1684
31	TANKS 0. 5M3 GLASS LINED	NEUBU RGER	1987	DEDIETRICH	315/3/87	1987	BROKEN	D4 PLANT	
32	TANKS 0. 5M3 GLASS LINED	NEUBU RGER	1987	DEDIETRICH	315/3/87	1987	BROKEN	D4 PLANT	
33	TANKS 0. 5M3 GLASS LINED	NEUBU RGER	1987	DEDIETRICH	315/3/87	1987	BROKEN	D4 PLANT	
34	TANKS 0. 5M3 GLASS LINED	NEUBU RGER	1987	DEDIETRICH	315/3/87	1987	BROKEN	D4 PLANT	
35	TANKS 0. 5M3 GLASS LINED	NEUBU RGER	1987	DEDIETRICH	315/3/87	1987	BROKEN	MPC PLANT	
36	TANKS 4M3 GLASS LINED	NEUBU RGER	1987	DEDIETRICH	315/3/87	1987	USED BEFORE	DMPH	1516
37	TANKS 4M3 GLASS	NEUBU RGER	1987	DEDIETRICH	315/3/87	1987	USED BEFORE	DMPH	1515

8	COLUMNS 1X1M GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1988	BRAND NEW	Storage area, South of Phenol plant	1555
9	COLUMNS 0.8X3M GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1988	BRAND NEW	Storage area, South of Phenol plant	1556
10	COLUMNS 0.6X3M GLASS LINED	PROTIC	1987	DEDIETRICH	2517/3/87	1987	BRAND NEW	West of first storage building	1686
11	COLUMNS 0.6X3M GLASS LINED	PROTIC	1987	DEDIETRICH	2517/3/87	1987	BRAND NEW	West of first storage building	1687
12	COLUMNS 0.8X3M GLASS LINED	PROTIC	1987	DEDIETRICH	2517/3/87	1987	BRAND NEW	W- stor. area, 10m south of ph. plant	1690
13	COLUMNS 0.8X3.5M	PROTIC	1987	DEDIETRICH	2517/3/87	1987	BRAND NEW	W- stor. area, 10m south of ph. plant	1691
14	COLUMNS 0.8X3.5M	PROTIC	1987	DEDIETRICH	2517/3/87	1987	BRAND NEW	W- stor. area, 10m south of ph. plant	1692
15	GLASS LINED COLUMNS 0.8X2.6M	PROTIC	1987	DEDIETRICH	2517/3/87	1987	BRAND NEW	W- stor. area, 10m south of ph. plant	1693
16	GLASS LINED COLUMNS 0.8X2.6M	PROTIC	1987	DEDIETRICH	2517/3/87	1987	BRAND NEW	W- stor. area, 10m south of ph. plant	1694
17	GLASS LINED COLUMNS 0.8X3.5M	PROTIC	1987	DEDIETRICH	2517/3/87	1987	BRAND NEW	W- stor. area, 10m south of ph. plant	1695
18	GLASS LINED COLUMNS 0.8X2.5M	PROTIC	1987	DEDIETRICH	2517/3/87	1987	BRAND NEW	W- stor. area, 10m south of ph. plant	1696
19	GLASS LINED COLUMNS 0.8X2.5M	PROTIC	1987	DEDIETRICH	2517/3/87	1987	BRAND NEW	W- stor. area, 10m south of ph. plant	1697

20	COLUMNS 0.8X3M GLASS LINED	PROTIC	1987	DEDIETRICH	2517/3/87	1987	IN SERVICE	Brake fluid formulation building	1701
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NO.	DESCRIPTION OF ITEM	EXPOR TER	YEAR OF EXP.	MANUFACT.	LC NO.	YEAR OF MANF.	STATUS	PRESENT LOCATION	TAG NO.
21	COLUMNS 0.8X3.5M GLASS LINED	PROTIC	1987	DEDIETRICH	2517/3/87	1987	IN SERVICE	Brake fluid formulation building	1702
22	COLUMNS 0.6X2.5M GLASS LINED	PROTIC	1987	DEDIETRICH	2517/3/87	1985	IN SERVICE	Brake fluid formulation building behind the end of storage area	1704
23	COLUMNS 0.6X2.5M GLASS LINED	PROTIC	1987	DEDIETRICH	2517/3/87	1985	IN SERVICE	Brake fluid formulation building behind the end of storage area	1706
24	COLUMNS 0.8X9.5M GLASS LINED	PROTIC	1987	DEDIETRICH	2517/3/87	1987	BRAND NEW	South of multi purpose building	1711
25	COLUMNS 0.5X1.8M GLASS LINED	PROTIC	1987	DEDIETRICH	2517/3/87	1987	BRAND NEW	South of multi purpose building	1713
26	COLUMNS 0.6X2.5M GLASS LINED	PROTIC	1987	DEDIETRICH	2517/3/87	1987	BRAND NEW	South of multi purpose building	1714
27	COLUMNS	PROTIC	1988	DEDIETRICH	2517/3/87	1987	BRAND NEW	South of multi purpose	1715

28	0.5X1.8M GLASS LINED COLUMNS 0.4X3M GLASS LINED,	PROTIC	1988	DEDIETRICH	2517/3/87	1985	BRAND NEW	building Scrap Yard	1723
29	COLUMNS 0.4X3M GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1985	BRAND NEW	Scrap Yard	1724
30	COLUMNS 0.6X2.5M	PROTIC	1988	DEDIETRICH	2517/3/87	1985	BRAND NEW	Scrap Yard	1730
31	GLASS LINED COLUMNS 0.3X3M GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1985	BRAND NEW	Scrap Yard	1735
32	COLUMNS 0.3X3M GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1985	BRAND NEW	Scrap Yard	1736
33	COLUMNS 0.4X4M GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1987	BRAND NEW	Scrap Yard	1926
34	COLUMNS GLASS LINED	PROTIC	1988	EDIETRICH	2517/3/87	1985	INSERVIC	IBN BYTAR	1761
35	TANKS 0.57M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1985	BRAND NEW	W- sto.area1,10m south of ph.plant	1689

NO.	DESCRIPTION OF ITEM	EXPOR TER	YEAR OF EXP.	MANUFACT.	LC NO.	YEAR OF MANF.	STATUS	PRESENT LOCATION	TAG NO.
36	TANKS 0.5 M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1987	USED BEFORE	phenol plant	1551
37	TANKS,REC V.1.4M3	PROTIC	1988	DEDIETRICH	2517/3/87	1987	USED BEFORE	PCI3 distillation plant	1638

38	GLASS LINED TANKS, REC V.1.4M3	PROTIC	1988	DEDIETRICH	2517/3/87	1987	USED BEFORE	PCI3 distillation plant	1639
39	GLASS LINED TANKS, REC V.1.4M3	PROTIC	1988	DEDIETRICH	2517/3/87	1987	USED BEFORE	PCI3 distillation plant	1640
40	GLASS LINED TANKS, REC V.1.4M3	PROTIC	1988	DEDIETRICH	2517/3/87	1987	USED BEFORE	PCI3 distillation plant	1641
41	GLASS LINED TANKS 1.2M3	PROTIC	1988	DEDIETRICH	2517/3/87	1987	USED BEFORE	phenol plant	1548
42	GLASS LINED TANKS 1.4M3	PROTIC	1988	DEDIETRICH	2517/3/87	1987	USED BEFORE	phenol plant	1902
43	GLASS LINED TANKS 1.4M3	PROTIC	1988	DEDIETRICH	2517/3/87	1987	USED BEFORE	phenol plant	1552
44	GLASS LINED TANKS 2 M3	PROTIC	1988	DEDIETRICH	2517/3/87	1987	BRAND NEW	W - sto.area 1, 10m south of ph. plant	1698
45	GLASS LINED TANKS 2 M3	PROTIC	1988	DEDIETRICH	2517/3/87	1987	BRAND NEW	Str.area 10m south of phenol plant	1937
46	GLASS LINED TANKS 3M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1987	USED BEFORE	PCI3 distillation plant	
47	TANKS 3M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1987	BROKEN	D4 plant	
48	TANKS 3M3 GLASS LINED	QTL	1988	DEDIETRICH	1250/3/84	1987	USED BEFORE	DMPH plant	1513
49	TANKS 3M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1987	USED BEFORE	Storage area FALLUJA 2	1680
50	TANKS 4M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1986	IN SERVICE	Phenol PLANT 1009/1553*	

51	TANKS 4M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1988	IN SERVICE	Stam plant FALLUJA 3	1767
52	TANKS 4M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1988	USED BEFORE	DMPH plant	1512
53	TANKS 4M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1988	BROKEN	D4 PLANT	
54	TANKS 4 M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1988	BROKEN	PC13 distillation PLANT	1649
55	TANKS 4 M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1988	BROKEN	MPC PLANT	
56	TANKS 4M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1988	USED BEFORE	Stam PLANT	1668
57	TANKS 4M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1988	BROKEN	Nerve Gas	
58	TANKS 4M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1988	USED BEFORE	SCRAP YARD FALLUJA 3	1936
59	TANKS 4M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1987	USED BEFORE	STORAGE AREA FALLUJA 2	1938
60	TANKS 6.3M3 GLASS LINED	PROTIC	1987	DEDIETRICH	2517/3/87	1987	USED BEFOR	PC13 distillation	1648

NO.	DESCRIPTION OF ITEM	EXPOR TER	YEAR OF EXP.	MANUFACT.	LC NO.	YEAR OF MANF.	STATUS	PRESENT LOCATION	TAG NO.
61	TANKS 6.3M3 GLASS LINED	PROTIC	1987	DEDIETRICH	2517/3/87	1987	BROKEN	D4 PLANT	
62	TANKS 10M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1987	BROKEN	D4 PLANT	

63	TANKS 10M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1987	BROKEN	MPC PLANT	
64	TANKS 10M3 GLASS LINED,	PROTIC	1988	DEDIETRICH	2517/3/87	1987	USED BEFORE	DMPH PLANT	1514
65	TANKS 10M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1987	BRAND NEW	Stor.area at eastern corner of site 1682	
66	TANKS 20M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1987	DEST. BY UN	Mustard PLANT	1527
67	TANKS 20M3 GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1987	IN SERVICE	Production building	1581
68	VESSEL 2 M3 GLASS LIND	PROTIC	1988	DEDIEERICH	2517/3/87	1987	INSERVIC	IBN BAYTAR	1762
69	VESSEL 2 M3 GLASS LIND	PROTIC	1988	DEDIEERICH	2517/3/87	1987	INSERVIC	IBN BAYTAR	1763

6. Iesa Project

NO.	DESCRIPTION OF ITEM	EXPOR TER	YEAR OF EXP.	MANUFACT.	LC NO.	YEAR OF MANF.	STATUS	PRESENT LOCATION	TAG NO.	NOTE
1	REACTORS 3M3 TEFEZEL	PILOT PLANT	1984	GERMANY	31/3/84	1984	Destroyed	Hydrolysis Plant	1533	
2	REACTORS 3M3 TEFEZEL	PILOT PLANT	1984	GERMANY	31/3/84	1984	DAMAGED	In castor oil plant Falluja 3	--	

7. General equipment

NO.	DESCRIPTION OF ITEM	EXPOR TER	YEAR OF EXP.	MANUFACT.	LC NO.	YEAR OF MANF.	STATUS	PRESENT LOCATION	TAG NO.
1	REACTORS 2.5M3 GLASS LINED	DEDIET RICH WET	1985	DEDIETRICH	567/3/84	1985	IN SERVICE	Stor.area south of phenol plant	1700
2	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	1985	IN SERVICE	production building 3	1573
3	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	1985	IN SERVICE	production building 3	1574
4	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	1985	IN SERVICE	Castor oil plant	1935
5	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	1985	USED BEFORE	PCl3 distillation	1642
6	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	1985	USED BEFORE	PCl3 distillation	1643
7	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	1985	USED BEFORE	Stam plant (DMMP)	1666
8	REACTORS 2.5M3 GLASS LINED	DEDIET RICH WET	1985	DEDIETRICH	567/3/84	1985	USED BEFORE	Stam plant (DMMP)	1667
9	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	1985	IN SERVICE	production building 4	1582
10	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	1985	IN SERVICE	production building 4	1583
11	REACTORS 2.5M3 GLASS LINED	I.T	1985	DEDIETRICH	1651/3/84	1985	IN SERVICE	Ferric chloride	1904
12	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	1984	PARTIALLY DES.	Stor.area at east. corner of site	1679

13	REACTORS 2.5M3 GLASS LINED	I.T	1985	DEDIETRICH	1651/3/84	1985	BROKEN	D4 plant	--
14	REACTORS 2.5M3 GLASS LINED,	WET	1985	PFAUDLER	489/3/84	1985	BROKEN	D4 plant	--
15	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	1985	BROKEN	D4 plant	--
16	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	1985	BROKEN	MPC plant	--
17	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	1985	BROKEN	MPC plant	--
18	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	1985	BROKEN	Stam plant	--
19	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	1985	Dest. by UN	Mustard gas	--
20	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	1985	Dest. by UN	Mustard gas	1524
21	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	1985	BROKEN	Mustard gas	1525
22	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	489/3/84	1985	BROKEN	Thionyl plant	--
23	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	490/3/84	1985	IN SERVICE	AL-QAQA	1613
24	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	490/3/84	1985	IN SERVICE	AL-QAQA	1614
25	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	490/3/84	1985	IN SERVICE	S.E.FOR VEGETABLE OIL	--
26	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	490/3/84	1985	IN SERVICE	S.E.FOR VEGETABLE OIL	--
27	REACTORS 2.5M3 GLASS LINED	WET	1985	PFAUDLER	490/3/84	1985	PARTIALLY DES.	AL-QAQA	--

28	REACTORS 1.6M3 GLASS LINED	WET	1985	PFAUDLER	770/3/85	1985	BROKEN	stam plant	--
29	REACTORS 1.6M3 GLASS LINED,	WET	1985	PFAUDLER	770/3/85	1985	BROKEN	stam plant	--
30	REACTORS 1.6M3 GLASS LINED	WET	1985	PFAUDLER	770/3/85	1985	BROKEN	stam plant	--

NO.	DESCRIPTION OF ITEM	EXPOR TER	YEAR OF EXP.	MANUFACT.	LC NO.	YEAR OF MANF.	STATUS	PRESENT LOCATION	TAG NO.
31	REACTORS 1.4M3 MONEL	W.E.T	1985-86	N.A	185/3/85	1985	BROKEN	PILOT plant 3	--
32	REACTORS 1.4M3 MONEL	W.E.T	1985-86	N.A	185/3/85	1985	IN SERVICE	IBNBAYTAR	1757
33	REACTORS 1.4M3 MONEL	W.E.T	1985-86	N.A	185/3/85	1985	IN SERVICE	S.E. FOR VEGETABLE OIL	--
34	REACTORS PTFE(TEFLON)1.5M 3	--	--	--	--	--	IN SERVICE	IBN BAYTAR	1764
35	REACTORS PTFE(TEFLON)1.5M 3	--	--	--	--	--	IN SERVICE	IBN BAYTAR	1758
36	HEAT EXCHANGERS 0.5X3.5M, 25M2 GRAPHITE	W.E.T	1984-86	LA CARBONNE,	1187/3/84	1984	IN SERVICE	Brake fluid formulation building	1703
37	HEAT	W.E.T	1984-86	LORRANA LA	1187/3/84	1984	BRAND NEW	Storage area 10m east of	1901

0110

38	EXCHANGERS 0.5X4M, 25M2 GRAPHITE HEAT EXCHANGERS 0.5X5.5M, 50M2 GRAPHITE HEAT EXCHANGERS 25M2 GRAPHITE HEAT EXCHANGERS 25M2 GRAPHITE HEAT EXCHANGERS 25.3M2 GRAPHITE HEAT EXCHANGERS 691,10M2 GRAPHITE HEAT EXCHANGERS 691,10M2	W.E.T	1984-86	CARBONNE, LORRANA LA CARBONNE, LORRANA LA CARBONNE, LORRANA LA CARBONNE, LORRANA LA CARBONNE, LORRANA ARATEBAN VICARB VICARB	1187/3/84	1984	IN SERVICE	phenol plant Brake fluid formul. behind the end of stor. area inside container Scrap yard	1705
39	EXCHANGERS 25M2 GRAPHITE HEAT EXCHANGERS 25M2 GRAPHITE HEAT EXCHANGERS 25M2 GRAPHITE HEAT EXCHANGERS 25.3M2 GRAPHITE HEAT EXCHANGERS 691,10M2 GRAPHITE HEAT EXCHANGERS 691,10M2	W.E.T	1984-86	CARBONNE, LORRANA LA CARBONNE, LORRANA LA CARBONNE, LORRANA LA CARBONNE, LORRANA ARATEBAN VICARB VICARB	1187/3/84	1984	BRAND NEW	Scrap yard	1729
40	EXCHANGERS 25M2 GRAPHITE HEAT EXCHANGERS 25M2 GRAPHITE HEAT EXCHANGERS 25.3M2 GRAPHITE HEAT EXCHANGERS 691,10M2 GRAPHITE HEAT EXCHANGERS 691,10M2	W.E.T	1984-86	CARBONNE, LORRANA LA CARBONNE, LORRANA LA CARBONNE, LORRANA ARATEBAN VICARB VICARB	1187/3/84	1984	BRAND NEW	Scrap yard	1734
41	EXCHANGERS 25M2 GRAPHITE HEAT EXCHANGERS 25M2 GRAPHITE HEAT EXCHANGERS 25.3M2 GRAPHITE HEAT EXCHANGERS 691,10M2 GRAPHITE HEAT EXCHANGERS 691,10M2	W.E.T	1984-86	CARBONNE, LORRANA LA CARBONNE, LORRANA LA CARBONNE, LORRANA ARATEBAN VICARB VICARB	1187/3/84	1984	USED BEFORE	DMPH Plant	1502
42	EXCHANGERS 25M2 GRAPHITE HEAT EXCHANGERS 25.3M2 GRAPHITE HEAT EXCHANGERS 691,10M2 GRAPHITE HEAT EXCHANGERS 691,10M2	W.E.T	1984-86	CARBONNE, LORRANA LA CARBONNE, LORRANA LA CARBONNE, LORRANA ARATEBAN VICARB VICARB	1187/3/84	1984	USED BEFORE	Stam plant(DMMP)	1669
43	EXCHANGERS 25M2 GRAPHITE HEAT EXCHANGERS 25.3M2 GRAPHITE HEAT EXCHANGERS 691,10M2 GRAPHITE HEAT EXCHANGERS 691,10M2	W.E.T	1984-86	CARBONNE, LORRANA LA CARBONNE, LORRANA LA CARBONNE, LORRANA ARATEBAN VICARB VICARB	1187/3/84	1984	BRAND NEW	Scrap yard	1737
44	EXCHANGERS 25M2 GRAPHITE HEAT EXCHANGERS 25.3M2 GRAPHITE HEAT EXCHANGERS 691,10M2 GRAPHITE HEAT EXCHANGERS 691,10M2	W.E.T	1984-86	CARBONNE, LORRANA LA CARBONNE, LORRANA LA CARBONNE, LORRANA ARATEBAN VICARB VICARB	1187/3/84	1984	BRAND NEW	Scrap yard	1738

45	GRAPHITE HEAT EXCHANGERS 691,10M2 GRAPHITE	W.E.T	1984-86	VICARB	1187/3/84	1984	PARTIALLY DEST	Scrap yard	1739
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NO.	DESCRIPTION OF ITEM	EXPOR TER	YEAR OF EXP.	MANUFACT.	LC NO.	YEAR OF MANF.	STATUS	PRESENT LOCATION	TAG NO.
46	HEAT EXCHANGERS 691,10M2 GRAPHITE	W.E.T	1984-86	VICARB	1187/3/84	1984	PARTIALLY DEST	Scrap yard	1740
47	HEAT EXCHANGERS 691,10M2 GRAPHITE	W.E.T	1984-86	VICARB	1187/3/84	1984	PARTIALLY DEST	Scrap yard	1741
48	HEAT EXCHANGERS 691,10M2 GRAPHITE	W.E.T	1984-86	VICARB	1187/3/84	1984	PARTIALLY DEST	Scrap yard	1742
49	HEAT EXCHANGERS 50M2	W.E.T	1984-86	LA CARBONNE,	1187/3/84	1984	USED BEFORE	Incinerator plant	1017
50	GRAPHITE HEAT EXCHANGERS 50M2	W.E.T	1984-86	LORRANA LA CARBONNE,	1187/3/84	1984	USED BEFORE	Incinerator plant	1018

51	GRAPHITE HEAT EXCHANGERS 25M2	W.E.T	1984-86	LORRANA LA CARBONNE,	1187/3/84	1984	USED BEFORE	Incinerator plant	1019
52	GRAPHITE HEAT EXCHANGERS 0.5X3.5M	W.E.T	1984-86	LORRANA DUKER	1187/3/84	1984	Dest. by UN	Pilot plant 1	1544
53	GRAPHITE 25 M2 HEAT EXCHANGERS 0.5X3.5M	W.E.T	1984-86	RICHTER	1187/3/84	1984	USED BEFORE	Scrap yard Falluja 3	1745
54	GRAPHITE 25 M2 HEAT EXCHANGERS 0.5X6 M	W.E.T	1984-86	PFAUDLER	1187/3/84	1984	Dest. by UN	Mustard gas	1526
55	GRAPHITE HEAT EXCHANGERS 0.5X6 M	W.E.T	1984-86	PFAUDLER	1187/3/84	1984	Dest. by UN	Nerve gas	1537
56	GRAPHITE HEAT EXCHANGERS 0.6X1.5M	W.E.T	1984-86	PFAUDLER	1187/3/84	1984	BROKEN	Thionyl plant	
57	GRAPHITE HEAT EXCHANGERS 4M2 GLASS LINED	I.T	1984	PFAUDLER	1651/3/84	1984	BRAND NEW	Scrap Yard	1722
58	HEAT EXCHANGERS 8M2	I.T	1984	PFAUDLER	1651/3/84	1984	BRAND NEW	Scrap Yard	1733

59	GLASS LINED HEAT EXCHANGERS 8M2 GLASS LINED, HEAT EXCHANGERS 12M2 GLASS LINED	I.T	1984	PFAUDLER	1651/3/84	1984	BRAND NEW	Scrap Yard	1731
60		I.T	1984	PFAUDLER	1651/3/84	1984	BRAND NEW	Scrap Yard	1568

NO.	DESCRIPTION OF ITEM	EXPOR TER	YEAR OF EXP.	MANUFACT.	LC NO.	YEAR OF MANF.	STATUS	PRESENT LOCATION	TAG NO.
61	HEAT EXCHANGERS 12M2 GLASS LINED HEAT EXCHANGERS 12M2 GLASS LINED HEAT EXCHANGERS GLASS LINED HEAT EXCHANGERS GLASS LINED	I.T	1984	PFAUDLER	1651/3/84	1984	BROKEN	D4 Plant	1768
62		I.T	1984	PFAUDLER	1651/3/84	1984	USED BEFORE	Storage area /Falluja2	1528
63		WET	1984-86	PFAUDLER	1187/3/84	1984	Dest. by UN	DF Plant (6)	
64		WET	1984-86	PFAUDLER	1187/3/84	1984	BROKEN	Thionyl Plant	

65	CONDENSER 7.5M2 HC	LENHA RDT	1984	GERMANY	1315/3/84	1983	USED BEFORE	DMPH plant	1509
66	CONDENSER T 20M2 HC	NEUBU GER	1985	GERMANY	250/3/85	1985	IN SERVICE	Production plant	1010
67	CONDENSER T 20M2 HC	NEUBU GER	1985	GERMANY	250/3/85	1985	USED BEFORE	DMPH plant	1507
68	CONDENSER 20 M2 HC	NEUBU RGER	1985	GERMANY	250/3/85	1985	IN SERVICE	product building 4 /Falluja 2	1011
69	CONDENSER HC	NEUBU RGER	1986	GERMANY	250/3/85	1985	BROKEN	Thionyl plant	
70	COLUMNS 0.8X4.5M	I.T	1985	PFAUDLER	1651/3/84	1984	USED BEFORE	PC13 distillation	1644
71	GLASS LINED COLUMNS 0.3X4.5M	I.T	1985	PFAUDLER	1651/3/84	1984	USED BEFORE	PC13 distillation	1647
72	GLASS LINED COLUMNS GLASS LINED 0.8X3M	IT	1985	PFAUDLER	1651/3/84	1984	BROKEN	D4 PLANT	
73	COLUMNS GLASS LINED 0.4X4M						BROKEN	MPC PLANT	
74	COLUMNS GLASS LINED 0.4X4M						USED BEFORE	STAM PLANT	1670
75	COLUMNS GLASS LINED						BROKEN	Thionyl PLANT	
76	COLUMNS 0.45X3 M HALLAR	NEUBU RGER	1986	GOOD BROT	666/3/86	1986	BRAND NEW	Storage area south phenol plant	1558
77	TANKS 2M3 GLASS LINED	PROTIC	1988	DEDIETRICH	1217/3/87	1987	BROKEN	MPC PLANT	
78	TANKS 2M3 GLASS LINED	PROTIC	1988	DEDIETRICH	1217/3/87	1987	BROKEN	MPC PLANT	

79	TANKS 2M3 GLASS LINED	PROTIC	1988	DEDIETRICH	1217/3/87	1987	USED BEFORE	Storage area Falluja 2	1765
80	TANKS 0.57M3 GLASS LINED,	-	1983-85	-	N.A		USED BEFORE	Stam PLANT(DMMP)	1658
81	TANKS 0.8 M3 GLASS LINED	NEWBU RGER	1986	DEDIETRICH	666/3/86	1985	USED BEFORE	Stam PLANT(DMMP)	1659
82	TANKS 0.8 M3 GLASS LINED	NEWBU RGER	1986	DEDIETRICH	666/3/86	1985	USED BEFORE	DMPH	1511
83	TANKS GLASS LINED	PROTIC	1988	DEDIETRICH	2517/3/87	1987	BROKEN	Nerve gas	
84	TANKS GLASS LINED	-	1983-85	-	N.A		BROKEN	Thionyl PLANT	

NO.	DESCRIPTION OF ITEM	EXPOR TER	YEAR OF EXP.	MANUFACT.	LC NO.	YEAR OF MANF.	STATUS	PRESENT LOCATION	TAG NO.
85	TANKS GLASS LINED	-	1983-85	-	N.A		BROKEN	Thionyl PLANT	
86	TANKS GLASS LINED	-	1983-85	-	N.A		BROKEN	PILOT PLANT 3	
87	TANKS 0.5-2M3 GLASS LINED	NEW BURGE R	1986	DEDIETRICH	666/3/86	1985	USED BEFORE	Stam PLANT	1660
88	TANKS 0.5-2M3 GLASS LINED	NEU BURGE R	1986	DEDIETRICH	666/3/86	1985	USED BEFORE	Stam PLANT	1663
89	TANKS 0.5-2M3 GLASS LINED	NEU BURGE R	1986	DEDIETRICH	666/3/86	1985	USED BEFORE	Storage area Falluja 3	1710

90	TANKS 0.5-2M3 GLASS LINED	R NEU BURGE	1985	DEDIETRICH	250/3/85	1985	BROKEN	DMMP PLANT	
91	TANKS 0.5-2M3 GLASS LINED	R NEU BURGE	1985	DEDIETRICH	250/3/85	1985	BROKEN	DMMP PLANT	
92	TANKS 0.5-2M3 GLASS LINED	R NEU BURGE	1985	DEDIETRICH	250/3/85	1985	BROKEN	DMMP PLANT	
93	TANKS 0.5-2M3 GLASS LINED	R NEU BURGE	1985	DEDIETRICH	250/3/85	1985	BROKEN	Thionyl PLANT	
94	TANKS 0.5-2M3 GLASS LINED	R NEU BURGE	1985	DEDIETRICH	250/3/85	1985	BROKEN	Storage area Falluja 2	1604
95	TANKS 4M3 GLASS LINED	R NEUBU RGER	1987	DEDIETRICH	315/3/87	1987	BROKEN	Pilot PLANT 3	
96	TANKS 6M3 GLASS LINED	I.T	1985	PFAUDLER	1651/3/84	1984	BROKEN	MPC PLANT	
97	TANKS 6M3 GLASS LINED	I.T	1985	PFAUDLER	1651/3/84	1984	BROKEN	Thionyl PLANT	
98	TANKS 20M3 GLASS LINED	NEU BURGE	1985	DEDIETRICH	250/3/85	1985	BROKEN	PCl3 production PLANT	
99	VESSEL 2 M3 HC	R LENHA RDT	1984	QUAST	1315/3/84	1984	IN SERVICE	Pesticide PLANT (Falluja 3)	1578
100	VESSEL 8 M3 HC	NEUBU RGER	1985	QUAST	250/3/85	1985	IN SERVICE	Production PLANT (Falluja 3)	1578
101	VESSEL 8 M3 HC	LENHA	1984	QUAST	1315/3/84	1984	IN SERVICE	Production building / 3	1579

102	VESSEL 2.8 M3 HC	RDT LENHA	1984	QUAST	1315/3/84	1984	BROKEN	Stam PLANT DMMP	
103	VESSEL 2.8 M3 HC	RDT LENHA	1984	QUAST	1315/3/84	1984	BROKEN	Stam PLANT DMMP	
104	VESSEL 5 M3 HALLAR	NEWBU RGER	1986	GERMANY	666/3/86	1985	BROKEN	Thionyl PLANT	
105	VESSEL 5 M3 HALLAR	WET	1986	N.A	N.A	N.A	BROKEN	Thionyl PLANT	
106	VESSEL 5 M3 HALLAR	NEWBU RGER	1986	GERMANY	666/3/86	1986	BROKEN	DMPH	
107	VESSEL 2.6 M3 HALLAR	N.A	N.A	LITERCL FRANCE N.A	1987	NEW	Storage Area Falluja 2 NEW	1681	
108	VESSEL 5 M3 HALLAR	NEWBU RGER	1986	GERMANY	666/3/86	1986		Storage Area Falluja 3	1718
109	VESSEL 5 M3 HALLAR	NEWBU RGER	1986	GERMANY	666/3/96	1986	NEW	Storage Area Falluja 3	1719
110	VESSEL 5 M3 HALLAR	NEWBU RGER	1986	GERMANY	666/3/86	1986	NEW	Storage Area Falluja 3	1720
111	VESSEL 5 M3 HALLAR	NEWBU RGER	1986	GERMANY	666/3/86	1986	NEW	Storage Area Falluja 3	1721
112	VESSEL 4.6 M3 HALLAR	N.A	N.A	N.A	N.A	N.A	BROKEN	Sarine PLANT	
113	VESSEL 1.2 M3 GLASS LIND	NEWBU RGER	1986	DEDIEERICH	666/3/86	1985	IN SERVICE	IBN BAYTAR	1760
114	TANK 5 M3 PVDF	LENHA RDT	1984	GERMANY	1315/3/84	1984			
115	TANK 2 M3 PVDF	LENHA RDT	1984	GERMANY	1315/3/84	1984			
116	TANK 2 M3 PVDF	LENHA	1984	GERMANY	1315/3/84	1984			

9. GHASI project

NO.	DESCRIPTION OF ITEM	EXPORT ER	YEAR OF EXP.	MANUFAC T.	LC NO.	YEAR OF MANF.	STATUS	PRESENT LOCATION	TAG NO.
1	Heating system 16KW, Normal steel	pilot plant	1984	Germany	83/3/1073	1982	broken	Thionyl plant	
2	Head condenser 1.5m2, Material s.s	pilot plant	1984	Germany	83/3/1073	1982	broken	Thionyl plant	
3	Collection receiver 0.5 m3 material s.s	pilot plant	1984	Germany	83/3/1073	1982	broken	Thionyl plant	
4	Reactor 1m3, material s.s	pilot plant	1984	Germany	83/3/1073	1982	broken	Thionyl plant	

10. SALADIN PROJECT

NO.	DESCRIPTION OF ITEM	EXPORTER	YEAR OF EXP.	MANUFACT.	LC NO.	YEAR OF MANF.	STATUS	PRESENT LOCATION	TAG NO.
1	Collection vessel 2m3,s.s	pilot plant	1984	Germany	pp 566	1983	broken	filling station area	
2	Filling station s.s	pilot plant	1984	Germany	pp 566	1983	broken	filling station area	

11. MEDA

NO.	DESCRIPTION OF ITEM	EXPOR TER	YEAR OF EXP.	MANUFACT.	LC NO.	YEAR OF MANF.	STATUS	PRESENT LOCATION	TAG NO.	NOTE
1	Centrifuge s.s, 0.25 m3	pilot plant	1982	W.G	82/3/899	1982	BROKEN			part of AHME D proj.

12. ALI project

1. C.S MILLER (pin type) was used for CS milling. 872/3/82
2. Dryer.

13. MC3 project

Chillers,Pipes, valves, fittings(GL & plastic)(spare part), from Protic L/C No 7/3/87.

14. DIAH Project

Note:-

All DIAH project equipment were from stores (imported as general projects).

15. TMP project (7201)

- decanter
- dissolver
- Nitrogen unit
- Tanks

16. distillation unit

a complete package (2 unit) for distillation of ethanol in order to obtain absolute alcohol this was installed in AL-Muthana in the end of 1984.

New

***** LIST OF TAGED EQUIPMENT WHICH ARE NOT IDENTIFIED IN ABOVE TABLE *****

NO.	DESCRIPTION OF ITEM	EXPORTER	YEAR OF EXP.	MANUFACT.	LC NO.	STATUS	LOCATION	TAG NO.
1	HC Vessel for Vacuum	N.A	N.A	N.A	N.A	DES. BY UN	AL_MUTHANA	1535

	pump									
2	HC Tank 500 L.	N.A	N.A	N.A	N.A	N.A	N.A	DES. BY UN	AL_MUTHANA	1536
3	HC Reactor 400 L.	N.A	N.A	N.A	N.A	N.A	N.A	DES. BY UN	AL_MUTHANA	1539
4	Glass Reactor 400 L.	N.A	N.A	N.A	N.A	N.A	N.A	DES. BY UN	AL_MUTHANA	1540
5	Glass Vessel 200 L.	N.A	N.A	N.A	N.A	N.A	N.A	DES. BY UN	AL_MUTHANA	1545
6	Glass Column	N.A	N.A	N.A	N.A	N.A	N.A	DES. BY UN	AL_MUTHANA	1546
7	Glass Column	N.A	N.A	N.A	N.A	N.A	N.A	DES. BY UN	AL_MUTHANA	1547
8	Housing Section of M.R.U	N.A	N.A	N.A	N.A	N.A	N.A	BRAND,NEW	AL_MUTHANA	1750
9	Housing Section of M.R.U	N.A	N.A	N.A	N.A	N.A	N.A	BRAND,NEW	AL_MUTHANA	1751
10	Housing Section of M.R.U	N.A	N.A	N.A	N.A	N.A	N.A	BRAND,NEW	AL_MUTHANA	1752
11	Housing Section of M.R.U	N.A	N.A	N.A	N.A	N.A	N.A	BRAND,NEW	AL_MUTHANA	1753
12	Housing Section of M.R.U	N.A	N.A	N.A	N.A	N.A	N.A	BRAND,NEW	AL_MUTHANA	1754
13	Housing Section of	N.A	N.A	N.A	N.A	N.A	N.A	BRAND,NEW	AL_MUTHANA	1755

	M.R.U								
14	Column Section	N.A	N.A	N.A	N.A	USED BEFORE	FALLUJA 2	1559	
15	Column Section	PROTIC	1988	DEDITRICH	2517/3/87	USED BEFORE	FALLUJA 2	1561	
16	Vacuum Pump	SULZER	1987	SULZER	664/3/86	USED BEFORE	FALLUJA 2	1940	
17	Vacuum Pump	SULZER	1987	SULZER	664/3/86	USED BEFORE	FALLUJA 2	1565	
18	Centrifuge Filter	PILOT PLANT	1983	N.A	899/3/82	USED BEFORE	FALLUJA 2	1683	
19	S.S Column	N.A	N.A	N.A	N.A	N.A	FALLUJA 2	1977	
20	S.S Column	N.A	N.A	N.A	N.A	N.A	FALLUJA 2	1978	
21	S.S Column	N.A	N.A	N.A	N.A	N.A	FALLUJA 2	1979	
22	HC Vessel 870 L	N.A	N.A	N.A	N.A	USED BEFORE	AL_MUTHANA	1661	
23	HC Vessel Pump	N.A	N.A	N.A	N.A	USED BEFORE	FALLUJA 3	1716	
24	Vacuum Pump	N.A	N.A	N.A	N.A	USED BEFORE	FALLUJA 3	1743	
25	Vacuum Pump	N.A	N.A	N.A	N.A	USED BEFORE	FALLUJA 3	1744	

NO.	DESCRIPTION OF ITEM	EXPORTER	YEAR OF MANUFACT.	LC NO.	STATUS	LOCATION	TAG
26	Spool piece		EXP. Deditrich 1987	---		South of multipurpose	NO. 1100
27	piece of colum.(GL)	---	Deditrich 1987	---		Scrap yard	1934
28	Mobile refrigerated unit compact	---	---	---		Equip. storage area	1013
29	Mobile refrigerated unit compact	---	---	---		Equip. storage area	1014
30	Column with vessel HC (100L)	---	Sulzer 1986	---		DMPH	1530
31	Column with vessel HC (100L)	---	Sulzer 1986	---		DMPH	1531
32	Vessel HC (300L)	---	1983	---		DMPH	1532
33	Tank	---	N.A	---	Broken	DF plant	1651
34	Tank	---	N.A	---	Broken	DF plant	1652
35	Tank	---	N.A	---	Broken	DF plant	1653
36	Tank	---	N.A	---	Broken	DF plant	1654
37	Mobile refrigerated unit	---	---	---		Equip. storage area	1748
38	Mobile refrigerated unit	---	---	---		Equip. storage area	1749
39	Inhalation chamber	---	N.A	---	Broken	---	1756

40	N.A	N.A	N.A	N.A	N.A	DES. BY UN	N.A	1662
41	Reactor	N.A	N.A	N.A	N.A	DES. BY UN	Pilot plant	1672
42	Tank Scrubber	N.A	N.A	N.A	N.A	DES. BY UN	Pilot plant	1673
43	Reactor stirred	N.A	N.A	N.A	N.A	DES. BY UN	Pilot plant	1674
44	Dist. Column	N.A	N.A	N.A	N.A	DES. BY UN	Pilot plant	1675
45	Heat Exchanger	N.A	N.A	N.A	N.A	DES. BY UN	Pilot plant	1676
46	Scrubber Column Glass	N.A	N.A	N.A	N.A	DES. BY UN	Pilot plant	1677
47	Column	N.A	N.A	N.A	N.A	USED BEFORE	PCI3 Dist.	1603
48	Tank Haller (Reactor)3M3	N.A	1985	Godbrot	N.A	In Service	Ferric Chloride unit	1566
49	Column						Scrap yard Falluja 2	1939
50	Column(D 0.5, L.3)M G.L						Beside Storage No.1	1980

NO.	DESCRIPTION OF ITEM	EXPORTER	YEAR OF MANUFACT. EXP.	LC NO.	STATUS	LOCATION	TAG NO.
51	Vessel G.L 100 I				Brand new	Storage area Falluja 2	1927
52	Vessel G.L 100 I				Brand new	Storage area Falluja 2	1928
53	Vessel G.L 100 I				Brand new	Storage area Falluja 2	1929
54	Vessel G.L 100 I				Brand new	Storage area Falluja 2	1930
55	Vessel G.L 4.4 M3		Deditrich		Used before	Storage area Falluja 2	1931
56	Piece Column Haller				Used before	Storage area Falluja 2	1932
57	Piece Column				Brand new	Storage area Falluja 3	1934

New

CHAPTER III - A

TYPES & QUANTITIES OF MUNITIONS PROCURED BY IRAQ
FOR C.W PROGRAMME

ITEM	MUNITIONS TYPE	TOTAL QTY PROCURED	QTY.MANUF LOCALLY	QTY. IMPORTED	DELIVERY YEAR	SUPPLIERS NAME	COUNTRY OF ORIGIN	L/C NO.	CONTR. CT NO.
1-	AERIAL BOMB 500	14829	329(AALD) RAW MATERIAL FROM L/C	2500(BR) 2000(LD)	1983 1984	EXPAL IT	SPAIN SPAIN	54/3/83 3/52/84	14/53/82 124/3/84
2-	AERIAL BOMB 250	18000	845/3/88 10000 RAW MATERIAL FROM L/C	5000(AALD) 5000(AALD) 5000(BR) 3000(LD)	1986 1986 1983 1985	IT IT EXPAL IT	SPAIN SPAIN SPAIN SPAIN	486/3/86 962/3/86 54/3/83 3/52/84	----- ----- 14/53/82 124/3/84
3-	ARTILLERY	85000	----- 1650/3/84	40000	1983	PBD	ITALY	-----	982/AS/1 32
	SHELL 155 MM type M 110 smoke			35000	1985	IT	SPAIN	125/3/84	4/53/84
				10000	1984	PBD	ITALY	305/3/84	84/3/6

4-	AERIAL	1360	1360	75 (25 OF WARHEAD FOR BW)	1360	---	1988	St. Est. for mechanical indus.		---	---
5-	BOMB DB2 • AL-HUSSAIN WARHEAD	75				[include (61) DB-0] ---	Project 144 (The container only provided by the project 144) Nassar St. Est. Nassar St. Est.	---		---	---
6-	AERIAL BOMB R-400	1224	1024 200			---	1990 1990	---	(For BW purpose)		

ITEM	MUNITIONS TYPE	TOTAL QTY PROCURED	QTY.MANUF. LOCALLY	QTY. DELIVERY IMPORTED YEAR	SUPPLIERS NAME	COUNTRY OF ORIGIN	L/C NO.	CONTRACT NO.
7-	* ROCKET 122MM	126500	18000 WARHEAD ONLY Supplied by the project/144	10000 1985 (firos-25)	PBD	ITALY	55/85	TM-183
				15000 1986 (firos 25)	PBD	ITALY	86/1/86	TM 214

8-	ARTILLERY	4000	4000	12000 1989 (Sakar 18) 6500 1986 (Sakar 30) 10000 1986 (Sakar 18) --- 1983	SAKAR SAKAR SAKAR SOTI (Hutteen) ---	EGYPT EGYPT EGYPT IRAQ CHINA CHINA	740/3/88 PROTOCOLE PROTOCOLE 20/3/85 20/3/85	74/101/88 2/84 2/84 (empty casing only) (empty casing only) ---
9-	SHELL 130MM Mortor bomb	40000	---	40000 1985	---			
10-	120mm ROCKET MOTOR 122 mm	5000	---	5000 1985	---			
11-	ROCKET 122 mm (conventional)	50000	---	20000 1988 30000 1989	---	Russia	From Army From Army	

- There was no importation or procurement of munition after 1988 except what was mentioned in the above table.
- Some prototypes of munition were received from suppliers as illustrated in chapter(viii).
- An attempts to procure munition but this was not materialized as illustrated in chapter (viii) of the FFCD.

* THE TYPES OF 122 mm ROCKET ACCORDING TO TYPE OF WARHEAD ARE AS FOLLOW :

1- 9000 ROCKET WITH CARBON STEEL WARHEAD CONSIST OF THREE TEFZEL CANESTER WAS RECEIVED

AT 1986 FROM EGYPT.

2- 1000 ROCKET WITH CARBON STEEL WARHEAD RECEIVED AT 1986 FROM EGYPT.

3- 6500 ROCKET WITH CARBON STEEL WARHEAD CONSIST OF THREE TEFLON LINED CANESTER WAS RECEIVED

AT 1986-1987 FROM EGYPT (TOTAL CONTRACT 10000, I.E 3500 ROCKET WAS NOT RECEIVED.

4- 12000 ROCKET WITH CARBON STEEL WARHEAD CONSIST OF TWO POLY ETHYLEN CANESTER WAS RECEIVED

AT 1989 FROM EGYPT (TOTAL CONTRACT 20000, ROCKET, I.E 8000 ROCKET WAS NOT RECEIVED.

5- 10000 ROCKET WITH CARBON STEEL WARHEAD WAS RECEIVED AT 1986 FROM ITALY.

6- 15000 ROCKET WITH CARBON STEEL WARHEAD CONSIST OF TWO POLY ETHYLEN CANESTER WAS RECEIVED AT 1986 FROM ITALY (7000 SETS OF POLY ETHYLEN CANESTER WAS RECEIVED ONLY, I.E 8000 SETS OF THESE CANESTER WAS NOT RECEIVED).

7- 30000 CONVENTIONAL ROCKET RECEIVED FROM ARMY AT 1989.

The total value for the procurement of munition which was imported (172.7) million Dollar which not mentioned in the letter of credit but mentioned in the tables of (type & Qty. of munitions procured by Iraq for CW program). These are as follow :-

<u>LC No.</u>	<u>Company</u>	<u>Type</u>	<u>Value/\$</u>
124/3/84	IT	aerial bomb - (2000) gauge 500 type LD	5.200.000
		- (3000) gauge 250 type LD	
962/3/86	IT	aerial bomb - (5000)) gauge 500 type AALD	7.000.000
125/3/84	IT	artillery shell 155 mm - (35000)	7.000.000
740/3/88	Sakar factory	122 mm Rocket - (12000)	18.000.000

20/3/85	Norengo/China	type Sakar-18 120 mm mortar shell (40.000) Rocket motor for 122 mm (5000)	16.000.000
1395/1/82	Sinia pbd	Artillery shell 155 mm - (40.000)	4.000.000
304/3/84	Sinia pbd	artillery shell 155 mm - (10.000)	19.225.000
55/1/85	Sinia pbd	122 mm Rocket (Firos-25) - (10.000)	29.250.000
208/1/86	Sinia pbd	122 mm Rocket (Firos-25)	

protocol(84/2)	Sakar factory	- (15.000)	26.000.000
		122 mm Rocket (Sakar 30) - (6500)	
protocol(84/2)	Sakar factory	122 mm Rocket (Sakar 18) - (10.000)	20.000.000
-----	USSR	Conventional 122 mm Rocket - (30.000)	21.000.000

*In August 11, 1987 Euromac Company was requested to offer for 10000 rocket 122 mm type Firos-25, the offer was not submitted so the matter was abandoned.

*The Swiss Company Boneventure was requested to submit an offer to procure empty casing for 155 mm and 122 mm aluminium rocket warheads with manufacturing technology, an offer with specifications was received for 155 mm, because of the high prices no agreement was reached, a sample for 122 mm aluminium warhead from Austria was received, but this was abandoned due to the success achieved in the local manufacturing.

*An offer was obtained from Al-Mashini Company (Jordan) to procure polyethylene canister for

the warhead 122 mm rocket, and also mold to manufacture the canister.

*In 1984, a group from Al-Muthana visited France to look on technical workshop of the aerial bomb manufacture, during the visit the group asked from the French side to procure proximity fuse for artillery shell and aerial bomb, but this was not materialized.

TYPES & QUANTITIES OF MUNITIONS PROCURED BY IRAQ FOR NON - C W PROGRAMME

Type of munition	Qty. imported			
	1980	1981	1982	1983-1990
155 mm **	NIL	25120*	130000	NIL
Gauge 250				
Aerial bomb	NIL	NIL	NIL	NIL
Gauge 500				
Aerial bomb	NIL	NIL	NIL	NIL

* 760 shells was received from Kuwait as a Gift in 1981

* 4360 shells was received from Saudi Arabia as a Gift in 1981

** Filled with White Phosphorous.

***** Imported empty munition by Army *****

Type of Munition	Qty. imported			Qty. remaining	Location
	1980-1985	1986	1987-1990		
155 mm	NIL	NIL	NIL	NIL	NIL
AA/GP/400 *	NIL	2000	NIL	1576	AL-Taji military Depot
AA/GP/LD 500 *	NIL	3000	NIL	3000	Ditto
AA/GP/LD 1000 *	NIL	3000	NIL	2200	Ditto

* These munitions were imported not for the purpose of W.P. but for the purpose of H.E.

CHAPTER III- B

LIST OF CONTRACT NO.
FOR AMMUNITIONS

LIST OF LC NO.
FOR AMMUNITIONS

LIST OF PROTOCOL NO.
FOR AMMUNITIONS

NO.	CONTRACT NO.		NO.	LC NO.		NO.	PROTOCOL NO.
1-	14/53/82		1-	124/3/84		1-	2/84
2-	3/52/84		2-	486/3/86			
3-	982/AS/153 2		3-	962/3/86			
4-	4/53/84		4-	125/3/84			
5-	TM 214		5-	740/3/88			
6-	74/101/88		6-	20/3/85			
7-	TM 183		7-	1395/1/82			
8-	1532/AS/82		8-	304/3/84			
9-	223/AS/86		9-	55/1/85			
10-	3/53/84		10-	208/1/86			
11-	6/3/84		11-	1650/3/84			
12-	10/MS/84		12-	54/3/83			
			13-	305/3/84			

LIST OF LETTERS OF CREDIT FOR THE PRECURSOR CHEMICALS PROCURED FOR CW- PROGRAMMES

	<u>LC.NO</u>	<u>EXPORTER</u>		<u>LC.NO</u>	<u>EXPORTER</u>
1-	251/3/82	TAFISA	35-	219/3/85	COMPANIES
2-	252/3/82	KBS	36-	2537/3/87	HIP

3-	380/3/82	ENTERPRISE	37-	1968/3/88	HIP
4-	537/3/82	TAFISA	38-	526/3/82	PRUSSAG
5-	1124/3/82	TAFISA	39-	790/3/82	HOCHST
6-	263/3/83	KBS	40-	1024/3/85	COMPANIES
7-	266/3/83	DIE MUNCHI	41-	377/3/86	COMPANIES
8-	579/3/85	COMPANIES	42-	862/3/84	REINING HAUS
9-	2790/3/87	ORAC	43-	431/3/84	KBS
10-	232/3/87	COMPANIES	44-	250/3/82	SCAPERT HOIZON
11-	1321/3/81	FLUKA	45-	421/3/86	WET
12-	979/3/82	KBS	46-	1457/3/86	KBS
13-	1090/3/82	KBS	47-	258/3/86	KBS
14-	416/3/84	KBS	48-	776/3/82	KBS
15-	870/3/82	KBS	49-	424/3/84	KBS
16-	1015/3/82	MELCHEMIE	50-	1058/3/82	KBS
17-	1091/3/82	KBS	51-	326/3/84	HADDAD
18-	257/3/83	KBS	52-	1120/3/83	KBS
19-	535/3/83	MELCHEMIE	53-	378/3/84	MELCHEMIE
20-	425/3/84	MELCHEMIE	54-	379/3/84	KBS
21-	1145/3/86	EXOMET	55-	292/3/84	KBS
22-	1874/3/87	KIM-AL-KHALEEG	56-	1401/3/84	REINING HAUS
23-	260/3/86	MELCHEMIE	57-	1114/3/84	WET
24-	973/3/84	EXOMET	58-	1205/3/84	MELCHEMIE
25-	1535/3/84	COMPANIES	59-	476/3/86	COMPANIES
26-	ABOZA'BAL	ABOZA'BAL	60-	291/3/84	MELCHEMIE
27-	1349/3/84	WET	61-	1093/3/84	WET
28-	1323/3/84	REINING HAUS	62-	850/3/84	REINING HAUS
29-	1121/3/83	KBS	63-	900/3/82	HOCHST
30-	1292/3/84	COMPANIES	64-	811/3/88	WECO
31-	220/3/85	COMPANIES	65-	34/3/82	MELCHEMIE
32-	1450/3/84	REINING HAUS	66-	898/3/82	KBS
33-	1401/3/84	REINING HAUS	67-	429/3/84	KBS
34-	1242/3/84	MELCHEMIE	68-	1379/3/84	KBS

LIST OF LC NO. FOR THE PRODUCTION EQUIPMENTS
PROCURED FOR CW-PROGRAMMES

	<u>LC.NO</u>	<u>EXPORTER</u>
1-	2517/3/87	PROTIC
2-	567/3/84	DEDIETRICH
3-	489/3/84	WET
4-	1651/3/84	IT

5-	490/3/84	WET
6-	1250/3/84	QTL
7-	770/3/85	WET
8-	1073/3/83	PILOT PLANT
9-	869/3/82	PILOT PLANT
10-	185/3/85	WET
11-	31/3/84	PILOT PLANT
12-	315/3/87	NEUBURGER
13-	1187/3/84	WET
14-	7/3/87	WET
15-	1315/3/84	LENHARDT
16-	250/3/85	NEUBURGER
17-	666/3/86	NEUBURGER
18-	899/3/82	PILOT PLANT
19-	423/3/86	WET

LIST OF "CASH DEALS " FOR THE PROCURED ITEM FOR C-W ROGRAMME

This kind of commercial deal was very limited in the C.W - programme, it happened at the beginning of the program especially in 1981-1982 with a very limited amount for the procurement of materials. From recollection of memory the following items were bought through cash deal :-

- 1- Pumps from March May Company / England.
- 2- Gas cylinder from Premus Company / Sweden.
- 3- Line for filling domestic gas cylinders from Kozan Company / Denmark.
- 4- Rotary evaporators and lab. equipment from Buchi Co. / swiss.
- 5- Cash deal through commercial attache/ London

Diacelt 200 (resin for chlorine plant in Falluja II) supplied by Oriac international S.A, 3B, BOUIEVARD Prince Henri, Luxembourg 1727.

The payment through Commercial Attache/ London in 1990.

6-One senior staff from SEPP visited Swiss in 1982 Buchi Company during that visit Lab. equipments (rotary evaporator capacity one liter, spare parts for rotary evaporators and general lab. equipments) were procured from the Company, the payment was carried through Iraqi Embassy in Swiss.
Also an agreement was achieved about the design drawing of modified rotary evaporator capacity (50) liter which were purchased later.

EXPLANATORY NOTES ABOUT THE PURCHASES OF AL-MUTHANA FOR THE PERIOD 1988 - 1990

A. Chemical Materials

- The activity in that period concentrated on purchasing the precursors specialized for the production of VX and mixtures of Sarin.
- The following materials have been bought from the following companies:

- Triethanolamine	50 tons	Kim Al-Khalij Co. LC/NO.87/3/1874
- P2S5	250 tons	EXOMIT Co. LC/NO.86/3/1145
- Sodium Nitrate	20 tons	Kim Al-Khalij Co. LC/NO.87/3/1874
- Chloro ethanol	190+10 tons	EXOMIT Co. LC/NO.86/3/1145
- Silica gel	10 tons	Kim Al-Khalij Co. LC/NO.87/3/1874
- Ethylene Oxide	required 50 tons (expecting 39 tons received)	Weco Co. LC 88/3/812 from cylinders and it doesn't exist in the file.
- Morpholine	15 tons	Kim Al-Khalij Co. LC/NO.87/3/1874
- Di-isopropyl amine	200 tons	EXOMIT Co. LC/NO.86/3/1145
	50 tons	Weco Co.
- HF	1.5 ton (35 cylinders/50 kg)	Kim Al-Khalij Co. LC/NO.87/3/1874
- Cyclohexanol	150 tons	HIP
	1 ton	EXOMIT Co. LC/NO.86/3/1145
- Sec-butanol	20 tons	Weco Co.
-O-Chlorobenzaldehyde	50 tons	Weco Co. LC/NO.88/3/811

- Contacts were made in order to Procure key precursors for Mustard gas, Sarin and CS for the purpose to increase the stock and as follows :

a. Contact with Italian company (Euromac Company-contact person Mr.Kasim Abbass) in March 1988 for the purpose of obtaining precursors (e.g. T.M.P, HF, T.D.G).

The delegation made contact with Montideson Co. and Montiflor Co. in Melano-Italy, but the negotiation was not successful and no precursors were obtained .

b. Contacts with the following companies were carried out in order to supply the precursors especially TMP and TDG but the results were negative .

- Bemenco (Argentina).

- Hib Flour Co.(Germany)/representative of Heberger Co.(Germany).

- Universal Tr Co. (Canadian) representative : Abdul-Kader Thakub.

- Servio Co. (Cyprus). The contact was with telex only.

- There were importations for raw chemical materials may have been imported before or after 8.8.1988 and as following :

Acetic acid	20 ton Kim Al- Khaleeg
Acetic acid	10 ton Weco LC 88/3/2729
Pipronyl Butoxide	3 ton Weco
Tetramethrine	1 ton Melchemie LC 88/3/2642
Aluminium chloride	- Weco
Peramethrine about	0.5ton Weco
Zinc powder	20 ton Weco LC 88/3/1517

In addition, general chemical substances were imported from Hip Co. and Haddad Co. .

From the above mentioned paragraph (a & b) one conclude that :

1. There were no chemical raw materials (precursor for C W agents) imported in production quantities other than those mentioned in declarations and as mentioned above.
2. There were no other company or country dealt with other than the above mentioned companies and countries or that stated in our declarations .

B. The technical productions equipment and munitions :

1- No contracts were signed concerning munitions except the following:-

- 20 thousands rocket 122 mm /12 thousands were received from the Egyptian side (LC 88/3/740: It is not in the file but it has been recognized from the boxes) .
- Raw materials for production of 10 thousands bombs caliber 500 from I.T Co. (LC 88/3/845: not found in the file but it has been recognized from the boxes) .
- Raw materials from Boneventure/Swiss Co. which consist of top nose and filling caps LC No. 88/3/3911.

2- The technical equipment :

-
- The main supply is concentrated on the contract MC3 (a code No. for the inquiry) for the technical equipment .
The main suppliers are KIM Al-Khaleeg Co. and FCA Co.

KIM Al-Khaleeg Supplied :-

- (2) product tanks 4m3 Hastalloy
- Piping and fittings
- Stainless steel sheets

FCA Supplied :-

- (6) steam generators
- Hastalloy sheets
- 30 cooling unit with the accessories were bought and as follows
24 cooling unit with the accessories from Euramac Co. in 1988
6 cooling unit with the accessories from KBS Co. in 1988.
- Different welding machines (for the aerial bomb workshop) were bought in order to complete the production line of 500 caliber bombs specially from I.T Co., Esab Co. (Swedish) and Sandivick Co.(contact:Telex only) in 1988.
- Machines for the glass workshop from Herbert Arnold Co. in 1988.
- The rest of the purchases were spare parts, glass raw materials, test and measuring equipment and pumps.
- Barrels coated with Poly Ethylene from Schwender Co.
- There were a number of inquires concerning different production

equipment before cease-fire and many offers were obtained from declared companies, but no. contracts were signed and nothing had been supplied. The purpose of these inquiries to establish four production sites in different places, each site consist of a plant to produce mustard and the other to produce sarin. One conclude that no production equipment have been imported in 1988 that have not been declared (covered by declarations formats) and no dealing had taken place with a company or country that with a company or country that was not known by UNSCOM .

3- A contract was signed with KIM Al-Khaleeg to supply us with the know-how LC No 88/10/24 and equipment and to supervise installing and operating the production factory T.M.P .

The know-how was obtained from the company and small part of the equipment were received.

- Decanter.
- Dissolver
- Nitrogen plant.

- There was an attempt from MSE to obtain offers for the ministry of industry for the HF production project and phosphorous production project.

- An offer was obtained from Kim Al-Khaleeg co. for the phosphorous Factory. The offer was given to the ministry of industry and negotiations were carried out between both sides.
FCA submit an offer to supply Know-how and technology for HF plant the above two projects were not executed.

- A contact with Cardeon company from Chile to submit an offer concerning phosphorous plant and supplying precursor (TMP & TDG) this was not fruitful.

- An Argentinian officer submitted a preliminary offer (without inquiry from Al-Muthana) for a plant of TDG and TMP. After studying these technical offer it appeared that the TMP offer was trimethyl phosphate and not trimethyl phosphite. Therefore, the above offer was neglected for both (TDG & TMP).

YEAR 1989-1990 :

- Receiving chemical precursors (e.g. PCl_3 start Jan. 1987 till Dec. 1989) and equipment (for TMP project) continued till 1990 through a contract that had been signed in 1987 and 1988.

- A contract was signed with TMC (German Co.) to deliver white phosphorous but the LC was canceled (LC No. 10/65801) (in order to operate A+B) PCl_3 + POCl_3 production plant.

And also (200) ton of white phosphorous was inquired from U.S.S.R through MIC in 1988-1989, no offer was received.

- No key Precursors was imported or contracted during the above period.

- All purchases were as follows:

- a. Raw materials for pesticides e.g. :

- DDVP from Kim Al-Khaleeg / Indian co. and lanceses link co./ Swiss co.

- Malathion from Kim Al-Khaleeg / Indian co. and lanceses link co./ Swiss co.

- additive materials (emulsifiers) from Perol/Swedish Co. and solvents from Hip Co.

- Propanil from Lances Link / Swiss Co.

- b. Completely manufactured pesticides.

Completely manufactured pesticides formulated were bought for the ministry of agriculture for the year 1990 from the companies: (e.g. I.C.I, Ciba Gigy, Dow, Roussel, Basf, Shell, Cyanamide, monsanto, Rohm & Hass ...etc.).

Pesticides were also bought through mediators (e.g. K+N/Greek, ERICK/German, Melchime premier/Cyprus).

- c. Negotiations were carried out in 1989-1990 with a number of companies in order to get the Know-how to produce certain pesticides (formulated Pesticide) (e.g. I.C.I Co., Monsanto, Dow, Sandoz Raussel Uclaf Ciba Gige).

4. Projects for AL-Muthana.

- a. A contract was signed to purchase a production line of containers for insecticide manufactured from "Tin plate", from Lanico (German Co.) in 1990. The first delivery was received then it was stopped due to the Gulf crisis.
- b. A contract was signed with FONG.Kee Co. in 1990 (Taiwan) to deliver machines for plastic container production (100 ml-200 L) (through the American Co. : Tentrix).
The contract had not been implemented because of the Gulf crises.
- c. Negotiations were carried out with the German Co."Mall" concerning Aluminium containers production line 400 ml. The negotiation was cancelled.
- d. An offer was obtained for the metal containers filling line from Coaster Co. through FCA Co.
- e. An offer for distillation and separation of(B.T.X) (Benzen, Toluene, Xylene) substance from FCA Co. in 1990 and it was stopped.

5. From above, conclusion that in 1989-1990 no chemical substances objected to monitoring have been imported.

All our importations from chemical substances and equipment were related to pesticide production.

Ethylene Oxide

concerning issue raised from UNSCOM about inventory list in 1988 it appear that 165 tons of ethylene oxide was procured by MSE.

No such quantity was imported by MSE except what was mentioned above (39 tones) was procured. May be an error in that inventory. Iraq side scorch about such quantity discovered that Samara drug industry imported 160 tones of 12% ethylene oxide 88% dicloro difluoro methane for the purpose of Babylon factory for disposable syringes as sterilizing agent.

***** CHAPTER III . C *****
PROCUREMENT NETWORKS

A) Governmental Institutions :

1- CENTRAL BANK OF IRAQ :-

Most of the procurement of the C.W programme, the letters of credit were opened through the Central Bank of Iraq for the period 1981-1988 with abbreviation X1/3/X2 Where

X1=the number of letter of Credit.

3=Section three in the Central Bank.

X2=Year.

2- RAFIDAIN BANK :-

After 1988 many letters of Credit were opened through different Branches of Rafidain Bank these Branches are :

- Main Branch /AL-Benook Street(Branch No.106).
- AL-Sinak Branch /(Branch No.10).
- AL-Reyade Branch /(Branch No.262 Cancelled).

3- AL-RASHEED BANK :-

- East Gate Branch / (Branch No. 505).
- Al-Reyade Branch / (Branch No. 506).
- Al-Shorja Branch / (Branch No. 42).

4- CORRESPONDENCE BANK :-

- Dresdner Bank / Aschaffenburg / W.G
- Union Bank of Switzerland / CH-9001 st.Gall
- Deutsche Bank Dusseldorf W.G
D-2000 Hamburg / Telex : 212535 - odhd
- Banco Exterior De Espana / Madrid
- Commerze Bank Dusseldorf

- Girozentrale / Wein
- Creditanstalt Banken Verein Vienna / Austria
- Amro Bank / Rotterdam / Telex : 22211
- Vereins and west Bank / Hamburg / W.G
- UBAE Arab German Bank / Frankfurt
- Rafidain Bank Amman Branch /Amman
- Deutsche Bank D- 3000 Hannover / W.G
- Dresdner Bank AG /Hannover /Telex :921920
- Gulf International Bank / London Branch/Telex:8812889 Gi Bank G
- Commerz Bank /D-6800 Mannheim /W.G
- Bank of Boston int / New York
- Gothard Bank /6901 Lugano / Swiss
- Bank of England. London.
- Midland Bank PLC-London.
- Rafidain Bank London.
- Lloyds Bank PLC-London.
- National Westminster Bank Plc-London.
- UBAF Bank Ltd,London.
- Barclays Bank London.
- The Dai-ich Kongyo Bank London.
- Banque De France Paris.
- Societe Generale Paris.
- Credit lyonnais Paris.
- Banque National de Paris France.
- Credit Commercial de France.
- Dresdner Bank AG Frankfurt.
- Deutsche Bank Frankfurt.

- Berliner Handels und Frankfurt.
- DG Bank Frankfurt.
- Westdeutsch landes Bank Dusseldorf.
- Bayerische landes Bank Munich.
- Hypo Bank Munich.
- Manufactures Hanover Trust Germany.

- Credit lyonnais Bank Netherlands Holland.
- Rabobank Netherlands Holland.
- ABN AMRU Bank Amsterdam.

- UBAF (Hong kong) Limited.

- State Bank of India.
- United Commercial Bank India.
- Central Bank of India.

- Banca Commerciale Italiano Italy.
- Banca Nazionale del lavoro Italy.
- Banca di Roma Italy.
- Credito Italiano Milano Italy.
- Banca popolare de Milano Italy.
- Banca Di Sicilia Rome Italy.
- Bank of valletta Ltd . Valletta-Malta.
- Bank of Newzealand.-Wellington Newzealand.
- Westpac banking Corporation - Newzealand.
- Den Norske Credit Bank- Oslo - Norway.
- National Bank of Pakistan - Karachi.
- Habib Bank Ltd- Karachi.
- Bank handlowy W. Warszawie- warsow.
- Qatar National Bank - Doha. State of Qatar.
- Romanian Bank for Foreign Trade - Bucharest.
- Islamic Development Bank - Jaddah.
- National Commercial Bank - Jaddah.

- Arab Bank Ltd. - Amman.
- Amman Bank for Investments. Amman.

- Mitsubishi Bank Ltd. -Tokyo.
- Bank of Tokyo, Ltd. - Tokyo.
- The Sumitomo Bank, Ltd. - Tokyo.
- Fuji Bank Ltd. - Tokyo.

- Union de Banques Arabes et Francaises (UBAF). Seoul.
- Korea Exchange Bank - Seoul.

- National Bank of Kuwait - Kuwait.
- Al-Ahli Bank of Kuwait - Kuwait.
- The Gulf Bank - Kuwait.
- The Commercial Bank of Kuwait - Kuwait.

- Post Och Credit Banken - Luxembourg.

- Perwira Habib Bank - Kuala Lumpur - Malaysia.
- Crediet Lyonnaise - London.
- Banque commercial de luxembourg./(Oriac) /Mr. Frans

B) Governmental Companies & Institutions :

- 1- State Organization for Chemical industry (SOCI)/ Paper Company.
BAGHDAD / AL-RASHEED Street / AL-SINAK /Telex : 213090 SEPP IK
IRAQ .

- 2- State Establishment for oil Refining and Gas processing (SORG)
only Paper Company.
Al-Sa'adoun Street /Baghdad Hotel Complex /
P.O.Box : 2075 Alwiyah /Telex :

- 3- State Organization for technical Industries (SOTI).
Baghdad / Palistinian Street.
- 4- Ministry of defence / Armament and supply directorate.
- 5- Air force / supply tail fin for R-400 from their own stock (1200
tail fin).
- 6- Chemical corp / supply gas mask and protective clothes.
- 7- Hutteen state Est. / supply empty casing.
- 8- Qaqa state Est. / supply fuses and SO3 and smoke canister for
Military training.
- 9- Project 144 / supply AL-Hussain warhead and warhead for 122 mm Rocket.
- 10- St. Est. for mechanical industries / supply aerial bombs DB-0
and DB-2.
- 11- Nassar St. Est. / supply aerial bomb type R-400.
- 12- petroleum research center / several joint research were carried out
between P.R.S and Al-Muthana during 1989 - 1990.

Material procured through SORG :-

<u>ITEM</u>	<u>QUANTITY/TON</u>	<u>LC\NO. & COMPANY</u>
TDG	400	85/3/579 Companies
TDG	650	87/3/2790 Companies
TDG	350	87/3/232 Companies
PCL3	50	84/3/535 Companies
TMP	100	84/3/1292 Companies
TMP	56	85/3/220 Companies
HF	200	85/3/219 Companies
POCL3	130	84/3/1535 Companies
POCL3	250	85/3/1024 Companies
POCL3	250	86/3/377 Companies
Dimethylamin	5	86/3/476 Companies
Control valves	---	10/66771 Companies
O-Chloro	50	88/3/811 Weco
Benzaldehyde		

MATERIAL PROCURED THROUGH SOCI/SEEP

<u>ITEM</u>	<u>COMPANY</u>	<u>LC/NO</u>
Technical equipment	Pilot plant	83/3/1073
Pumps Acc to prof.	P.P	83/3/1079
Mechanical equipment	Sitac	83/3/867
Air-condition/Scrubber	K.Kolb	82/3/989
Spectrophotometer	Perkin Elmer	86/3/269
Steam jet pumps system	Neuberger	86/3/263
Chemicals	Fluka	85/3/747
Chemicals	Fluka	85/3/1114
Workshop of stores	WTB	85/3/772
glasslined piping	WET	85/3/771
materials		
Technical equipment	Ludwinghammer	83/3/1124
Scrubber system	Heberger	84/3/778
Technical equipment	Wormald Eng.	83/3/133
Technical equipment	Buchi Lab	82/3/1197
Liquid Nitrogen	Philips Export	86/3/718
Producing Plant		
Technical equipment	WET	85/3/787
Pumps	Preussag	84/3/1197
Lab equipment	Supped Co	85/3/784

Technical equipment	WET	85/3/799
Chemical (190 Ton)	Melchmie	83/3/824
Chemicals	Exomet	86/3/1145
Chemicals	WET	86/3/1365
Chemicals	Melchemie	84/3/1205
Chemicals	WET	85/3/444

(PROCUREMENT NETWORK)

***** Private foreign Companies :- *****

COMPANY NAME	ADDRESS	ENTITY NAME	LC.NO./DATE OF TRANSACTIONS	MATERIAL	QUT. TON	BROKER/MIDDLEMEN
PILOT PLANT	W. GERMAN Y/ FRANK FURT AM MOLKE NBORN 2,D 6072, DREIEI CH	KARL KOLB	967/3/81	Erecting sys.in		FRINZIL/HERMAN
		NEU BURGER LENHARD T	1104/3	Hebergers Building Different pumps		
		PROTIC	1340/3	Technical Instrument		
		LAB CONSULT	50/3/82	Ditto		
			167/3/82	Warning sys.		
			168/3/82	Vacuum		
			169/3/82	Technical Equipment		
			190/3/82	Vacuum		
			869/3/82	48-51,92-102,122,123 126-128,130,131,134-136,183-187,265,298-309,316-333 *		
			872/3/82	Miller & Dryer		
			899/3/82	271,296,297 *		
			150/3/83	Tank for G.Reactor		

NEUBURGER KUNSTSTOF FIN- DUSTRIE GMBH	AUSTRI A A-8692 AD MURZ LECHE M 14	PILOT PLANT	1101/3/83 1073/3/83	Reactor 40- 47,137,138,139, 140,146- 148,173,179- 182,294,295,310- 315*	FRINZIL/HER MAN
			1079/3/83 1081/3/83	Pumps Technical Equipment	
			1082/3/83	Humid fire unit	
			31/3/84	55,56 *	
			37/3/84	Ventilation equi.	
			188/3/84	Anti Acids pipes	
			243/3/84	Ventilator	
			266/3/84	Technical Equipment	
			821/3/85	Drying Equipment	
			501/3/86	Vacuum pressure Apparatus	
			250/3/85	116,117,129,132, 227 -231,263,266 *	
		KARL KOLB LENHARD T PROTIC LAB CONSULT	488/3/85	pipes & Valves	
			669/3/85	Spare parts	
			670/3/85	Tanks	
			145/3/86	Vacuums	
			262/3/86	Technical Equipment	
			263/3/86	Vacuums	
			499/3/86	Spear parts	
			500/3/86	Ditto	
			666/3/86	197,218,219,224- 226, 274,276,278- 281,290*	
			697/3/86	Spare parts	
			1420/3/86	Ditto	
			1461/3/86	Ditto	

LEHNHARDT		KARL KOLB PROTIC LAB CONSUIT NEU BURGER PILOT PLANT	1514/3/86 224/3/87 315/3/87	Ditto Ditto 59-63,188- 196,209- 213,247-252 *		FRINZIL/HER MAN
			1315/3/84	115,267-270,291- 293*		
PROTIC	FRANC E	KARL KOLB	65417/10	Thermal Oil		FRINZIL/HER MAN
	S-A 23,RUE DE HOUT POINT F-68400	NEU BURGER	380/3/86	Circulator Softener Unit		
	RIDISH EIM TLX 881010 F	LENHARD T PILOT PLANT LAB CONSULT	2517/3/87	1-6,141-143,149- 172, 198-208,214- 216,220, 232,234,236- 246,253- 254,257- 262,288,289*		
			2187/3/87 2931/3/88 2160/3/88	Additional Mixer for Tifzel Reactor Spare parts Valves		
LAB CONSULT GMBH	W.GER MANY AM MOLKE NBORN 2 D-6072 DREIEI CH	KARL KOLB NEU BURGER	693/3/86 669/3/86	Coating Equipment Technical Equipment		FRINZIL/HER MAN
		LENHARD T	1363/3/86	Ventilator		
		PILOT PLANT	2976/3/86	Spare parts		

KARL KOLB	W.GER MANY P.O BOX 102040 6072 DREIEI CH TLX.041 7981 KOLB-D PROTIC TEL.(06 103)653- 0	PROTIC				FRINZIL/HER MAN
		LAB	608/3/82	Scientific Instru.		
		CONSULT	777/3/82	Two Tanks		
		NEU				
		BURGER				
		LENHARD	793/3/82	Furniture erecting		
		T				
		901/3/82	100Suit	Equi.		
		PILOT	923/3/82	Lab. Equipment		
		PLANT				
			925/3/82	Instrument		
			956/3/82	G. Instrument		
			989/3/82	Cooling		
				Equipment		
			1053/3/82	Lab. Equipment		
			1059/3/82	Lab. Vehicle		
			181/3/83	Tables		
			333/3/83	Additional Eq.		
			518/3/83	Supply & Erection Eq.		
			543/3/83	Spare parts		
			580/3/83	Filling Equipment		
			659/3/83	Technical		
				Equipment		
			770/3/83	Tube Bender		
			781/3/83	Spare parts		
			1021/3/83	Water Cooler		
	1100/3/83	Technical				
		Equipment				
	1062/3/83	Metal Covers				
	1195/3/83	Supply Reaction				
		Tech.				
	1125/3/83	Technical				
		Equipment				
	430/3/84	Ditto				
	1486/3/84	Lab. Equipment				
	796/3/85	Ditto				
	255/3/86	Ditto				
	259/3/86	Filtering Machine				
	502/3/86	Lab. Apparatus				
	503/3/86	Lab. pumps				

FLUKA CHEMIE AG	SWISS 25CH- 9470 BUCHS- SCHWE I	504/3/86	Lab. Apparatus	0.6	
		511/3/86	Viscosity Measuring Apparatus		
		492/3/86	Microscope Device		
		695/3/86	Spare parts		
		903/3/86	Polarization inst.		
		908/3/86	Lab. Equipment		
		909/3/86	Spare for Lab. Equ.		
		911/3/86	Lab. Equipment		
		1360/3/86	G.Spare parts		
		1534/3/87	Measuring Inst.		
		1565/3/87	Vacuum sys.		
		2885/3/87	Welding Wires		
		2886/3/87	Sites Spare parts		
		2887/3/87	Spare parts		
		1217/3/87	Holes Testing device		
		2188/3/87	Lab. Equipment		
		2319/3/87	Density Meter		
		10/66380	Lab. Unit		
		1918/3/88	G.& Machines		
		737/3/79	Air Ducts		
		871/3/81	?		
		341/3/82	Tools Materials		
		1046/10/82	Expects Wages		
		6629/78/91	Lab. Cooling Unit		
		7171/78/91	Stores Cooling sys.		
		1321/3/81	Suspected TDG		
		39/3/84	Lab. Chem.		
		1346/3/84	Lab. Chem.		
		1114/3/85	Lab. Chem.		
		747/3/85	KI		
		783/3/85	Lab. Chem.		
		494/3/85	3.Hydroxy Methyl		
		238/3/85	Lab. Chem.		
		913/3/86	Lab. Chem.		
		726/3/86	Lab. Chem.		
		257/3/86	Lab. Chem.		
		526/3/87	Lab. Chem.		
MELCHEMIE	HOLLA	34/3/82	O.ChloroBenzald		WEIMAN

BUCHI	ND JANSPU ITENSI GEL 20 P.O BOX 143 6800 AC ARNHE M TLX 45523 MELC NL	1015/3/82	ehyed SOCl2	100	CHBLUNKER
		535/3/83	SOCl2	750	
		824/3/83	NaOH+DCM+W P		
		291/3/84	KHF2	100	
		378/3/84	IP	150	
		425/3/84	SOCl2	1000	
		1080/3/84	CH2Cl2	600	
		1205/3/84	KHF2	20	
		1242/3/84	HF	5	
		1251/3/84	Unknown		
		1637/3/84	Unknown		
		260/3/86	KI+CH2CH	600	
		2642/3/88	Unknown		
		192/3/82	Technical Equipment		
		525/3/82	Spare parts		
SCHUCHARD T HOHENBRU N	SWISS CH 9230 FLAWIL TLX 77403	1098/3/82	Heating Equipment		
		1196/3/82	Technical Equipment		
		1197/3/82	Ditto		
		695/3/83	Ditto		
		714/3/84	Eq. Spare parts		
TAFESA	W.GER MANY/ MUNIC H W.GER MANY HILDES HIMER STRASS E 7 P.O.BO X 5924 3000	250/3/82			
		251/3/82	TDG	25	
		537/3/82	TDG	50	
		1124/3/82	TDG	250	
		689/3/83	Unknown		
		854/3/83	Unknown		

KBS	HANNO VER 1 TLX 923510 SVHAN	219/3/87	Unknown		M.L. SAKHEL
	HOLLA ND/ B-V P.O.BO X 554530 AB TERNE UZEN	252/3/82	TDG	50	
		389/3/82	Oxygen Tanks		
		776/3/82	DMA.HCl(Suspe cted)	10	
		870/3/82	SOCI2	50	
		898/3/82	O.ChloroBenzald ehyed	7	
		924/3/82	Monochlorobenze n		
		979/3/82	Unknown		
		1058/3/82	TDG(Suspected)	100	
		1090/3/82	TDG(Suspected)	250	
		1091/3/82	SOCI2	100	
		245/3/83	Technical Equipment		
		257/3/83	SOCI2	250	
		263/3/83	TDG	500	
		335/3/83	Unknown		
		1120/3/83	IP	100	
		1121/3/83	TMP+DMP HCl	20+100	
		1122/3/83	Ethyl Alcohol		
		46/3/84	Water Chiller		
		87/3/84	Technical Equipment		
		292/3/84	KHF2	100	
		379/3/84	Chemicals		
		413/3/84	pipes & Valves		
		416/3/84	Chemicals		
		427/3/84	Chillers		
		429/3/84	Molononitril	14.4	
		431/3/84	TMP	500	
		424/3/84	NaCN+CH3I	500+2	
		517/3/84	CH3I	2	
		776/3/84	G.Lined pipes		
		777/3/84	Vacuum pumps		
		819/3/84	pumps		
		820/3/84	Technical Equipment		
		934/3/84	?		
		1113/3/84	Chlorobenzene	50	

Preussag	W.Germ any P.O BOX 4840 D3000 HANOV ER 1 TEL.(05 11)4206- 1	1167/3/84	Heat Exchanger	2	NIZAR AL- KADI
		1379/3/84	Dimendelic Acid		
		1490/3/84	Unknown		
		1534/3/84	Unknown		
		1543/3/84	Valves		
		1612/3/84	Unknown		
		332/3/85	Filling Heads		
		424/3/85	Chemicals		
		813/3/85	Packing for towers		
		814/3/85	Valves		
		562/3/85	spare parts		
		1203/3/85	Pipe & valves		
		1457/3/86	DMA-HCl	100	
		256/3/86	G.L. Tubes		
		450/3/86	presure Mesuring Equ.		
		498/3/86	Welding Wires		
		569/3/86	Unknown		
		670/3/86	Spare parts & Tech.		
			Equipment		
		1365/3/86	Chloroamine	0.361	
		1306/3/87	Measuring Inst.		
		2304/3/87	Tubes		
		2504/3/87	Welding Wires		
		2891/3/87	Chillers Spare Parts		
		2090/3/87	Cables		
		310/3/88	Pneumatic Valves		
962/3/88	G.Material				
1024/3/88	Spare parts				
1746/3/88	Phenolformaldeh yde				
65740/10	Eq. Spare Parts				
65758/10	Iron Balls				
1058/3/82	NaCN	100			
253/3/82	Two Water Freezing Unit				
313/3/82	500Chlorine cylinder				
526/3/82	POCl3	30			
1021/3/82	Fire Extinguisher				

TLX. 923523	80/3/83	Trucks
	868/3/83	Chlorine cylinder
	1080/3/83	Cranes
	1539/3/84	G.Cating M\C
	1540/3/84	Telephone Cables
	1541/3/84	Car Washing M\C
	1542/3/84	Ice maker
	1558/3/84	Electric Dis. Board
	1609/3/84	Raw material Net
	1679/3/84	Kitchen Equipment
	1786/3/84	Tile Grinding Machine
	1787/3/84	Spare parts
	1356/3/84	Equipments
	1363/3/84	500 container with Valves
	1425/3/84	Medical Equipments
	1453/3/84	Equipments
	1489/3/84	spare parts
	1537/3/84	Steel Pipes & plats
	1142/3/84	Pumps
	1143/3/84	Tech. Equipments
	1197/3/84	Pumps
	1239/3/84	Electric Dis. Board
	1331/3/84	machine & Equipment
	1097/3/84	tire unit
	1101/3/84	Spare part
	1091/3/84	Cooling Unit
	1104/3/84	Cables 1000M(12box)
	1111/3/84	Agricultural Equ.
	1092/3/84	Fire extinguisher U.
	1094/3/84	Spare parts
	1138/3/84	Cranes & Chains
	1139/3/84	Limit Switches
	1140/3/84	Spare parts
	925 /3/84	Spare parts
	966 /3/84	Prevention Equ.
	967 /3/84	Warning Sys.
	1016/3/84	Batteres 43A/4
	1020/3/84	Tieres

			465 /3/84	Cranse /5		
			479 /3/84	Crude Water Supply U.		
			480 /3/84	Cranse /5		
			491 /3/84	Carvans		
			536 /3/84	Hydraulic lift		
			270 /3/84	Tech. Equipment		
			290 /3/84	Valves		
			312 /3/84	Frion cylinders		
			347 /3/84	Incinerator /2		
			30 /3/84	Hallon cylinders		
			535 /3/84	Crude Water net work		
			80 /3/84	Spare parts		
			92 /3/84	Equ. & Spare parts		
			99 /3/84	Industrial Equ.		
			116 /3/84	Filling Station		
			189 /3/84	Spare parts		
			190 /3/84	Equipment		
			197 /3/84	Chemicals		
			201 /3/84	Laundary		
			836 /3/85	Equ.		
			837 /3/85	Paints		
			838 /3/85	Safety shoes		
			839 /3/85	Spare parts		
			1014/3/85	Folders		
			1054/3/85	Spare parts		
			1113/3/85	Elivatore		
			1115/3/85	Workshop Equipment		
			533 /3/85	Spraying machine		
			534 /3/85	H.T,Cable		
			535 /3/85	Blook manufacturing machine		
			586 /3/85	Flexable houses		
			786 /3/85	Instrumentation cards		
			789 /3/85	air filter		
			414 /3/85	Water treat. plants		
			451 /3/85	?		
			454 /3/85	Tech. Equipment		
			457 /3/85	Mercedes Cars		
			458 /3/85	Lab. Equipment		
			460 /3/85	Tech. Equipment		
			492 /3/85	Library Equipment		
			517 /3/85	Pipes & fitting		
			526 /3/85	Raller & dumper		

			164 /3/85 290 /3/85 301 /3/85 353 /3/85 357 /3/85 370 /3/85 372 /3/85 401 /3/85 406 /3/85 1362/3/86 694 /3/86 508 /3/86 2804/3/87 309 /3/88 621 /3/88 958 /3/88 2510/3/88	Silos mercedes trucks Welding Equipment Machines H.T.cables Specialist truck Vacuum Pumps Mechanical machines Communication Equ. Lab devices Water Pipes network Spare parts Pumps,spare part Plastic gloves voltage stabilizer compressors valves		
Hochest	W.Germ any		790 /3/82 900 /3/82 773 /3/84	POCl3 O.ChloroBenzald ehyed Spare part	10 10	NIZAR K. JAWDAT
Keramchemie	W.Germ any		38 /3/84 1051/3/80 91/78/7103 529 /3/82 1066/10/82 1117/3/79 785 /3/84 794 /3/82	anti acid tiles compersate material tower production Lap equipment Experts wages Bricks compersate ? Material for gas system		
Dow corning	W.Germ any		868 /3/82 1138/3/83	Equipment Litheam-800		
Vitalograph	ENGLA ND MAIDS MORET ON		1092/3/82 1566/3/87	Medical equipment Medical instrument		

	HOUSE BUCKI NGHAN MK 18 1 SW					
HAHN & KOLB	W.Germ any		1240/3/82	Equipment		
UNIC	ENGLA ND		78/3/83	Animal unit		
POLYMA	W.Germ any		79/3/83	Generators		
	P.O.BO X 102849 D 3500 KASSEL		378/3/83	Spare part		
			792/3/85	Electric generators		
			509/3/86	Spare part,generator		
			2303/3/87	H.T. equipment		
WARMALD	KAISER ESTATE		133/3/83	Fire extinguisher		
	LOWER GROUN D		317/3/80	Supply-Erection		
	FLOOR 41 MAN YUE		236/3/82	Forklift		
	STR. HUNG HOM KPWLO ON HONG KONG TLX HX 79433		491/3/86	Heat sensors		
INTERPRISE	BRAZIL	EVIBRASE	380/3/82	TDG	100	
HERBERT	W.Germ any		381/3/82	Machine & Equipment		
ARNOLD	P.O.BO X 1220 WEILST		194/3/84	Tech. Equip.		
			3096/3/88	Glass machines		

	RASSE 6, 6290,WE ILBURG / LAHN TLX 484231 ARLO D				
NUWAY ENERGY	ENGLA ND		594 /3/82	Fire cement	
			871 /3/82	Civil &Tools equip.	
			797 /3/85	Spare parts	
			7116/42	Erecting burning	
PHB	W.Germ any		264/3/83	Shelves for cooling	SCHWENDE R
			32 /3/84	Equipment	
MERK	W.Germ any		335 /3/83	Chemical material	
			357 /3/83	Lab. Chem.	
HERAUSE	W.Germ any		358 /3/83	Analyzer	
	ENGLE RSTR 11 6900		1063/3/83	Air,Press	
	HEIDLB ERG FAX INT.622 1/3043 43		2315/3/87	Heating tape	
			223/3/87	Spare parts	
RIDEL DEHEIN	W.Germ any		371/3/83	Lab. Chem.	
			121/3/84	Chloroamin	
EIVS	FRANC E		434/3/83	Tech. equipment	
			2631/3/87	Pumps,Spare parts	
			4835/42	Scientific equip.	
TSA.AUSSEN H- AEND	W.Germ any		592 /3/83	Catting machine	

AL, SHAREF CO.	EGYPT		694 /3/83	Supply & erecting pipes		
K S U	SWISS		826/3/83	Cars lift		
HEWLETT PACKARD	SWISS 7 RUE DU BOIS DULAN, 1217 MEYRI N GENEV A		855/3/83 1115/3/84	Data process units Computer		
ENGICO	W. Germ any		856/3/83	Vacuum cleaner		
LANSING	U.K		869/3/83 1449/3/84	Forklift Spare parts for Forklift		
LUDWIG HAMMER	W. Germ any BRUGH ANNEN 8752 KLEINO STHEIM P.O BOX 1107 TLX.418 8692 TEL.(06 027)809 6-9		1072/3/83 1124/3/83 1409/3/84 1200/3/84 1262/3/84 1107/3/84 712/3/84 832/3/85 926/3/85 559/3/85 580/3/85 774/3/85 439/3/85 497/3/85	Electric power stat. Tech. equipment Electrical station chillers Equipment Spare parts Electric power stat. Electric equipment Electric equipment Ventilation Elumination equip. Alarm system H.T.station Electric boards		

I.T.E	SPAIN/E MILIO VARGA S 20-6 28043 MADRI D TLX.492 83 TEL.413 5895 4135963		727/3/86	Tools&cables	JAFEAR
			270/3/86	Electric equipment	
			698/3/86	Spare parts	
			915/3/86	Electrical works	
			265/3/86	Electric equipment	
			1355/3/84	Electric trans	
			1650/3/84	Elec.equi.&materi al	
			1651/3/84	17,19,103- 108,124,125 144,145,174,255, 256*	
			1652/3/84	Elec.equi.&materi al	
			66/3/85	Special equipment	
PIGANT E.E. SCHWENDE R KG	FRANC E W.GER MANY ORANIE NWEG 17 D-4530 IBBENB UEREN TLX.945 81 TEL.054 51-8000	909/3/84	486/3/86	Tech. equipment	SCHWENDE R
			268/3/86	Tech. equipment	
			2242/3/88	Welding Machine	
			1660/3/84	Distillation Unit	
			1678/3/84	Steel flat pallets	
			900/3/84	Welding Machine	
			Equ. & tools		
			486/3/84	Air Compressor	
			1380/3/84	Machine & Equ.	
			26/3/84	Tech. equipment	
			829/3/85	Barrel holders	
			452/3/85	Spare parts	
			146 /3/86	Equ.&tools for Store	
			725 /3/86	Analyze device	
			1594/3/87	Spare parts	
			2888/3/87	Chillers Spare parts	
			164/3/87	Machine&Tech.E qu.	
			145 /3/88	Pneumatic valves	

			655/3/88 65464/10 65702/10 901/3/86 1747/3/88	Spare parts Equipment Lathe tools P.E Coating drums Elec.lines Inspect Unit		
SOUTH WALES	U.K		1712/3/84	Spare parts		
BRAITH	U.K		1239/3/83	Water Tanks		
SUMITOMO CORPORATI ON	JAPAN C.P.O.B OX1524 TOKYO 100-91		1123/3/83 566/3/85 443/3/86	Different Cars Land Crozer Car Cars Spare parts		
			945/3/85 459/3/85	4 Cars Elect. Cables		
AIAX	ITALY		1555/3/84 1521/3/84	Spare parts spare for Cooling		
GEORGE FISHER	W.GER MANY CH-8201 SCHAFF HAUSE N MFD 3974		1557/3/84 1661/3/84 772/3/84 692/3/86	Pipes flanges Pipes & valves Plastic Pipes		
			700/3/86 478/3/86 2803/3/87	Pipes & pumps Spare parts Pumps Spare Parts		
			2093/3/87 1288/3/87	Tech. equipment Anti Corrosive Pipes		
TALABAC TRADING	HONG KONG 2940 WINGO N-	GIG	1785/3/84 667/3/86	Special Equipment Equipment		
CO.LTD	CENTE R 111 ONNAU GHT ROAD		141/3/87	Vacuum & pipes		

	CENT L					
GIG	AUSTRI A	TALABAC	438/3/86	Prod. Equipment		
CEILCOTE	W.GER		496/3/86	Pumps & Spare		
GMBH	MANY		668/3/86	parts		
	D-6083			Tech. equipment		
	BIEBES		1806/3/84	Spare parts		
	HIM					
	RHEIN,		831 /3/85	Pumps		
	P.O.BO		1052/3/84	fiber G. Water		
	X			tanks		
	1120		493/3/84	Softener Units		
			1040/3/85	Gas mashing		
				Units		
			415/3/85	Ashing rines		
			229/3/85	filling tanks		
			311/3/85	Heat isolation		
				material		
			276/3/85	Pumps& spare		
				parts		
			496/3/86	Pumps& spare		
				parts		
			820/3/87	Instrument		
HYSTER	U.K		1348/3/84	Fork lift		
			1350/3/84	Fork lift		
W.E.T	W.GER	T.E.T	1349/3/84	PCI3+NaF+KI	32+54+	LEIFER
	MANY /				0.268	
MASSAFIND	LEUNA		1424/3/84	pumps&spare		
OU	STRAB			parts		
	E 50-		1426/3/84	Steel Equipment		
ZEKOM LTD	2000					
	HAMBU		1427/3/84	Pumps& spare		
	RG-50			parts		
	TLX.2		1141/3/84	P.P.Pipes		
	165950					
	WETD		1187/3/84	64-84,109-110 *		
	TEL.040		1093/3/84	NaF	52.8	
	-8560 44					

			1095/3/84	Spare parts		
			1096/3/84	pumps		
			1106/3/84	G.pipes		
			1114/3/84	KHF2	38	
			489/3/84	8-13,15,16,18,20-28*		
			490/3/84	29-33 *		
			1258/3/85	Equipment		
			1259/3/85	Equipment		
			1260/3/85	Lab. Equipment		
			65/3/85	Engineering Services		
			1743/3/85	Computer		
			884/3/85	Cylinders		
			35/3/85	Desine & drawing		
			798/3/85	Equipment		
			769/3/85	Tech. equipment		
			770/3/85	37-39 *		
			771/3/85	IP	10	
			772/3/85	Warehouses		
			773/3/85	Warehouses		
			787/3/85	Tech. equipment		
			788/3/85	Tech. equipment		
			790/3/85	Tech. equipment		
			444/3/85	CH3I	2	
			185/3/85	52-54 *		
			242/3/85	Inspection Equ.of Chemical Unit		
			1364/3/86	Spare parts		
			1462/3/86	Pumps		
			896/3/86	Spare parts for fire fitting		
			904/3/86	Machine & pipes		
			907/3/86	N2 generator		
			910/3/86	Spare parts		
			914/3/86	Cl2 detector		
			916/3/86	machine & workshop		
			917/3/86	Spare parts		
			918/3/86	KI	3	
			950/3/86	Spare parts		
			474/3/86	Dichloromethane	58	
			671/3/86	Tech. Equipment		
			721/3/86	Electric fork lift		
			722/3/86	pent&coating material		
			724/3/86	Weighing device		
			720/3/86	H.T.Cable		
				Equipment		
			447/3/86	Pipes Juneten		

T.E.T	W.GER MANY / HAMBU RG	W.E.T	448/3/86	Pipes for tankes	60	
			465/3/86	Spare parts		
			449/3/86	Tech. Equipment		
			497/3/86	Spare parts		
			507/3/86	Metalcoating apparatus		
			510/3/86	Carrying , Tools		
			378/3/86	Elec. Power station		
			382/3/86	S. parts for stat.		
			383/3/86	Lab equipment		
			421/3/86	DMH HCl		
			423/3/86	272,273 *		
			437/3/86	chemical factory		
			229/3/87	Spare parts		
			1855/3/87	Water pumps		
			7/3/87	85-91,111- 114,118- 121,133 *		
			1527/3/88	Spare parts		
			1467/3/88	A+B equipment		
			1920/3/88	Spare parts		
			2890/3/87	S. parts for reactor		
			717/3/86	Vacuum system		
PHILIPS	HOLLA ND / AMSTE RDAM P.O.BO X 218 5600 MD EINDH OVEN		2073/3/88	Pumps,Spare parts		
			2410/3/88	Tech.pressure reducer		
			517/3/83	Spare parts		
			1117/3/84	Intercommunicati on		
REINING HAUSS	W.GER MANY		718/3/86	N2 device	15+20 15+13.68+2 0 5.12+15+	
			1017/3/88	Voltage stabilizer		
			1401/3/84	TMP+KHF2		
			1450/3/84	TMP+POCl3+Na CN		
			1323/3/84	PCl3+TMP+POC		

			850/3/84 862/3/84	I3 NaF POCl3+NaCN+N aF	10.26 2 3.04+16+ 17.6	
SHOTT	W.GER MANY		1408/3/84	Glass material for		
GLASS	P.O.BO X 101152 D		1403/3/84	work shop Glass Equipment		
WARE	8580 BAYRE UTH TLX 642786 SORU		2801/3/87	Pumps,Spare parts		
			2650/3/88	Glass raw Material		
			1359/3/86	Lab.material &Equi.		
HORSELEY BRIDGE COMPANIES	U.K		1456/3/84	Tanks		
INCORORAT ED	PANAM A VIA MADRN O 10, 6900 LUGAN O		949/3/86	Unknown		
			476/3/86	DMA	5	
			377/3/86	POCl3	250	
			232/3/87	TDG	350	
			1024/3/85	POCl3	250	
			579/3/85	TDG	400	
			1535/3/84	PCI3+POCl3	50+130	
			1292/3/84	TMP	100	
			219 /3/85	HF	200	
			220 /3/85	TMP	56	
ORAC	LUXEM BOURG 30, BOULE VARD DE LA FOIRD		2790/3/87	TDG	650	FRANSE

FCA	SWISS VIA DELLE AIE 1/A 6900 LUGAN O		1873/3/88	Tech. Equipment		
JETRACO	W.GER MANY		1188/3/84	Spare parts		
			727/3/84	Spare parts		
AB GROEDERNA EXBERGS	SWEDE N		1198/3/84	pipes & Fitting		
A H B TECHNOCO MERZ			1249/3/84	Spare parts		
VFF CO			1253/3/84 450/3/85	Tower Packing Ball Ring		
MOTOR AIR			1261/3/84	Air compressors		
AL HADDAD	U.S.A		775/3/84	Tiflon pipes		SAHIB AL- HADDAD
ENTERPRISE S	3212 WEST END AVENU V		313/3/84	Tech. Equipment		
INC.	NASHVI LLE, IN37203		326/3/84	DMMP(Suspecte d)	60	
			793/3/85	Air Compressors & Dryer		
			785/3/85	pipes		
			461/3/85	filters		
			105/3/84	Unknown		
			847/3/85	Equipment		
			1343/3/84	Chemical literatures		
PERKIN ELMER	U.S.A		1345/3/84	Spare parts		

		420/3/84 421/3/84 423/3/84 460/3/84 269/3/86 2876/3/88	Equipment Spare parts Spare parts Spare parts Annalyzing apparatus Spare parts		
DEVAINTS	BELGIUM	983/3/84 752/3/84	Spare parts Spare parts for Cooling Unit		
MARTIN	W. GERMANY	1105/3/84	Flunges & nuts		
MERKEL	P.O.BOX 930280 D 2102 HAMBURG 93	480/3/86 198/3/84	pipes material pipes		
		2802/3/87 2302/3/87 2974/3/88	Teflon pipes Teflon Hose Teflon tubes		
EUROPLAST		774/3/84	P.E tubes		
DAIKIN	JAPAN	901/3/84	Air condition		
DAIKIN KOGYO		412/3/84	Spare parts		
HEINRICHS	W. GERMANY	959/3/84	Flow meters		
MEINBURK	W. GERMANY	962/3/84	Inspection Equip.		
ELECTRICAL	D-8000 MUNICH EM 45	1192/3/85	Communication Equip.		
GMBH CO.KG	LUGOL STADT ER STR.43 TLX 5215545	3681/3/88 823/3/83 1807/3/84	Wireless Sys. Radio -Telephone Communication Sys.		

	MEIN D		1611/3/84			
EXOMET	INDIA	KIM ALKHALL EEJ	973/3/84	PCl3+POCl3+Na CN	300+250+5 0	KAMAL AL- SAUDI
PLASTICS	401KAK AD CHAMB ERS 132 DR,ANN IE BESAN T ROAD, WORLI, BOMBA Y 400018		1145/3/86	SOCI2+DMA HCl	1000+300	
KIM KHALLEEJ	SINGAP ORE MIDDL E ROAD,1 6-20 FORTU NE CENTE R 0718	EXOMET PLASTIC	24/10/88 899/3/88	Documents Tech. Equipment		KAMAL AL- SAUDI
GEKA	W. GERMA NY		1057/3/84	Oil Electrical Gases		
FOXBORO	JORDA N P.O.BO X 3361A MMAN		1081/3/84	Control Unit		
	-		713/3/84	Control&mussare ment Sys. Instrument. Equi. Temp. Controllers flow meter valves		
			192/3/84 795/3/85 438/3/85 182/3/86			

DON GRESSWELL	U.K		1082/3/84	Lib.rary Equipment		
EXPOSEL			461//3/84	Tech. Equipment		
PULLEN PUMPS	U.K		464/3/84	Pumps		
			812/3/85	Pumps		
PAUL HEDFELD	W. GERMA NY		484/3/84	Spiral Conveyozisi		
			407	valves Tankers for chemical		
			715	A+B project equ.		
ALLWEILER			487/3/84	pumps&spare parts		
SIHI CO.	W.GER MANY LANDE STRA SSE 170 D-2210 ITZEHO E		492/3/84	pumps&spare parts		
			1039/3/85	pumps&spare parts		
			518	pumps&spare parts		
			665/3/86	drain pumps		
DEDIETRICH	FRANC E		567/3/84	7,14 *		
DUEKER	W. GERMA NY		515/3/84	pipes		
			65696/10 267/3/86	lined spare parts G.L tubes		
HAUKE	AUSTRI A P.O.BO X 63 CUMBE SLAND STR. 46/50		523/3/84	force pumps		
			445/3/85	spare parts,pumps		
			948/3/86	S. parts for pumps		
			2598/3/87	pumps spare parts		
CIBA GEIGY	SWISS		902/3/86	lab. equ.		
			716/3/84	material & equ.		

			159/3/85	acid resistance paints		
RUSTON DIESEL	U.K		728/3/84	generator,S. parts		
DERMAN DIESEL	U.K		729/3/84	generator,S. parts		
MECS INT INC	JAPAN		314/3/84	micro film sys.		
	5-25-6- 606		191	copy machine		
	MINANI DAI NAKAN O- KU,TOK YO		2163/3/88	spare parts		
			221/3/87	spare parts		
			475/3/85	micro film sys.		
WINTER			324/3/84	gas leak detector		
MAGNETRO L			380/3/84	Equipment		
JOSEF BERTSCH			381/3/84	Thermal Oil Plant		
LEWA HERBERT	W. GERMA NY ULMER STR.10 P.O.BO X 1563 D 7250 LEONB ERG BEI STUTT GART		408/3/84	pumps		
	W. GERMA NY		821/3/87	pumps		
PFAUDLER WERKE	W. GERMA NY		406/3/84	Scrabber		
CH.ABSTRA CTS SERVIES			74/3/84 140/3/84	Tech. Equipment micro film sys.		

ORLITA GMBH CO.	W.GER MANY MAX- EYTH- STABE 10,63 GIEBEN		73 /3/84	pumps		
SOFRAF			100/3/84	Industrial Equipment		
TAYLOR			193/3/84	Instrumentation Equip		
EEER	FRANC E		1200/3/85	Drainage Network		MICHAEL RANJFEAL
			1199 409	Air washers spare parts		
O B O	W. GERMA NY		819/3/85	Elec. Equ.		
PYE UNICOM	U.K		820/3/85	Analyzing Material		
	YOURK STR. KAMBR IDGE,E NG		294	collector Equ.		
	EB,2PX TEL. 0223- 358866 TLX.817 351 PY KAM		600/3/87	spectrophot meter		
			900/3/86 264	lab. Equ. S. parts for lab.Equ.		
			265/3/87	lab. Instruments		
			290 696/3/86	lab. device chromotography device		
BEST CORPORATI ON	JAPAN		830/3/85 434	Air conditioners Air conditioners		
RICHTER	W.GER MANY P.O.BO X 609 D		325/3/84	Valves		
			1083/3/85	Valves		

COGELEX	4152 KEMPE N 1		794/3/85	Valves		
			1625/3/86	spare materials		
			274/3/88	spare parts		
			2577/3/88	Valves		
			2973/3/88	spare parts		
			3309/3/88	lined Valves		
	FRANC E 13 RUA ANTON IN RAYNA UD 92309 LEVAL LOIS PERRET CODAX		1075/3/86	Electrical stations		
BDH	ENGLA ND		1049/3/86	Lab. Chem.		
	BROOM RD. POO LE. DORSE T B.H.12, 4NN		899/3/86	Lab. Chem.		
SUPELCO	SWISS CHEMI N DU		784/3/85	lab. Equ.		
			116/3/86	spare parts for		
				water sweetener units		
	LAVAS SON 2, 1196 ELAND		477/3/86	lab. materials		
			898/3/86	lab. materials		
			1361/3/86	Analyzing materials		
COULTER	ENGLA ND		1459/3/86	spare material		
	NORTH WELL		891/3/87	spares & Access. for		

	DIVELU TION,B UDS, LU3,3R D	135/3/88	lab. In. spare parts		
LE TELMECANI Q - UE	FRANC E	1460/3/86	Analyzer Device		
GANSSEN	BELJIU M TURNH OUTSE WEGE 302340 BEEVSE BRUXE ELS	1534/3/86	Chemical Materials		
UHDA	W.GER MANY D.4600 DURTM UND 1 TLX.822 841-32 UDD TEL(023 1)547 2996	4/10/85	Chlorine plant		
		6/10/85	Chlorine plant		
		86/3/85	Chlorine plant		
		29/10/86	Engineering doc.		
TRANE		239/3/85	Cooling Equipment		
		1771/3/88	spare parts		
WERNERL- PUPERM	W.GER MANY	165/3/85	pumps&spare parts		
BRAND	W.GER MANY	317/3/85	spare parts		
RITZ	W.GER MANY P.O.BO X 1780 7070	568/3/85	pumps		
		993/3/88	spare parts		

	SCHWA EBISCH GMUEN D FED					
MANTECH	KUWAI T P.O.BO X 20228 SAFAT		632/3/85 490/3/86 220/3/87	Computer spare parts Access. of print mach.		
INTEREYIM	FRANC E 27 RUE DE LA MICHO DIERE- 75002 PARIS		741/3/85	pumps		
KARL LUTZ	W.GER MANY P.O.BO X 390 ERLEN STR 5-7, 6980 WERTH EIM 2		791/3/85 381/3/86	pumps pumps		
F.U.G.N			2301/3/87	H.T Equipment		
YOKOHAMA	JAPAN		2632/3/87	spare parts		
GLASWERK WERTHEIN	W.GER MANY P.O.BO X 1265 ERNST- ABBE STR -16980 WERTH EIM		2407/3/87	Raw material&manuf- acturing Glass Apparatus		
ZINSER	W.GER		2316/3/87	spare part for		

	MANY P.O.BO X 1440 D7333 EBERSB ACH/F			oxygen cutter		
HIP	W.GER MANY	2537/3/87		Cyclohexanol	50	Dr.LUTZ DYCKERHOF F
	D.5000 KOLN 41 P.O BOX 420208 TLX.888 1951 HIP D TEL(49) 2233165 091	1968/3/88		Cyclohexanol	100	
		65733/10		Xylene		
ENDRESS- HAUSER	W.GER MANY P.O.BO X 1261 7864 MAULB URG	2674/3/87		Humidity meter		
FRANZ KLAUS- UNION	W.GER MANY P.O.BO X 101349 BLUME NFELD STR. 18D- 4630 BOCHU M 1	2763/3/87		spare part		
BOEHRINGE R	W.GER MANY SANDH OFER STR 116 P.O.BO	512/3/86		lab. chemicals		

PANDS	X 310120 6800 MANNH EIM 31		495/3/86	spare parts		
LIBHERR	W.GER MANY P.O.BO X 1361,D- 7930EHI NGEN/E ONAU		493/3/85 719/3/86	Cranes spare parts		
SULZER	SWISS DORNA CHER STR.210 CH-4002 BASLE		664/3/86 2649/3/88	Air pumps Kiraback stuff		
EUROCLIMA	ITALY LOVEN ZNERST RASSE, 36,39031 BRUNE CK		464/3/86	Cooling Equ.		
GALLENKA MP	ENGLA ND BELTO N ROAD WEST LOUGH BOROU GH LEICES TORSHI RE LENTO R		897/3/86	lab. Equ.		
LABSCO	W.GER		905/3/86	lab. Equ.		

	MANY P.O.BOX 1728-D 6360 FRIEDE RGIH		906/3/86	lab. device		
METTLER INSTRUMENTE	CH-8606 GRELFE NSEE IM LANGA CHER,8 606 GRELFE NSEE SCHWE LZ		912/3/86 266/3/87	lab. device Temp. Analyzer		
WTB	W.GER MANY		444/3/86	Stores Erection		
			445/3/86 951/3/86	Stores Erection Supply & Install of Civil works		
PHARMACIA	SWEDE M AB S- 751 82 UPPSAL A		266/3/85	Lab.Chem.		
			505/3/86	Lab. Material		
LUMMUS	U.S.A		9/3/87	gas chromatography		
			261/3/86	Lab. Equipment		
FREDRICHSELD			2889/3/87	pumps spare parts		
ORLITA	W.GER MANY		2088/3/87	pumps spare parts		
OXOID	ENGLA ND WADE ROAD		494/3/86	Lab. materials		

	BASING STOK HANTS R,G24 OEW TLX 858793 G					
CARL ZEISS	W.GER MANY P.O.BO X136911 380D 7082 OBERK OCHEN		506/3/86	Microscope		
AVIV BLOM EDICAL	U.S.A 810 TOWEI N AVENU E P.O.BO X 994 LAKEW OOD NEW J 08701		291/3/87	Spectro Photo Meter		
JOUANNT	FRINCE RUE BOBBY SANDS CASE POSTAL 3203 44805,8 AINT HARBL AIN CEDEX		780/3/87	Lab. Device		
LKB	ENGLA ND CANBRI DGE SCIENC		781/3/87 607/3/88	spare parts Electro Phorecess		

	E PARK,M ILTON ROAD					
PHOENIX	W.GER MANY P.O.BO X 901140, 2100 HAMBU RG 90 TLX 0217571 PXHHD		1289/3/87 2977/3/88	Valves & Pumps Teflon Tubes		
PURPACK	W.GER MANY RHEINS T-5-D- 6054 RODGA V 2		2089/3/87	Scrale Instrument		
ARESCON	BAHRA IN P.O.BO X 2774 MANA MA		2091/3/87	D.30 TM device		
WEIR	SCOTL AND		2092/3/87	Pumps		
MESSER GRIES- CHEIM	W.GER MANY P.O.BO X 101530, 6000 FRANK FURT		8/3/87 338/3/88	Welding Machines Welding Machines, Equ.		
SIGMA	ENGLA ND FANCY ROAD,P OOLE DORES		142/3/87 65756/10	Lab. Chemicals Lab. Chemicals		

	T BH 17-7-NH TLX 418242S IGMA G					
KARDEX ORGANISATI ONS SYSTEM GMBH	W.GER MANY NIEDER HOECH STAED TER STR.64 6242 KROMB ERG		218/3/87	Cabinet		
JAKOB THALER	W.GER MANY 2357,WE DDELB ROOK UBER NEAUM UNSTE R NAHE HAMBU RG		222/3/87	Tools for Cables		
WECO INDUSTRIAL	W.GER MANY WILHE LMSTR 45,		46/3/88 2648/3/88	Zn Powder Chemical for	7	GEORG GAZZY
PRODUCTS	POSTFA CH		2729/3/88	Pesticides Raw materials		
EXPORT GMBH	1448, 5200 SIEG BURG		2880/3/88	Chemical for		
	-		3444/3/88 65714/10 65718/10 811/3/88	Pesticides spare parts spare parts HgCl2 O.ChloroBenzald ehyed	50	

BOBININDUS	BELGIUM RIJKSW EG, RUISBR OEK- PUURS	134/3/88	spare parts		
		66537/10	spare parts		
ESAB	UAE P.O.BOX 8964 DUBI	308/3/88	Welding Machine		
BUSC(GHVN)		307/3/88	spare parts		
ASE	BELGIUM 58 CENTURY CENTER PUS 1.B.2018 ANTWERP	352/3/88	Freion Cylinder		
MOTIVAIR	ENGLAND TWICK ENHANT TRADING ESTATE RUGBY ROAD TWICK ENHANT MIDDLE X TW1 1DH	484/3/88	spare parts		
AHRENS	W.GERMANY 50RHEIN GOLDWEG 2000 HAMBURG	83/3/88	Valves		
KLINKHART CO.		1593/3/88	balances 5 ton		

EURMAC	RG 56					
	ITALY		874/3/88	spare parts,cooling Tech. Equipment		
	MANUFACTURER CENTRE VIA AMPERA N.5,2005 2 DLX 351073		1871/3/88 2930/3/88	 Cooling Unit		
RYCOFT	ENGLAND DUNCOMB ROAD, BRADFORD BD8 9TB		957/3/88	Air compressor,spare parts		
BOEHRINGE MANNHEIM			1101/3/88	Solutions		
ADOBADE	W.GERMANY RABOISEN 16,D 2000 HAMBURG		1234/3/88	Belts		
SICA	BELGIUM 9,RUE DU PARADIS 5960 ORP		1240/3/88	Flow meter Unit		
ARMSTRONG	U.K. PEARTREE ROAD		1335/3/88	Spare parts		

	STANW AY COLCH ESTER 6SSEX CO3 5JX TEL 987858 ARMCO L G					
WESPER			1461/3/88 1748/3/88	spare parts Metal discs		
M.K.JUCHHE LM	W.GER MANY 6400 MOLTK ESTR 13/3 P.O.BO X 1209		1770/3/88	spare parts		
SANDVIK	SWEDE N P.O.BO X 12 S- 163, 93 STOCK HOLM		1859/3/88	Lathe,tools		
F.G.BODE CO.	W.GER MANY P.O.BO X 900167 2100 HAMBU RG 90 TLX 217600 MALAC D		1872/3/88	Glass Equipment		
BEMENCO			1256/3/88	Raw materials		
FSL INT.	U.K 27 HOXTO		1922/3/88	spare parts		

	R SQUAR E LANDO N NI6 NN TLX 9419022 FSL INT G					
OCHSNER	OBERF ELD STR. 8 P.O.BO X 60 A- 4024 LINI TLX 214390C HSNR A		1923/3/88	spare parts		
GRANDFOS	DENMA RK 9620 AALES TRUP, TLX 60267 B GFOS DK		1921/3/88	spare parts		
MUNSCH CHEMIE	W.GER MANY D-5412 RANSB ACH 2 TLX 863150 PUMA D		1991/3/88	spare parts		
KSB			2979/3/88	Pumps		
WINKELMA NNT			3442/3/88	Tanks		
BONAVENT URE	SWISS P.O.BO		3911/3/88	Special material Production		

	X 314, 1211 GENEV A 12					
UMIVERGEL TRELDING			65421 /10	Chemical material		
REMECO			65462/10	Pressed Air- Cylinder		
ZETILER			65463/10	spare parts		
IUTZ			65484/10	Vertical pump		
WALLAETTI E- RNAN			65757/10	spare parts		
SANDVIC			65802/10	Carbide dies		
FESTO			65719/10	spare parts		
ALDASA			65778/10	distillation Unit		
MIDLAND			66106/10	pump-spare parts		
NEUMAN	W.GER MANY		2978/3/88	spare parts		
KLOCKNER	W.GER MANY P.O.BO X 1880 5300 BONN 1		2972/3/88	spare parts		
ALEXANDER WIEGAND GMBH	W.GER MANY P.O.BO X 480,8763 KLINGE NPERG TLX 689231 A- WIK-A-D		2975/3/88	pressure gage		

GUHRING	W.GER MANY		2159/3/88	drills&Screws		
KRUPP WIDIA	W.GER MANY P.O.BO X 102161 D4300 ESSEN		2162/3/88	Lathe tools,for CNC		
PARKFAME	ENGLA ND 23MELR OSE GARDE NS MAMM ERSMIT H LANDO N W 6		2161/3/88	spare parts		
YORK	U.S.A		2388/3/88	spare parts		
MARLEYE COOLING TOWER CO.	U.S.A 5800 FOXBR IDGE P.O.BO X 2612 MISSIO N,KANS AS 66201		2405/3/88	towers spare parts		
SABROE	W.GER MANY P.O.BO X 1810 DK 8270 HOEJER G		2441/3/88	Valve Relief		
WREYAND	W.GER MANY		2511/3/88	spare parts		
SIEMENS	W.GER MANY		2647/3/88	Head testing Unit		

	P.O.BOX 3240,D 8520 ERLANGEN TLX 62921-0 SID					
GLASSWERK	W.GERMANY		2932/3/88	Glass Raw material		
WISLY HUGES			91/77/6336	Maps, Desigus		
			42/7598	Air-Conditions		
EXPAL	SPAIN		83/3/54	Contract 4/53/8		JAFEAR
KNOEDLER			3777/106	spare parts		
LANCESLIN K			66431/10	Pesticide Malathion DDVP for Formulation		
APPARATEP AUE			66491/10	Heat Conveyer Unit		
TELENORMA			2076/106	Operator,spare parts		
CHRONPACK	HOLLAND CHROM PACK PACKARD RD BV VULCA NUSWEG 259 P.O.BOX 519, 2600,AN DELFT		1686/3/87	N2 generator		
PACKARD	HOLLAND		1887/3/87	Chromotography		

DR.SCHALE R & LONGE	HOLLA ND PORNK ANPSW EG 139//147 2000 HAMBU RG 50		1457/3/86	Instrument Tech. Equipment		
GRESCHBAC H INDUSTRIE	W.GER MANY P.O.BO X 430180, 7500 KARLS UHE 41		699/3/86	Chemicals		
			1347/3/84	Equipment of 2 Warehouse		
QUINTON (TRA)			1250/3/84	Tech. Equipment		
MARKARTE R WISKANS			1010/3/82	50 Suit		
HOXID			779/3/83	Fork Lift		
SCABERT HOIZON			250/3/82	DMA HCl	10	
Q T L			1250/3/84	34-36,235,287 *		

NOTE :- * THE NUMBER MEAN THE ITEM IN THE TABLE TYPE &
QUANTITIES OF PRODUCTION EQUIPMENT PROCURED
BY C W - PROGRAMME/ 5 FEB. 1996

PROCUREMENT THROUGH GOVERNMENTAL AGREEMENTS OR CONTRACTS

No procurement for Al-Muthana State Est. was made through governmental

agreements or contracts. However, contracts were made directly with enterprises of foreign countries as follow :-

1- Egyptian Enterprises :

There was a contracts between the Iraqi government and the Egyptian Enterprises (Sakar Factory & Abo-Zaabal Factory) in 1984 according to this many chemicals and munitions supplied to Iraq . Chemical supplied to Iraq from Abo-Zaabal Factory(Protocol /1) were shipped to AL-Kuddiymi port and then transported to Iraq by trucks the end user certificate of the chemical was Iraq.

The munition supplied to Iraq from Sakar factory (Protocol /2) were shipped to Aqaba and then transported to Iraq by trucks the end user certificate of the munition was Jordan.

2- Chinese Enterprises :

The Iraqi procurement from China in 1985 was only munitions (120 mm mortar shell and Rocket motor for 122mm) (Contract No. : 20/3/85 from north industrial company (Norencos)) .

Which were shipped to Aqaba and then transported by Trucks to Iraq the end user certificate of the munition was Jordan.

PROCUREMENT THROUGH THIRD COUNTRIES OR COMPANIES
IN THIRD COUNTRIES

1- Companies supplied chemicals to Trieste port.

Responsibility stopped there upon request of SORG.

Shipping documents were handed over to Italian shipping and forwarding company, called Italteco with offices in Milan.

And the same for all chemical supplied from Japan by companies.

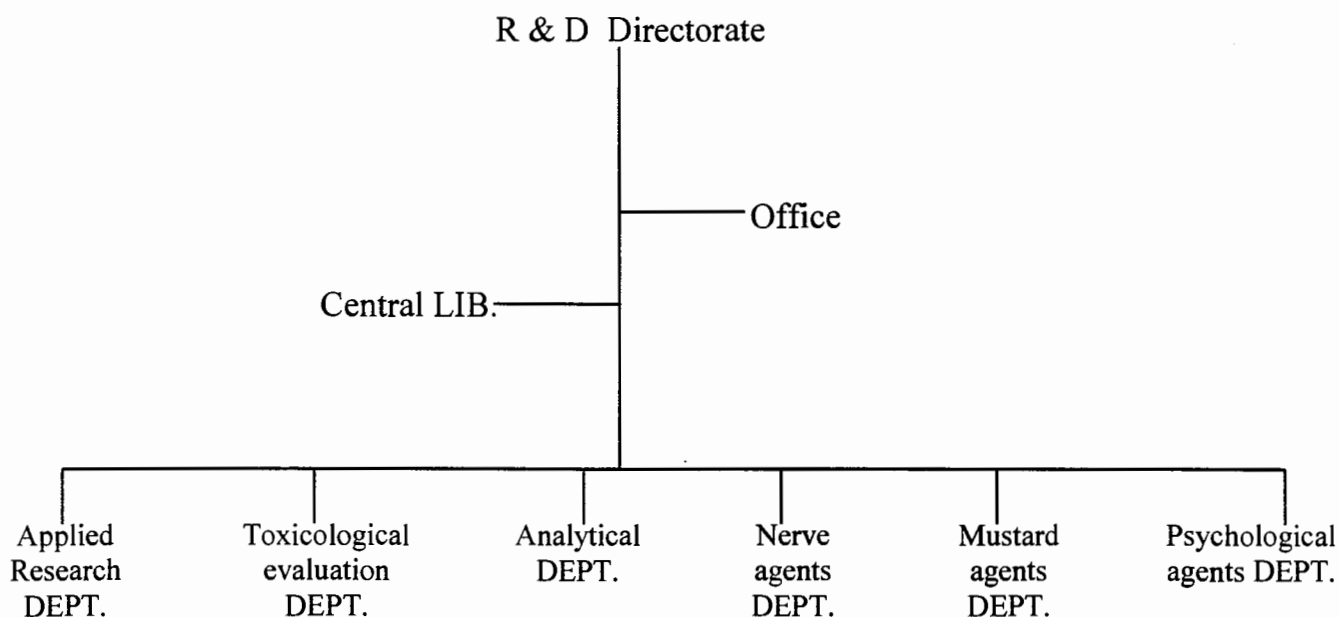
2- Oriac Co. supplied TDG 650 Tons from USA, N.U Kraft (the Brokers Co.).

Which purchased from the manufacture company called Alcolac in 1987-1988 in Baltimore.

After the 3rd shipment Alcolac company asked for an end user certificate.

***** CHAPTER IV *****
**RESEARCH & DEVELOPMENT OF IRAQ'S CHEMICAL WEAPON
 PROGRAMME**

The organization structure of R & D



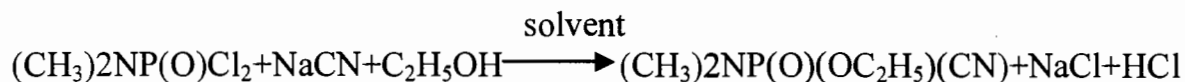
4.1. TABUN

4.1.1 Syntheses of Tabun

From D4 + Ethanol and NaCN

1982

4.1.1.1.



D4 was added drop wise to equimolar quantities of NaCN and absolute ethanol in chlorobenzene or dichloromethane as solvent with the temperature controlled not above 5 C until the end of the reaction.

The product was left to settle and the slurry was removed which contains Tabun in about 50-60%.

The product was not distilled due to the expected problems of contamination and toxicity and also it was found out during the distillation of few samples that large quantities of the agent were lost due to polymerization.

In order to obtain pure product, the starting material D4 was used in the highest purity. The above procedure was adopted for the product of Tabun.

4.1.1.2 Syntheses of Tabun using ClCN instead of NaCN 1987

One mole of absolute ethanol, one mole of ClCN and 200 ml of chlorobenzene were added in three neck flask and the mixture were cooled to 5 C. D4 was added drop-wise in a period of time (2 hrs) and keeping the temp. of the mixture at 20 C, after addition of D4, the mixture kept at room temp.

Traces of tabun was found only 2-3 experiments were carried out.

Purity = 7%

Yield = 15%

4.1.1.3 Stabilizers for Tabun

Due to the fact that percentage of Tabun was decreasing very quickly, many routes were tested to find a stabilizer for it: Tabun was synthesized using many solvents (dichloromethane, chlorobenzene, dichloro ethane, benzene) it was found that chloro, benzene the best solvent used for Syntheses of tabun.

Chlorobenzene was found to be the best in stabilizing the percentage of Tabun and since this solvent was used in the Syntheses of Tabun, it was considered as a stabilizer also for the agent.

4.1.1.4 How to increase the percentage yield of Tabun

The best method found to be useful to increase the percentage yield of tabun during many test reactions, was to use dry sodium cyanide and very pure D4 and to carry out the reaction under nitrogen gas blanket to protect the reaction mixture from humidity, also using excess of NaCN and methanol in reaction mixture was led to increase the purity and yield of Tabun. Tabun was analyzed by gas chromatography by (FID) detector using internal standard method.

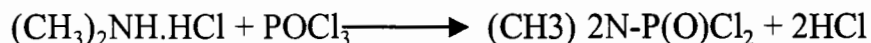
4.1.1.5 The effect of Tabun on construction material

This procedure was carried out in order to determine effect of Tabun on the construction material of the aerial bombs and production equipment. The test was to immerse one piece of known weight of the material to be tested in a bath of crude Tabun, and the difference in the weight of the material was monitored with time, and also the physical test of the surface to see of corrosion under microscope, it was

found the corrosion by Tabun on material of construction was due to unreacted D4 and not by Tabun itself.

4.1.2 Syntheses of D4

4.1.2.1 From POC13 and Dimethylaminehydrochloride 1981



D4 was synthesized from the reaction of 3 mole of POC13 and one mole of DMA.HCl. The reaction was smooth, but the problems were the large quantities of HCl gas liberated, another problem was the addition and mixing of the DMA.HCl. The excess quantity of POC13(2 moles) was removed through the distillation of the product D4, then D4 was distilled under vacuum.

Purity = 90%

Yield = 80%

This procedure was adopted for the production of D4.

4.1.2.2 From POC13 and Dimethylamine gas 1985-1986

Due to the problem of large quantities of HCl gas liberated during the reaction of POC13 and DMA.HCl, the addition of DMA. HCl and the hygroscopicity of DMA.HCl which causes the deterioration of the salt. This research topic was thought about in order to minimize the above problems.

DMA gas was bubbled through POC13 with gradual heating and the molar quantity of the DMA gas was calculated through the difference in the weight of the cylinder of DMA gas.

D4 was produced and distilled under vacuum, the problem in the procedure was the control of the rate of addition of the DMA gas and the losses in the gas during the reaction. This method was not adopted industrially.

4.1.2.3 D4 was analyzed by gas chromatography using (FPD) detector by internal standard method.

Column type = packed glass column 3% OV-225

Detector type = FPD

Column temp. = 110 C

Detector temp. = 270 C

Injector temp. = 270 C

Range = 1

Attenuation = 6

Purity = 90%

Yield = 80%

4.1.3 Syntheses of Dimethylaminehydrochloride 1985

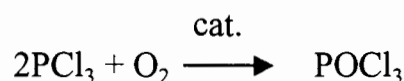
Methanol (44 mole, 2 L) was placed in an autoclave cooled to 5 C, ammonia was added through a bubbler under pressure during 2 hrs and the reaction temperature should be kept less than 15 C, and pressure not more than 3 bars, hydrochloric acid (50 mole, 4.2 L) was added, the product precipitate was obtained by filtration.

Purity - 28%

Yield - 5%

Due to the low yield and purity of the product of DMA.HCl and the high technology of the Syntheses of the production of DMA.HCl led to stop the research.

4.1.4 Syntheses of POCl₃ 1984



Oxygen gas was bubbled through a column containing PCl₃ and 0.1% acetone (catalyst) at a suitable depth and the rate of oxygen gas was maintained at a rate keeping the temperature not above 80 C. When the temperature decreased, that mean the reaction was completed, POCl₃ was obtained in

Purity = 95%

Yield = 90%

4.1.5 It was analyzed by gas chromatography by internal standard method.

Column type = packed glass column 5% OV-101

Detector type = FID

Column temp. = 120 C

Detector temp. = 250 C

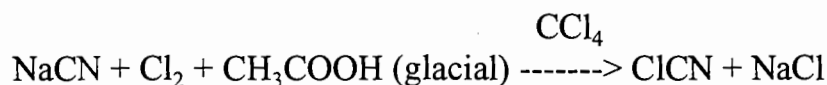
Injector temp. = 250 C

4.1.6 Syntheses of PCl₃

- (1) Chlorine gas was bubbled through melted white phosphorous, until yellow liquid was formed, followed by distillation to get 30% purity and 10% yield of PCl₃.

- (2) This research was not continued due to the following: Low purity & yield of PCl_3 , and starting to build a new plant to produce PCl_3 and POCl_3 in Falluja 2. The product was analyzed by spectrophotometric method.

4.1.7 Syntheses of cyanogen chloride (ClCN) 1987

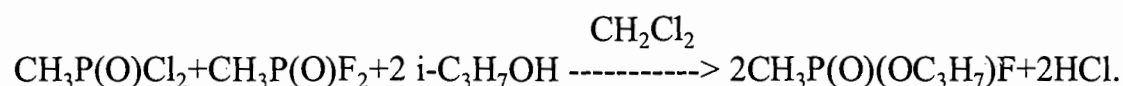


A mixture of sodium cyanide, CCl_4 (as solvent), and glacial acetic acid was placed in a jacketed flask. The mixture was, cooled to (-10°C) , then dry nitrogen gas was passed in the flask. Dry chlorine gas was bubbled into the mixture for 5 hrs. with controlling of reaction temp. at (-5°C) . The temp. arose to (60°C) for 2hrs. Cyanogen chloride was collected in a cold receiver and stored in a cylinder. Only (2-3) experiments were carried out.

4.2 SARIN

4.2.1 Syntheses of Sarin

4.2.1.1 From MPC, MPF and Isopropanol 1983-1984

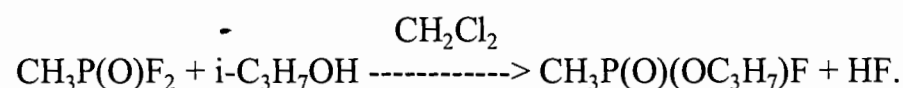


Isopropanol was added drop-wisely to the mixture of equimolar of MPC + MPF and dichloro methane. Temp. was not exceed 40°C during the addition of isopropanol. After addition of isopropanol, dry air was bubbled through the mixture to get rid of HCl gas formed and to reduce the amount of the solvent (dichloromethane). The produced sarin was used as it is with out further purification due to lock of high efficiency of vacuum pumps which lead to decomposition of sarin.

Purity = 45 - 60 %

Yield = 75 %

4.2.1.2 From MPF and Isopropanol 1986



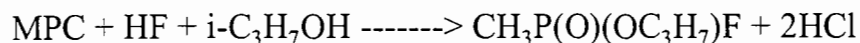
Isopropanol was added drop-wise to the mixture of MPF and dichloromethane the temperature of the reaction was kept at 40 C. Dry air was passed in order to get rid of HF gas and excess of dichloromethane.

Purity = 45-60%

Yield = 70%

The above mentioned procedure was adopted for the production of Sarin from the end of 1987 and not before because the problem of losing large quantities of HF gas.

4.2.1.3 Syntheses of sarin from MPC and HF in isopropanol



One mole of HF was dissolved in one mole isopropanol with cooling in Teflon flask. This solution was added to one mole MPC with 100 ml. CH_2Cl_2 gradually and controlling the temp. with reflux. At 40 C, dry air was bubbled with stirring for 1 hr.

Purity = 40-50%

Yield = 40-50%

4.2.1.4 Direct Syntheses of sarin 1988

Direct Syntheses of sarin in the shell was carried out. Calculated amount of MPF was loaded first in the (155 mm) artillery shell then a mixture of isopropanol and an acid, acceptor (pyridine, diisopropylamine or triethylamine) was added immediately. After 10 min. a sample was taken to determine the purity, the shell was closed.

Purity was about 60%

4.2.1.5 It was analyzed by gas chromatography using standard curve and internal standard method.

Column type = Capillary column SPB- 5 on 30

Length

Detector type = FID

Column temp. = 120 C

Detector temp. = 250 C

Injector temp. = 250 C

Range = zero

4.2.2 Syntheses of Sarin derivatives

4.2.2.1 Syntheses of Sarin derivatives using different alcohols 1987-1988

The same procedure was used under (4.2.1.1) and (4.2.1.2) above was carried out but instead of using isopropanol alcohol, the following alcohols were used cyclohexanol, sec-butanol, isopentylalcohol mixture 1:1 of isopropanol, cyclohexanol, mixture 1:1

of isopropanol, sec-butanol, mixture 1:1 of cyclohexanol, sec-butanol, mixture 1:1:1 of isopropanol, sec-butanol cyclohexanol.

The mixture (IP and cyclohexanol) was adopted in the production of Sarin mixtures due to the fact that the toxicity of the mixture was found to be highest toxicity.

4.2.2.2 Syntheses of mixture of G-gases by direct method

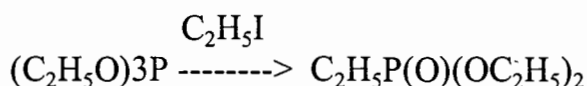
Direct Syntheses of G-gases derivative (ip-cyclo hexanol 1:1) was carried out the same procedure used under (C) above. Calculated amount of MPF was loaded first in the shell, then a mixture of Alcohol (Isopropanol and Cyclohexanol) in addition to the acid acceptor (Pyridine) was added immediately.

After (10) minutes a sample was taken to check the purity then the shell was closed. Purity was about 60 %.

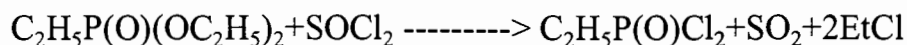
4.2.2.3 Syntheses Ethyl Sarin (1988-1989)

The other derivative of sarin which was synthesized. This compound was synthesized using the same route of sarin as follows:

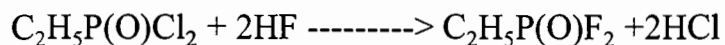
4.2.2.3.1 First step by using triethyl phosphate and ethyl iodide to form diethyl, ethyl phosphonate.



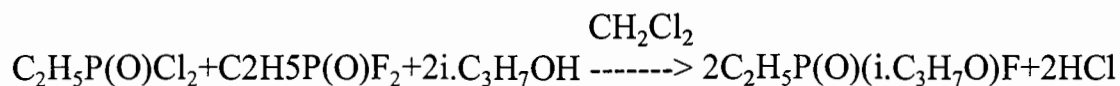
4.2.2.3.2 Second step by the reaction of diethyl ethyl phosphonate with thionyl chloride to form ethyl phosphonyl chloride.



4.2.2.3.3 Third step by using - ethyl phosphonyl chloride and 2 moles of HF gas, to form ethyl phosphonyl fluoride.



4.2.2.3.4 The last step by the reaction of ethyl phosphonyl fluoride with 2 moles of isopropanol to form ethyl sarin.

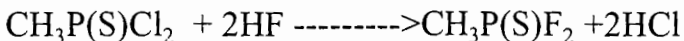


Purity = 40%

Yield = 65%

4.2.2.4 Syntheses of Thio Sarin 1988-1989

4.2.2.4.1 MPSF2

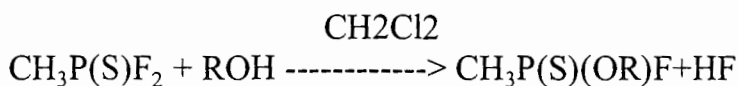


HF gas was bubbled through MPSCl₂ and maintaining the temp. not more than 40 C.
HF gas was passed through MPSCl₂, the mixture heated for one hr.

Purity = 80%

Yield = 70%

4.2.2.4.2



R = isopropanol or cyclohexanol

Isopropanol or cyclohexanol was added drop-wise to a mixture of CH₃ P(S)F₂ and dichloromethane, the temperature should kept not more than 40 C, dry air was passed through, the mixture to get ride of HF and excess dichloro-methane.

4.2.2.5 Tammalin 1989



Only (1-2) experiments were carried out to study the toxicity of this compound. The same procedure of the Syntheses of sarin was used to prepare this compound. The research was stopped because of low toxicity and difficulty of preparation.

4.2.2.5.1 Analysis of tammalin using gas Liquid chromatography

Column type = packed glass column 5% OV-101

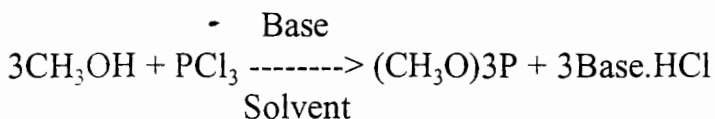
Detector type = FID

Column temp. = 110 C

Detector temp. = 220 C

Injector temp. = 200 C

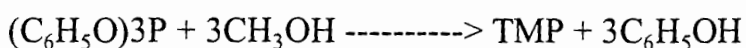
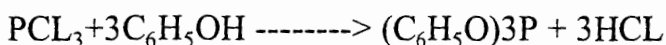
4.2.2.6 Syntheses of TMP 1985, 1987-1990



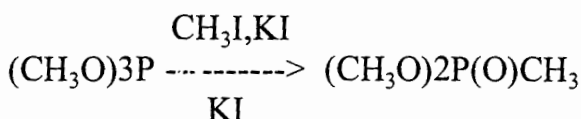
4.2.2.6.1 In 1987 few experiments were carried out to prepare TMP. The synthesis was not continued due to the low yield & purity of the product.

3 Moles of methanol, base (e.g. pyridine, aniline, dimethylaniline, ammonia, ammonium carbonate... etc.), and solvent (ether, benzene, butane, or petroleum ether) were mixed and cooled to 0°C. PC13 (1 mole) was added drop wise with stirring. The mixture was filtered using Buchner funnel, the filtrate was distilled first under normal pressure to remove the solvent and the residue was distilled under reduced pressure (100 m bar) 50-60% yield of TMP was obtained. The base was regenerated by treatment with NaOH.

4.2.2.6.2 Another method for the Syntheses of TMP was tried called trans-esterification.

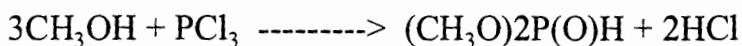


4.2.2.7 Syntheses of DMMP from TMP, (CH₃I, KI) as catalyst 1984.



One mole of TMP, CH₃I and KI were mixed and heated to 150°C and then TMP was added while the temperature of the mixture was controlled between 140-180°C. After the addition of 1 mole TMP, the heating was continued until the reflux stopped. The product DMMP was cooled and used as it is without further purification. A yield more than 90% was obtained.

4.2.2.8 Syntheses of DMPH (1984-1989)



Two processes were carried out synthesize DMPH.

4.2.2.8.1 Batch process

One mole of PCL₃ was added drop-wise to the 4 moles. Of methanol with good stirring at room temp, the temp. of reaction was raised till the reflux was started, Dry air was bubbled to get rid of formed HCL gas. The mixture was distilled under reduced pressure.

Purity = 90%

Yield = 20%

4.2.2.8.2 Continuous process

Two dropping funnel, one of them contained methanol the other PCL3. Two liquids (MeOH, PCL3) mixed in the vessel reactor by 4:1 (MeOH:PCl3) & the temp. of the reaction must kept at 60 C by controlling the mixing ratio MeOH :PCl3.

The time of the mixing must be very short, the reaction passed through very cooled column to get the temp. of the reactant 15 C. After that the reactant passed through packed column at reduced pressure to get rid HCl gas & excess methanol. The product was distilled by reduced pressure in other reactor.

Purity = 90-95%

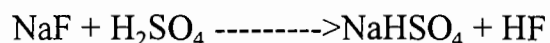
Yield = 50%

4.2.2.9 Pyrolysis of DMPH 1985, 1988

A mixture of one mole of DMPH and (0.01 mole) of catalyst (H2O or acetone) was heated for few hrs until the temperature reaction raised to 220 C. The temperature raised again. The mixture was cooled, the product was used as it is with out further distillation.

4.2.2.10 Syntheses of HF 1987, 1989

Few experiments were carried out to obtain (HF) gas to use it in MPF preparation.



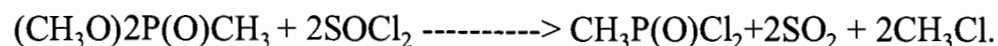
NaF was placed in a Teflon flask and 3 mole of concentrated H2SO4 was added drop wisely. The evolved HF gas was cooled by a Teflon condenser and analyzed. The research was stopped due to low yield and large quantity of by-products.

The by-products of the above reactions were not identified because of the difficulty of analysis and low yield and purity of the prod.

4.2.2.11 Syntheses of MPC

4.2.2.11.1 From DMMP and SOCl2 1984

It was intended to synthesize MPC from DMMP and SOCl2 without using any catalyst.



1 mole of DMMP and 2 moles of SOCl2 were mixed and reflux for a long period and then the mixture was distilled under reduced pressure (5-10 m bar). The MPC produced was collected, and was analyzed by spectroscopies method. Very low yield & purity were obtained. This research was stopped due to above reasons.

4.2.2.11.2 From DMMP and SOCl₂ using catalyst (Pyridine & DMMP)

DMMP was mixed with pyridine at room temperature, then the mixture was heated at 40-50 C for two hrs and cooled, followed by adding small amount of SOCl₂. This mixture was used as a catalyst.

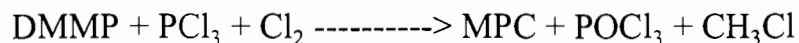
(2.2) mole of SOCl₂ and catalyst were reflux, then 1 mole of DMMP was added drop wise at a period of 3 hrs.

After the completion of addition, the mixture was then reflux for another 1 hr, followed by removing of excess SOCl₂ by vacuum distillation (500 m bar).

The formed MPC was then distilled under reduced pressure, A yield of 60-70% was obtained with a purity about 90%. This procedure was adopted in production of MPC.

There were other catalyst were tried to get a good yield of MPC such as DMF, TPP, and pyridine alone. DMF gave good results, but it was not used industrially because of unavailability of it.

From DMMP and PCl₅

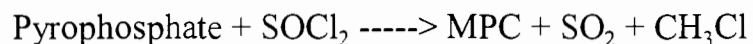


One mole of DMMP was added to one mole of PCl₃ in 250 ml of benzene, Chlorine gas was bubbled in the mixture, the temp. of the reaction was raised to 80 C then reflux was started. When the temp. of reaction was decreased the chlorine was stopped. Then the mixture was refluxed for two hrs. Benzene and POCl₃ were removed by distillation. The product (MPC) was distilled under reduced pressure.

Purity = > 90 %

Yield = 40 %

4.2.2.11.4 From Pyrophosphate 1984 & 1988



112 gm of pyrophosphate was mixed with 4 moles of SOCl₂ and refluxed for 3 hrs. The product was distilled to obtain MPC with

Purity = > 75 %

Yield = 60 %

4.2.2.11.5 The product was analyzed by gas chromatography using (FID) detector and standard curve method.

Column type = Capillary column SPB-5 on 30 m length

Detector type = FID

Column temp. = 110 C

Detector temp. = 250 C

Injector temp. = 250 C

4.2.2.12 Syntheses of MPF 1984

4.2.2.12.1 From MPC using either NaF, KHF₂ or KF

Molar quantity of MPC was mixed with solvent (chlorobenzene) and heated to 70 C, then the required quantities of either NaF, KHF₂ or KF was added portion wise.

Then the mixture was reflux for a certain period checking the formation of the product periodically. Afterwards the mixture was filtered to obtain the MPF mixed with the solvent, then this product was distilled to obtain the MPF.

The resulted purity of MPF from using KHF₂ was better than using NaF but generally both gave low purity of product.

Yield 50%

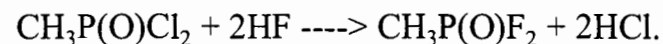
Purity 60%

In addition, dangerous handling of products during filtration was taken in account for stopping method in Syntheses of MPF.

4.2.2.12.2 From MPC and HF

Due to formation of NaCl and problems of filtration and low yield and purity led to search for other routes, the alternative route was to use other fluorinating agent like HF gas, this research was carried out in 1984.

HF gas was bubbled through melted MPC maintaining the temperature not exceed 80 C, this can be controlled by addition of HF gas.



The required quantity of the HF gas was measured by the difference in the weight of HF gas cylinder.

The product was used as it is without further purification with a percentage of 85-90% depending on the purity of MPC itself.

The above mentioned procedure was adopted in the production of MPF.

4.2.2.12.3 From MPC and pyridine .XHF (1985) 1985



HF gas was bubbled in one mole of pyridine at room temp. to get pyridine. XHF.

To this solution, one mole of MPC was added drop-wise at room temp. The product was filtered and distilled.

Purity = 80 %

Yield = 60 %

Only one or two experiments were carried out.

4.2.2.12.4 MPF was analyzed by two methods

By colorimetric method using alizarines as indicator, and by gas chromatography method (internal standard) using FID detector.

Column type = capillary column SPB-5 on 30m length

Detector type = FID

Column temp. = 90 C

Detector temp. = 250 C

Injector temp. = 250 C

Range = zero

Attenuation = 6

4.2.2.13 Attempts to increase the percentage yield of Sarin

During the production of Sarin by method mentioned under 1.(A) above, losses of product occurred due to long passing of dry air to decrease the percentage of HCl. The use of method mentioned under 1.(B) increased the percentage yield because the time of passing dry air was shortened and losses did not occur.

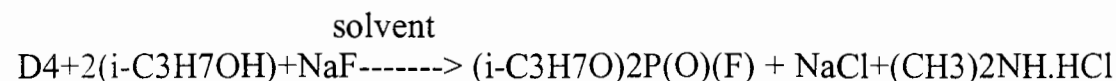
4.2.2.14 Finding suitable stabilizer

The task was to reduce the percentage of HCl or HF from the reaction medium. Tertiary amine was chosen to be the acid acceptor (e.g pyridine, triethylamine). The percentage of the amine was related to the quantity of HCl or HF present in the production mixture but nevertheless, the stabilizers were not effective.

4.3 DFP

4.3.1 Syntheses of DFP 1983,1984,1987,1988 & 1989

4.3.1.1 From D4



4.3.1.1.1 In around bottom flask fitted with mechanical stirrer, condenser and dropping funnel, 2 moles of isopropanol, 3.5 moles of NaF and 300 ml solvent (benzene, Cl₄,...) were mixed and heated to 50 C, heating was stopped, and the addition of D₄ was started. Vigorous reaction started after the addition of half quantity of D₄. The temp. of the reaction was controlled between 70-80 C. The by product salt was filtered, and the solvent was distilled from the filtrate under normal pressure. DFP distilled under reduced pressure.

Purity = 90 %

Yield = 45-50 %

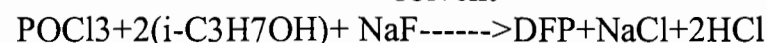
4.3.1.1.2 In a reactor of 200L (15kg) sodium fluoride was mixed with (15.5L) isopropanol and (30L)benzene. (12L) D₄ was added drop-wise at 40-50 C during (2-3)hrs. through the duration of reaction, suddenly vigorous reaction was occurred. Only one attempt was done. The product was filtered and benzene was removed from the filtrate.

Purity = 70%

Yield was less than expected.

4.3.1.2 From POCl₃, NaF 1987-1988-1989

solvent



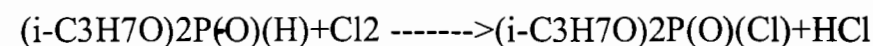
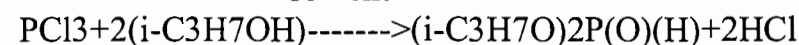
One mole of POCl₃ added to mixture of 2 moles isopropanol, 3.5 moles NaF and 300 ml solvent at 40 C, refluxed for 3 hrs. filtered, the solvent removed under normal pressure, then DFP residue was distilled under reduced pressure, DFP was obtained with

Purity = 90 %

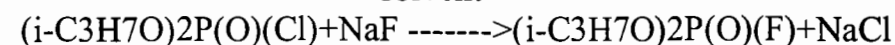
Yield = 45 %

4.3.1.3 From PCl₃

solvent



solvent



Two moles of isopropyl alcohol mixed with 200 ml of CCl₄ in round bottom flask
One mole of PCl₃ was added to the mixture at 30 C for one hr., then the mixture heated for one hr. at 40 C, and cooled to room temp.

The chlorine gas passed through the mixture with controlling on reaction temp. at 25-30 C until the color of the mixture get yellowish and the temp. starting decrease
Chlorine gas was stopped, the solvent distilled under normal pressure. The product (diisopropyl chlorophosphate) was distilled under reduced pressure.

Purity = 90 %

Yield = 50 -60 %

One mole of (diisopropyl chlorophosphate) added to mixture 3.5 moles of sodium fluoride and 300 ml of solvent (benzene, CCl₄) at 40C, then refluxed for 3 hrs. and filtered. The solvent removed from the filtrate under normal pressure, and the product (DFP) distilled under reduced pressure.

Purity = 90 %

Yield = 40 %

4.3.1.4 From POCl₃, HF



Isopropanol was addto 0.5 mole of POCl₃ at a temp. <40 C, then was bubbled through the mixture at a temp. <40 C HF gas for one hr. Low purity and yield was obtained of DFP. Few experiments were carried to synthesize DFP by this route.

4.3.1.5 Derivatives of DFP

Few experiments were carried out using other alcohols (e.g. cyclohexanol, butanol) instead of isopropanol) by the same procedure of DFP from POCl₃. Low purity and yield was obtained.

4.3.1.6 Analysis of DFP using internal standard by gas Liquid chromatography

Column type = packed glass column 5% FFAP

Detector type = FID

Column temp. = 120 C

Detector temp. = 200 C

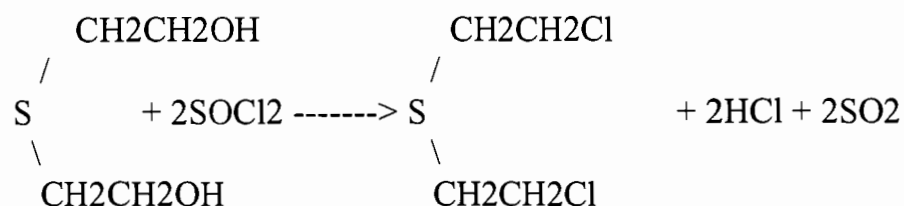
Injector temp. = 200 C

Solvent for dilution = chloroform

4.4 MUSTARD (MG)

4.4.1 Syntheses of MG

4.4.1.1 From Thiodiglycol 1980, 1981



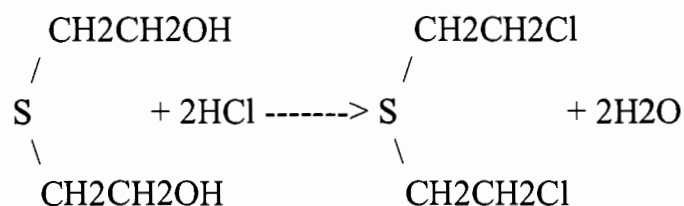
One mole of TDG was placed in three necked round bottom flask with a stirrer, dropping funnel and thermometer. SOCL2 was gradually added to TDG, 60 C. stirring was continued for 0.5 - 1 hr to expel HCL + SO2 . MG was obtained;

Purity = 90-95 %

Yield = 90 %

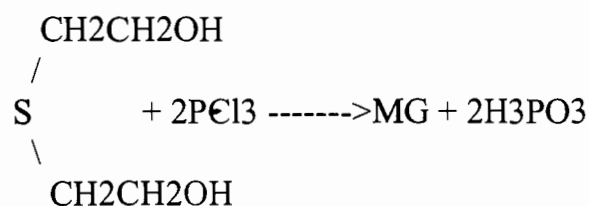
The above procedure was adopted in the production of Mustard.

4.4.1.2 From HCl gas and Thiodiglycol 1981



TDG was placed in a tube glass with a drain in the bottom of the tube, then the tube of TDG was heated to 80 C and HCl gas was passed in the TDG with a controlled rate related to the formation of Mustard. After cooling Mustard was accumulated (due to difference in density) in the bottom of the tube and was separated through the drain. Mustard was not distilled because it was of good quality about 95%. This method was not adopted in the production of Mustard because of complexity in using special equipment and problem of handling of HCl gas.

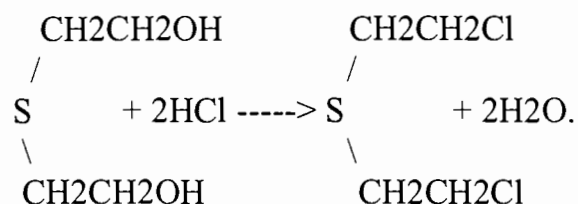
4.4.1.3 From PCl3 and Thiodiglycol 1987



PCl₃ was added drop wise in molar quantities to TDG and the temperature was maintained at 60 C. 10 % water from the total volume of the mixture was added to dissolve phosphorous acid and to increase separation of MG (organic layer). MG was collected with 90 - 95 % purity.

This method was adopted in the production of Mustard in the year 1987 due to the shortage of thionylchloride.

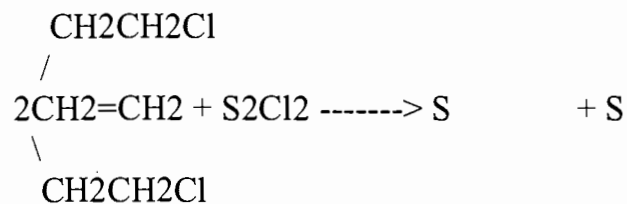
4.4.1.4 From hydrochloric acid and Thiodiglycol 1989



TDG was placed in three necked flask equipped with agitator and thermometer, then hydrochloric acid was added drop-wise with agitation at 30-35C degree for about 3-4 hrs.

Mustard was separated due to difference in density (in the bottom layer). Purity and yield = 60 % . This method was not adopted in the production of Mustard gas because the yield was Low and the reaction was slow.

4.4.1.5 From ethylene gas and S₂Cl₂ 1985 and 1989-1990



Mustard gas was prepared by bubbling ethylene gas through sulfur mono-chloride in column by bubbler, reaction temp was 60-65C.

The ethylene was reacted with S₂Cl₂, and sulfur was precipitated, the reaction time was from 6-8 hrs.

Purity = 60-65 %

Yield = 50%

This research was stopped because of low purity and complexity separation of soluble sulfur and polysulfides.

4.4.1.6 Binary of MG 1988

Five to six exp. were done in lab. for binary, in a small vial (10 ml capacity) closed with a rubber stopper, TDG was injected, then stoichiometric amount of PCl_3 was injected Exothermic reaction with pressure was formed, after cooling (about 30 min.) Sample was taken for analysis Purity was 40 - 50%

Artillery shell 155 mm with two aluminum canisters one filled with PCl_3 and the other with TDG, five experiments (one shell for each) were done and samples from the earth were taken and analyzed.

Purity 39%

This research was stopped due to low concentration of MG obtained.

4.4.1.7 Syntheses of MG by direct method 1990

In a 10 lit. carbon steel container, thiodiglycol was putted, and stoichiometric amount of PCl_3 was added with out any control of temp. after the end of reaction (when the temp. of reaction mixture reached to room temp.), a sample was taken for analysis, purity was about 50%. The product was destroyed using calcium hypochlorite.

Another experiment was done with 100 lit. container capacity, the purity of the product was about 40%.

4.4.1.8 MG was analyzed by GC method using FID detector with internal standard method.

Column type = packed glass column 5% OV-101

Detector type = FID

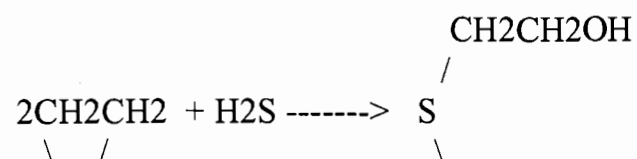
Column temp. = 110 C

Detector temp. = 250 C

Injector temp. = 250 C

4.4.2 Syntheses of Thiodiglycol 1985

4.4.2.1 From ethylene oxide and H_2S .

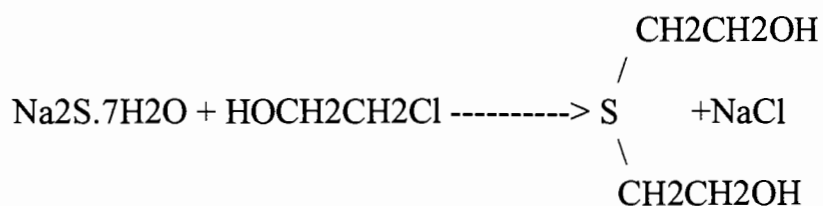


In a pressurized jacketed coil (Stainless steel), H₂S was introduced at (one bar) and ethylene oxide at (two bar), working pressure was 3-5 bar, reaction temp. between 40-45 C Reaction time was about 30 min, the end of the reaction was indicated by decreasing of the pressure to 1 atm.

Purity = 60%

Yield = 30%

4.4.2.2 From Na₂S & Ethylene chlorohydrine 1984 -1985



In a three necked flask equipped with a thermometer and mechanical stirrer, Na₂S (66%) was added to ethylene chlorohydrin (85%) at 30-40 C, then the temp. of the mixture raised to 80 C for one hour, then cooled to room temp., then ethanol was added to precipitate NaCl. TDG was separated, by separating funnel. Ethanol and water were distilled. Because of unavailability of chlorohydrin in Iraq, the research was stopped.

Purity = 50 -60 %

Yield = 60 %

4.4.2.3 Determination of thiodiglycol (TDG) using internal standard by gas liquid chromatography

Column type : Capillary column SPB-5 on 30 m length

Detector type = FID

Column temp. = 110 C

Detector temp. = 250 C

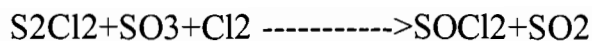
Injector temp. = 250 C

Range = zero

Attenuation = 5

4.4.3 Syntheses Thionyl chloride 1987- 1988

Thionyl chloride was prepared from S₂Cl₂, Cl₂ and SO₃



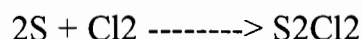
Cl₂ gas and SO₃ were bubbled through S₂Cl₂ in presence of SbCl₃ (1-5 %) ,Thionyl chloride was formed then distilled.

Purity =90 - 95

Yield = 70%

This procedure was adopted in production of SOCl₂, were plant constructed in Falluja site 2.

4.4.4 Syntheses of sulfur chloride (S₂Cl₂) 1987



Sulfur chloride was Synthesized from sulfur and chlorine, by bubbling chlorine gas through sulfur in presence of fine Fe, the temp. raised from room temp. to 110 C (exothermic reaction) until all sulfur is reacted

Purity = 90 - 95%

Yield = 80%

4.4.5 Finding a stabilizer for mustard gas

4.4.5.1 Morpholine 1985

Test no.1

Four containers (made of carbon steel) with 100 ml capacities were filled with mustard gas containing 0,0.5,1, and 2% of morpholine and then stored for six months. The tests were carried out every two weeks for the purity of MG then it was found that 1% of morpholine was the best percentage as a stabilizer.

Test No.2

In two artillery shell (155 mm), one filled with mustard gas only, and the other filled with mustered mixed with 1% morpholine as stabilizer, then stored for two months, and it was found that morpholine good stabilizer.

4.4.5.2 Tetramethyl ammonium bromide (TMAB) 1987

Two containers (made of carbon steel) of 100 ML capacity were filled with mixture of MG and 0.45 gm TMAB and they were left for 3 - months. The test was carried out for them every two weeks to check the purity of MG and HCL percent age. At the end of this period, it was recommended this material according to it is good

behaviour for stabilizing of MG. Purity before storage 92 %. Purity after three months by using TMAB 90 %.

4.4.5.3 Using thickener for MG 1984

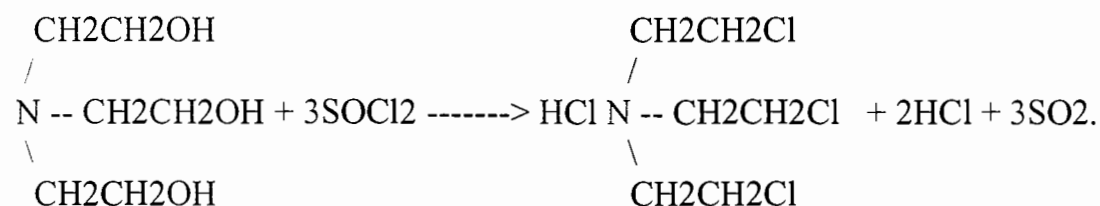
In order to increase the viscosity of the produced Mustard so as to make it more persistent, it was found from the journals that polyacrylate was the best thickener for Mustard. 5-10% of this polymer was tested and it proved to be effective. But it was not adopted in the production because the acrylate was not available in large quantities, and the thick Mustard was not required.

4.4.6 Effect of MG on different Materials

The method mentioned in (g) in the Sarin was followed to check the effect of MG on different materials of construction of weapons and production equipment.

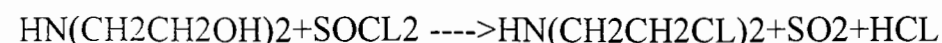
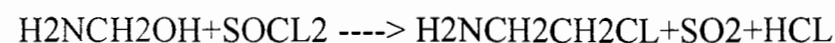
4.5 Syntheses of Nitrogen Mustard 1984 and 1987

4.5.1 It was Synthesized to study its chemical and physical specification



In a three necked flask equipped with condenser thermometer and dropping funnel. Triethanolamine was placed in the flask, then thionyl chloride was added drop wise at a controlled temperature of 35-45 C. After the completion of the addition of thionyl chloride, the reaction mixture was kept stirring for one hour at room temperature to complete the reaction and to get rid of SO₂, neutralization was required, 50% yield and 80% purity were obtained. This research was stopped at this stage due to the formation of salt which need a base like Ammonia to get a free Nitrogen Mustard. And this process caused contamination problems.

4.5.2 Mono and di-Nitrogen Mustard were Synthesized by chlorination of mono and di-Ethanol amine using Thionyl chloride, equimolar ratio of amines and Thionyl chloride were used and as follows:



4.5.3 Syntheses of triethanolamine 1987

(1) Ethylene oxide was condensed in cooled packed column, excess of ammonia gas was bubbled through the column to react with ethylene oxide. The temp. was controlled and should not exceed 25 C, the product was distilled under reduce pressure to obtain a 60% purity and 70% yield.

(2) Only few experiments were carried out on this research and mono and di-isomers were obtained in this reaction, and for this reason the research was stopped.

4.5.4 It was analyzed by GC using (FID) detector

Column type = packed glass column 5% OV-101

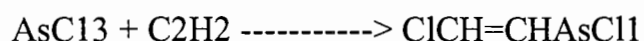
Detector type = FID

Column temp. = 150 C

Detector temp. = 250 C

Injector temp. = 250 C

4.6 Lewisite 1987



Acetylene was bubbled through a solution of AsCl₃ in HCl and CuCl₂ as catalyst at 30 - 40 C for 6 - 8 hr with stirring, a crude oil was formed and separated by distillation to give Lewisite

Purity = 60 %

Yield = 50 %

4.7 RIOT CONTROL AGENT 1980

4.7.1 Syntheses of CS

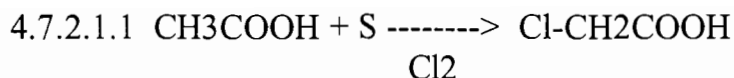
CS was synthesized as a tears agent, used to check the protection wears. Equimolar amount of O- chlorobenzaldehyde was mixed with malono nitrile using sodium methoxide as a catalyst. The formed crystals of CS were filtered and dried. The above method was adopted in the production of CS.

4.7.2 Syntheses of Starting material for CS. 1987

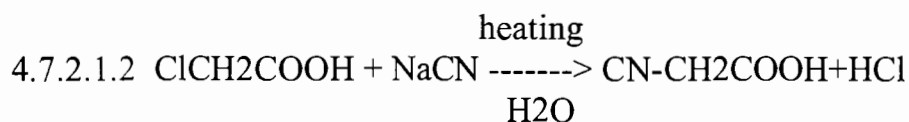
4.7.2.1 Syntheses of Malononitrile

Malononitrile was Synthesized in four steps

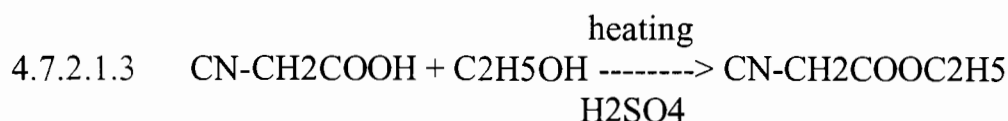
heating



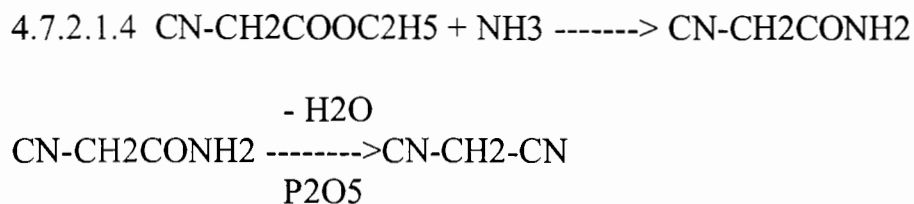
*. Monochloroacetic acid was prepared by passing chlorine gas into hot acetic acid In the presence of sulfur.



Cyano acetic acid is prepared by reaction of α -chloro acetic acid with sodium cyanide in the aqueous medium. The mixture heated with stirring for 6 - 8 hr. Filtered NaCl salt and distilled the water to obtain α -cyano acetic acid.



Esterification was achieved by the reaction of α -cyano acetic acid with ethanol in the presence of conc. H_2SO_4 as catalyst. The mixture heated with stirring for 8 hr., then NaCl was filtered off, and the filtrate was distilled, the residue was α -cyano acetic acid.



& - cyano acetamid was Synthesized by the reaction of ethyl & - cyano acetate with ammonium gas . The mixture was heated several hrs. and Malononitril was Synthesized by dehydration of &- cyano acetamide with P2O5.

4.7.2.2 Syntheses of O-chlorobenzaldehyde

A mixture of toluene, FeCl_3 was placed in a three necked flask, equipped with bubbler, thermometer condenser was heated to 50 C. Chlorine gas was then bubbled through the bubbler. Two isomers were obtained i.e. orthochlorotoluene and parachlorotoluene isomers with a ratio of 2.5:1, followed by separation of the isomers. Mixture of O-Chloro toluene and, traces of Isobutyrone nitrile as catalyst was placed in 3 necked flask and was heated at 80-85 C, followed by bubbling chlorine gas for few hours. A mixture of mono, di- and trichloro-isomers was obtained. The hydrolysis of these chloro-isomers to corresponding aldehydes was failed. The

research was stopped due to the difficulty for obtaining the right isomer and to hydrolysis it to the corresponding aldehyde.

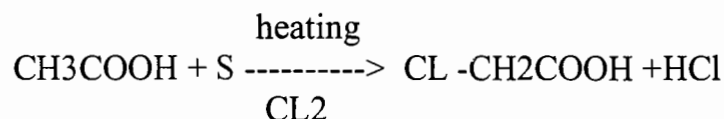
4.7.3 Syntheses of Chloroacetophenone 1987



A mixture of finely powder AlCl_3 and anhydrous benzene was placed in round bottom flask, and cooled by ice bath, chloro acetyl chloride was added during 15 min. Through separating funnel with stirring. The mixture was heated to 50 C by water bath four 1 hr., then the mixture was poured in cold water and filtered. The ppt. was obtained as chloroacetophen one with yield 80 % and purity 90 %.

4.7.4 Syntheses of Starting material for chloroacetophenone 1987

4.7.4.1 Syntheses of &-Chloroacetic acid

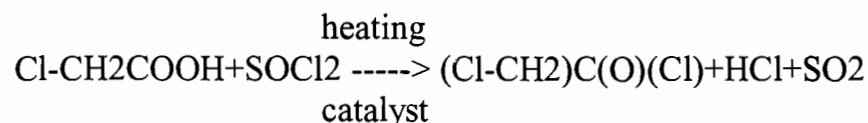


Monochloroacetic acid was prepared by passing chlorine gas into hot acetic acid in the presence of sulfur during reaction time, about 6-8 hrs.

Yield = 85 %

purity = 90 %

4.7.4.2 Syntheses of chloroacetyl chloride



In a R.B.F, a mixture of mole chloroacetic acid and 1.2 mole of thionylchloride with small amount of catalyst DMF was added The mixture was heated and refluxed for 2 - 3 hrs. The produced chloro-acetyl chloride was distilled, a purity of 90 -95 % and yield of 80 % was obtained. Only 10 lit. was synthesized.

4.7.5 Syntheses of chloropicrine 1987

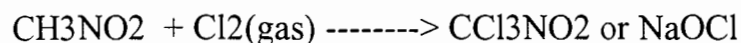
It was Synthesized by two steps:-

4.7.5.1 Nitration



Iso propawas added drop-wisely to mixture of conc. HCL, HNO₃ and controlling the temp. not exceed 50 C. The stirring was continued to about 2 - 3 hrs. The mixture was left for separating. The lower layer was nitromethane.

4.7.5.2 Chlorination



NAOCl (6-8 %) was added to nitromethane with stirring and was continued to 2-3 hrs., the mixture was left for separating. The lower layer was chloropicrine. A purity of 80% and yield of 70 - 75 % was obtained. This procedure was adopted to produce 500 kgm of chloropicrine.

4.7.5.3 Analysis of chloropicrine using internal standard by gas Liquid chromatography

Column type = packed glass column 3% OV-210

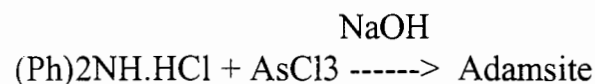
Detector type = TCD

Column temp. = 80 C

Detector temp. = 150 C

Injector temp. = 150 C

4.7.6 Syntheses of Adamsite 1987



Diphenylamine HCl was converted to the free amine by using NaOH solution (33%). The diphenylamine was added to arsenic chloride and heated at 100 C for 3 hrs. The product was recrystallized from acetic acid.

Purity 70%

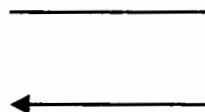
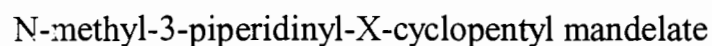
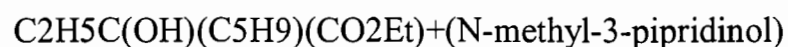
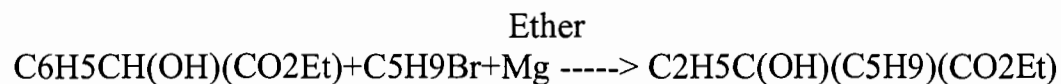
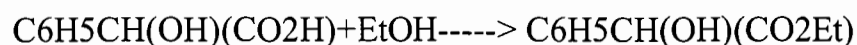
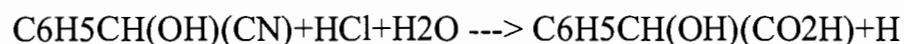
Yield 65%

About (20) kilograms were produced at laboratory scale and then the research was stopped.

4.8 Physiological agents 1986

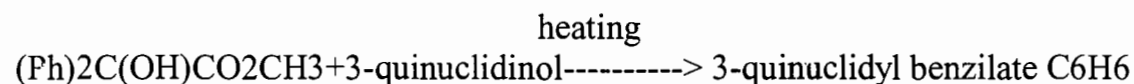
4.8.1 Syntheses of (N-alkyl-3-piperidiny-cyclopentyl mandelate)

This type of BZ was Synthesized from benzaldehyde for the formation of mandelic acid and the last stage coupling or tranesterification with N-alkyl-3-Hydroxy Piperidine for the formation (BZ)



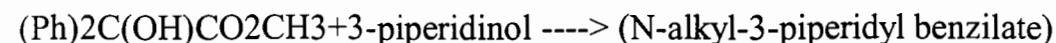
The research was continued for several month & stopped due to difficulty in identified, the product, in addition to the high cost of the starting material and many steps for the Syntheses of the final products and lack of experience in this field.

4.8.2 BZ (3-quinuclidyl benzilate)



A mixture of equimolar of methyl benzilate and 3 - quinuclidinol and benzene was placed in a three necked flask. The mixture was heated with stirring with temp. of 70-80 C. The indication of completion of the reaction depend on the volume of methanol which was collected by dear stark apparatus. The solvent was distilled off and the oily residue was treated with solvent and acid to get BZ with purity of 70% and yield of 40-60 %.

4.8.3 BZ (N-alkyl-3-piperidyl benzilate) at 1982, 1986 alkyl= (methyl, ethyl)



In three neck round bottom flask a mixture 1- mole of methyl benzilat and one mole 3-piperidinol and about 250 CC benzene as solvent, was placed then mixture heated at 70-80 C with stirring. The end of the reaction depend on the amount of methanol which collected by Dean-Strak separator. The solvent was removed from mixture and the residual become oily, which treated with solvent and acid to obtain pure-BZ.

Yield = 60 %

Purity = 70 %

4.9 VX COMPLEX

4.9.1 Reasons for and purpose of interest in V-agents:-

It was planned since the beginning of the chemical program to conduct research and production of nerve agents including VX agent. The research on the VX agent started in 1985 when literature survey was carried out concerning the preparation and production methods of the VX agent. Through the literature survey the best and easiest method was chosen for the preparation of VX agent. Then the available lab chemicals in the stores were checked, while other unavailable chemical materials were imported from the suppliers like Merck, Aldrich, Fluka, BDH, Tafesa and Ridel de hein. The reasons for choosing VX agent were as follows:

- High toxicity.
- It is a new generation of nerve agents.
- The experience of the researchers from G-agent lead to think of about V-agent.
- The VX agent is more stable in various atmospheric conditions and the area contaminated for longer time (low vapour pressure & high boiling point).

4.9.2 Preliminary work on V - agents 1985

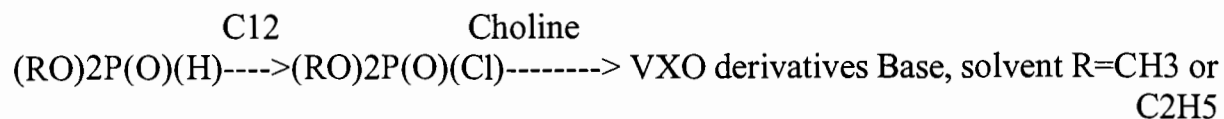


R = Me, Et

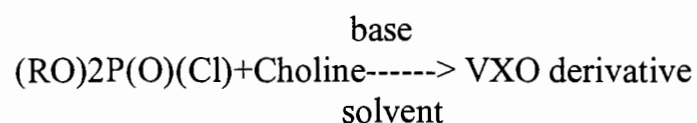
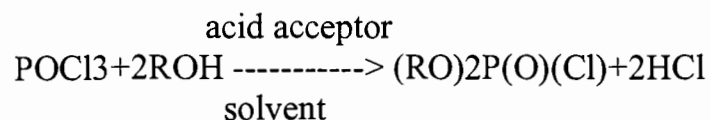
/
R = Me, Et, IP.

These compounds were Synthesized before knowing the real structure formula of wanted VX, and this research was done since 1985. Only few experiments were carried out and stopped due to low purity, low yield and toxicity.

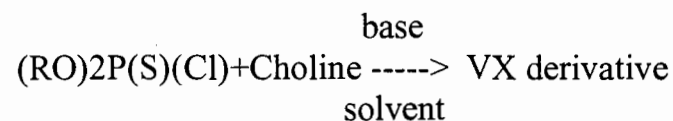
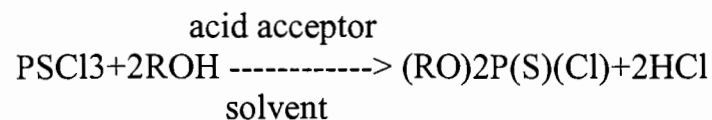
4.9.2.1 1985



4.9.2.2 1985,1987



4.9.2.3 1985

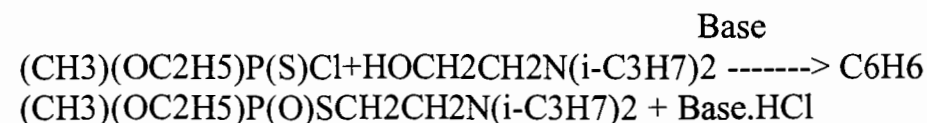


4.9.3 Syntheses of VX 1986,1987

Compound with general formula
(CH₃)(C₂H₅O)P(O)SCH₂CH₂N(i-C₃H₇)₂ (VX)

4.9.3.1 By using CH₃(C₂H₅O)P(S)Cl 1986,1987

4.9.3.1.1 -



A mixture of Benzene (solvent) and one mole of choline was placed in a flask then 1.1 mole of monoester was added at a period of 1.5 hour with stirring. 2.0 mole of 5% solution of Na_2CO_3 was added drop-wise. The mixture was heated with stirring at 80 C, for 1 hr. then it was settled down and the organic layer was separated and dried. The purity of 50% and yield of 30% of the VX was obtained.

4.9.3.1.2



$\text{CH}_3(\text{OC}_2\text{H}_5)\text{P}(\text{S})\text{Cl} + \text{NaOCH}_2\text{CH}_2\text{N}(\text{i-Pr})_2 \longrightarrow \text{No. Reaction}$

1 mole of sodium metal was added to 1 mole choline stepwise in benzene, then the mixture was refluxed for 2 hour, after the completion of the reaction, one mole of monoester was added to it. No reaction was noticed.



4.9.3.1.3 $(\text{CH}_3)(\text{OC}_2\text{H}_5)\text{P}(\text{S})\text{Cl} + \text{HOCH}_2\text{CH}_2\text{N}(\text{C}_3\text{H}_7)_2 \xrightarrow{\text{Na}_2\text{CO}_3} \text{VX}$
5-10 %

210 gm. of monoester and 190 gm. of choline were mixed in a flask. Then 260 ml. of 5 % Na_2CO_3 solution was added, the mixture was heated at 80 C for 3 hours. After settling, the organic layer was separated which contain VX in a yield 20 %, purity 50 %.

4.9.3.2 By using $\text{CH}_3\text{P}(\text{S})(\text{OK})(\text{OC}_2\text{H}_5)$



$(\text{CH}_3)(\text{OC}_2\text{H}_5)\text{P}(\text{S})(\text{OK}) + \text{ClCH}_2\text{CH}_2\text{N}(\text{i-C}_3\text{H}_7)_2 \cdot \text{HCl} \longrightarrow$
 $(\text{CH}_3)(\text{OC}_2\text{H}_5)\text{P}(\text{O})\text{SCH}_2\text{CH}_2\text{N}(\text{i-C}_3\text{H}_7)_2 + \text{H}_2\text{O} + \text{KCl} + \text{NaCl} + \text{CO}_2$

One mole of choline chloride hydrochloride and 0.5 mole of Na_2CO_3 was dissolved in sufficient quantity of water, 1 mole of $\text{CH}_3\text{P}(\text{S})(\text{OK})(\text{OC}_2\text{H}_5)$ dissolved in water was added drop-wise to the first solution, the mixture was heated at 80 C for 1 hour, cooled and settled. The organic layer was the VX with low purity & yield.

4.9.3.3 By using $\text{CH}_3\text{P}(\text{S})(\text{OC}_2\text{H}_5)_2$

$\text{CH}_3\text{P}(\text{S})(\text{OC}_2\text{H}_5)_2 + \text{HOCH}_2\text{CH}_2\text{N}(\text{i-Pr})_2 \longrightarrow \text{VX} + \text{C}_2\text{H}_5\text{OH}$

One mole of $\text{CH}_3\text{P}(\text{S})(\text{OC}_2\text{H}_5)_2$ was added to excess quantity of choline at 120 C, the reaction was indicated by distillation of ethanol. The excess of choline was distilled off and the residue was VX with very low yield and purity.

4.9.3.4 By using $\text{CH}_3\text{P}(\text{O})(\text{OC}_2\text{H}_5)_2$

S

$\text{CH}_3\text{P}(\text{O})(\text{OC}_2\text{H}_5)_2 + \text{HOCH}_2\text{CH}_2\text{N}(\text{i-Pr})_2 \xrightarrow{\text{S}} \text{No. Reaction.}$

One mole of $\text{CH}_3\text{P}(\text{O})(\text{OC}_2\text{H}_5)_2$ was added to excess quantity of choline at 120 C. The reaction was indicated by distillation of ethanol. The excess of choline was distilled off, then one mole of sulfur was added at temperature of 150 C for 2 hours. No reaction was indicated and no VX was obtained.

4.9.3.5 By using $\text{CH}_3\text{P}(\text{O})(\text{OC}_2\text{H}_5)\text{Cl}$

Na_2CO_3

$\text{CH}_3\text{P}(\text{O})(\text{OC}_2\text{H}_5)\text{Cl} + \text{HSCH}_2\text{CH}_2\text{N}(\text{i-Pr})_2 \xrightarrow{\text{Na}_2\text{CO}_3} \text{Vx} + \text{NaCl} + \text{CO}_2 + \text{H}_2\text{O} \text{ 5-10\%}$

The crude $\text{CH}_3\text{P}(\text{O})(\text{OC}_2\text{H}_5)\text{Cl}$ was mixed with one mole $\text{HSCH}_2\text{CH}_2\text{N}(\text{i-Pr})_2$, the mixture was stirred for one hour, then a solution of 5-10% sodium carbonate was added with stirring, the mixture was heated for 2 hours at 50 C. Two layers were separated and organic layer was concentrated by vacuum. Low yield and purity of VX was obtained.

4.9.3.6 By using $\text{CH}_3\text{P}(\text{O})(\text{OC}_2\text{H}_5)\text{SH}$

Na_2CO_3

$\text{CH}_3\text{P}(\text{O})(\text{OC}_2\text{H}_5)\text{SH} + (\text{C}_3\text{H}_7)_2\text{NCH}_2\text{CH}_2.\text{Cl}.\text{HCl} \xrightarrow{\text{Na}_2\text{CO}_3} \text{VX} + \text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$

5-10 %

0.1 mole of $\text{CH}_3\text{P}(\text{O})(\text{OC}_2\text{H}_5)\text{SH}$ was added to the mixture of 0.1 mole of Choline chloride hydrochloride and 0.05 mole of Na_2CO_3 Solution with stirring and the mixture was heated for 2 hrs. at 50 C. Two layers were separated, and VX layer was concentrated, low yield and purity of VX was obtained.

4.9.3.7 By using VXO

4.9.3.7.1 Syntheses of VXO

benzene

$(\text{OC}_2\text{H}_5)_2\text{P}(\text{O})(\text{Me})\text{Cl} + (\text{i-C}_3\text{H}_7)_2\text{NCH}_2\text{CH}_2\text{OH} \xrightarrow{\text{benzene}} \text{CH}_3\text{P}(\text{OC}_2\text{H}_5)\text{OCH}_2\text{CH}_2\text{N}(\text{i-C}_3\text{H}_7)_2 (\text{VXO})$
 $(\text{C}_2\text{H}_5)_3\text{N} + (\text{C}_2\text{H}_5)_3\text{N}.\text{HCL}$

0.5 mole of choline was added to the mixture of 0.5 mole MeP(O)(OEt)Cl , 0.5 mole triethylamine, and 200 ml of benzene. The mixture was heated to 80 C for 2 hrs. The product was filtered, the solvent distilled off, The residue was VXO.

Purity = 60 %

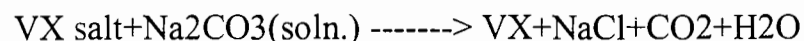
Yield = 40 %

(VXO)



0.5 mole of (VXO) mixed with 0.125 mole of P_2S_5 and heated to 100 C for 3 hrs., then the product was washed with a small quantity of water to dissolve the by product P_2O_5 with cooling. Then the organic layer was separated and dried. Low yield and purity was obtained.

4.9.3.8 By using VX salt



One mole of ethanol and one mole of choline were mixed in a dropping funnel, and added to one mole of MPS gradually at a temp. below 40 C, then the mixture was heated at 80 C, for one hrs. with stirring. Two moles of a solution 5 % Na_2CO_3 was added and stirred for one hr. The organic layer was of separated, dried and concentrated.

Purity = 50 %

Yield = 35 %

4.9.3.9 Analysis of VX-agent and derivatives using internal standard by gas liquid chromatography

Column type = packed glass column 5% OV-101

Detector type = FID

Column temp. = 150 C

Detector temp. = 220 C

Injector temp. = 200 C

Range $\Rightarrow 3$

Attenuation = 6

Internal standard = Dimethylphthalate

4.9.4 Stabilizer for VX agent

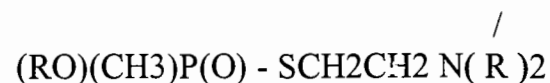
4.9.4.1 Dicyclohexyl dicarbimide was tested as stabilizer with percent of 0.1%.

But it was found ineffective for crude vx.

4.9.4.2 VX was dried with vacuum and heating to 80-100 C, was found to increase the stability.

4.9.4.3 VX salt was stored for months and checked every week by neutralization with Na₂CO₃ solution and analyzed, this procedure was found a good method for storage (only on lab produced agent).

4.9.5 Derivatives of VX 1987



R = Me, Et

R = Me, Et, IP

These compounds were synthesized in the same procedures of VX to Check their toxicities.

4.9.6 Binary of VX 1989

In 10 ml vial a mixture of choline and ethanol were placed, and closed. Stoichiometric amount of MPS was injected in the vial by a syringe and mixed well for one min., then a stoichiometric amount of Na₂CO₃ soln. was injected after settling for few mins., samples of the generated vx was analyzed after intervals of time, and the percentage of the agent, was recorded. It was found that the VX formed in low purity.

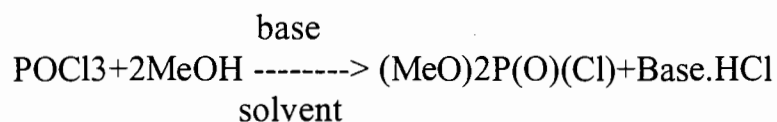
4.9.7 Starting materials of VX 1985, 1987

4.9.7.1 Syntheses of (C₂H₅O)₂P(O)(Cl)



solvent

4.9.7.2 Syntheses of (MeO)₂P(O)(Cl) 1985



4.9.7.3 Syntheses of CH₃P(S)Cl₂ (MPS) 1985

4.9.7.3.1 MPC + 1/5 P₂S₅ -----> MPS + 1/5 P₂O₅

A mixture of 133 gm. of MPC and 55 gm. of P₂S₅ was refluxed for about one hour, then it was distilled under vacuum or normal pressure. A yield of 70% and purity of 85% were obtained.

4.9.7.3.2 MePOCl₂ + S -----> No. Reaction 1987-1988

The mixture of one mole MPC, 0.4 mole sulfur and 10 gm of cat. (red phosphorus, AlCl₃, pyridine, TEA) were refluxed for 8 hrs. MPS was not obtained by this method.

4.9.7.4 Syntheses of CH₃P(O)(OC₂H₅)₂ 1986,1987

4.9.7.4.1 MPC+2C₂H₅OH -----> CH₃P(O)(OC₂H₅)₂ + 2HCl

One mole of MPC was added to excess ethanol with reflux. After the reaction was completed the excess alcohol was distilled off.

Yield = 80%

Purity = 90%

4.9.7.4.2 MPC+2EtOH -----> CH₃P(O)(OC₂H₅)₂+2(C₂H₅)₃N.HCl

One mole of MPC was added to the mixture of 2.1 mole triethylamine and excess ethanol with reflux. After the reaction was completed, the mixture filtered off, excess ethanol was distilled off.

Purity = 90 %

Yield = 90 %

CH₃I

4.9.7.4.3 (C₂H₅O)₃P -----> CH₃P(O)(OC₂H₅)₂+C₂H₅OH

One mole of triethylphosphite and one mole of methyl iodide were mixed and refluxed. The heating was continued until the reflux stopped. The product was cooled and distilled, and the following data were obtained.

Purity => 85 %

Yield => 80 %

4.9.7.5 Syntheses of CH₃P(O)(OC₂H₅)Cl 1986



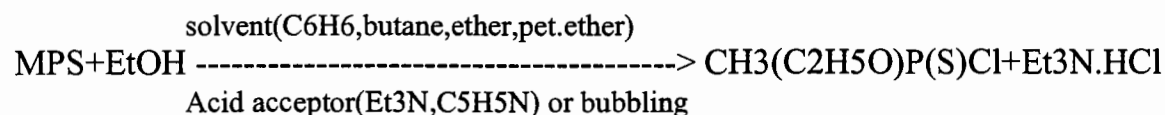
One mole of ethanol was added to one mole of MPC drop-wise, and bubbled with air for 3 hours to get rid of HCl gas. The product was distilled under vacuum.

Yield = 70%

Purity = 85%

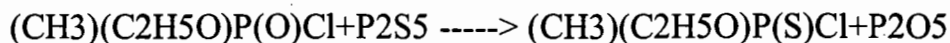
4.9.7.6 Syntheses of CH₃P(S)(OC₂H₅)Cl 1986

4.9.7.6.1



One mole of ethanol and one mole of acid acceptor (or bubbling) was added drop-wise on one mole of MPS and solvent (benzene or ether) with control of reaction temperature below 45 C. The product was filtered and distilled under vacuum, yield 40%, purity 85% were obtained.

4.9.7.6.2

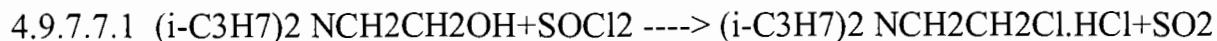


One mole of EtOP(O)(CH₃)Cl and 0.25 mole of P₂S₅ was refluxed for 4 hrs, then the Product was distilled to obtain.

Purity = 70 %

Yield = 30 %

4.9.7.7 Syntheses of Choline chloride hydrochloride 1986,1987,1988



One mole of choline was added drop-wise to 3 moles of SOCl_2 . The reaction was refluxed for one hr, filtered, washed with benzene and dried, the following results was obtained.

Purity = 95 %

Yield = >90 %

solvent



One mole of choline was dissolved in 250 ml ethanol, bubbled with hydrogen chloride gas. The solvent distilled off, the residue was filtered and dried, to obtain a Purity = 80 % and Yield = 60 %.

4.9.7.8 Syntheses of $\text{CH}_3\text{P}(\text{SH})(\text{O})(\text{OC}_2\text{H}_5)$ 1986,1987



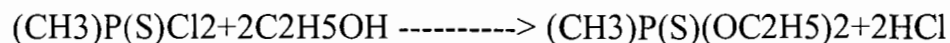
One mole of potassium hydroxide was dissolved in 4 moles of ethanol, and added to the one mole of MPS with cooling below 5 C. The excess ethanol was distilled off. The residue was dissolved in a sufficient quantity of water and acidified and separated in two layers. The organic layer was distilled under reduced pressure to obtain:

Purity = 85 %

Yield = 60 %

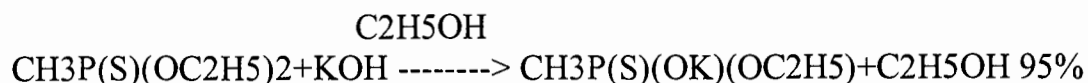
4.9.7.9 Syntheses of $(\text{CH}_3)\text{P}(\text{S})(\text{OC}_2\text{H}_5)_2$ 1987

BF₃-Ether



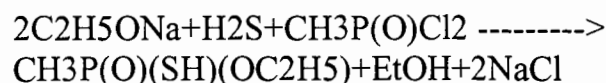
1 mole of $(\text{CH}_3)\text{P}(\text{S})\text{Cl}_2$ was added to 3 moles of ethanol contain 3 ml. BF₃ - ether as catalyst, then the mixture was refluxed for about one hour. The excess alcohol was distilled off to get the diester in a purity and yield more than 80%.

4.9.7.10 Syntheses of CH₃P(S)(OK)(OC₂H₅) 1987



1 mole of potassium hydroxide was dissolved in 100 ml of 95% ethanol. This solution was added gradually to 1 mole of diester at room temperature. Then the mixture was refluxed for one hour. Ethanol was distilled off to get the product with yield and purity more than 85%.

4.9.7.11 Syntheses of (CH₃)(C₂H₅O)P(O)SH 1987



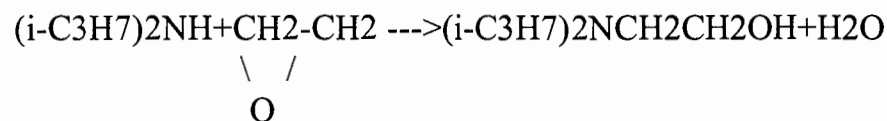
Hydrogen sulfide gas was bubbled in freshly prepared solution of sodium ethoxide until the appearance of turbidity. To this mixture, one mole of MPC was added dropwise, refluxed for one hr., filter, and distilled the excess ethanol, then the product was distilled under reduced pressure to get:

Purity = 80 %

Yield = 55 %

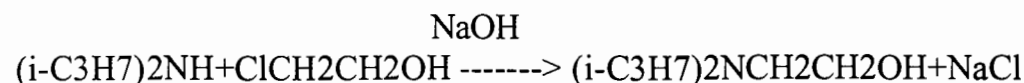
4.9.7.12 Syntheses of Choline 1987

4.9.7.12.1 By using ethylene oxide



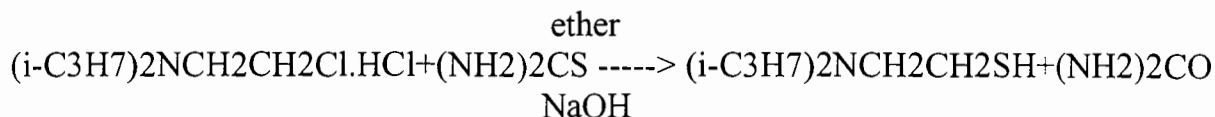
It was synthesized by using autoclave vessel as reactor. 1400 gm. of Ethylene oxide was liquefied and placed in this reactor, followed by adding 1750 gm. of diisopropylamine and 100 ml. of hydrochloric acid as a catalyst. The reaction temperature was 120 C. Dropping of the pressure sharply indication for the end of the reaction. The organic layer was separated to get choline in a yield 98%, purity 98%.

4.9.7.12.2 By using chlorohydrine 1987



The mixture of 5 moles of chlorohydrine , 5 moles diisopropyl amine and 10% of sodium hydroxide solution were placed in autoclave. The reaction temp. was 140 C. Dropping of the pressure sharply indication for the end of reaction. The organic layer was separated to get choline in a yield more than 90 % and Purity = 90 %.

4.9.7.13 Syntheses of (i-C₃H₇)NCH₂CH₂SH

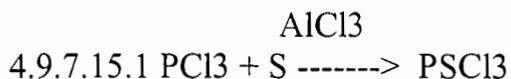


One mole of (i-C₃H₇)₂NCH₂CH₂Cl.HCl was added to 100 ml 40% NaOH solution. Organic layer was separated, and it was added to one mole of thiourea in 100 ml ether, at 40 C with stirring for 4 hours. The solution was filtered, the filtrate was distilled to get, a Yield = 70% and Purity = 90%.

4.9.7.14 Syntheses of ethylene sulfide

Attempts were done to Syntheses ethylene sulfide, to used it as starting materials for choline-SH but were unsuccessful.

4.9.7.15 P(S)Cl₃ 1987

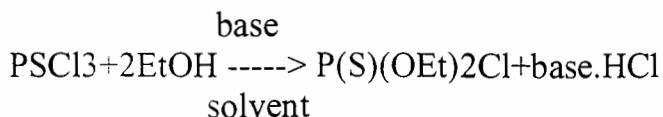


One mole of PCI₃ and 32 gm of S was heated with reflux, then heating was stopped and the catalyst (AlCl₃) was added once. An exothermic reaction started, after the reaction was subsided, then the mixture was refluxed for one hr. and the product P(S)Cl₃ was distilled under normal pressure. Good purity and yield was obtained.

4.9.7.15.2 POCl₃ + P₂S₅ -----> P(S)Cl₃ 1987

one mole of POCl₃ and 0.25 mole of P₂S₅ was refluxed about one hr. then it was distilled to get a Purity = 90 % and Yield = 85 %

4.9.7.16 Syntheses of (C₂H₅O)₂P(S)Cl 1987



4.9.7.17 Syntheses of MEPCl₂ 1988

H₂O



In around bottom flask, 0.1 mole phosphorus trichloride and 0.1 mole aluminium Chloride were mixed, then methyl iodide was added gradually (or CH₃Cl gas was bubbled) with cooling (0 - 5 C), after stirring for one hr , 0.1 mole of water was added drop-wisely with direct distillation of produced MEPCl₂.

Purity = un analyzed

Yield = 30 %



The mixture of the vapor PCl₃ and methane was passed in tubular reactor at 500 C, MePCl₂ vapor condensed in chilled trap, very low purity and yield were obtained.

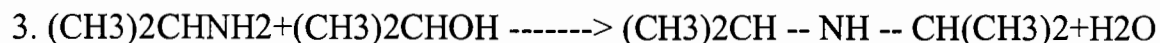
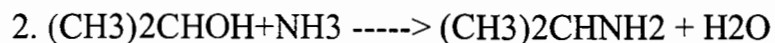
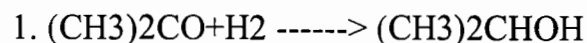
4.9.7.18 Syntheses of P₂S₅ 1989

2 mols of red phosphorus was heated in a tubular reactor to about 280 C and flashed with dry nitrogen. 5 moles of sulphur was heated 130 C and added it gradually on the red phosphorus. Then the mixture was heated to 380 C for one hr. to get:

Purity = 50 %

Yield = 40 %

4.9.7.19 Syntheses of Diisopropylamine 1988



It was synthesized by the hydrogenation of acetone and ammonia gas was passed in an autoclave with a temp. of 160 C and 120 bar, using 3% copper chromate as a catalyst. The product was obtained in purity of 60- 62%.

4.10 Biological and toxicological activity for certain organophosphorus compounds.

4.10.1 Choice of Agents Using Molecular Design

- 4.10.1.1 According to molecular orbitals theory and using (CNDO/2) package and empirical method which include electronic indices for single atom or two atoms and the whole compound, as well as radius, volume, surface, Van der Waals forces and compound shape. Seven organophosphorus compounds were obtained. However, several of them are found in the literature e.g. GB, DFP, GD.
- 4.10.1.2. Using the relationship analysis between the above indices and LD 50 and biological activity for above mentioned compounds available information and empirical equation were obtained with good confidence. Accordingly these equations were made to obtain a biological and toxicological activity for members of different compounds which were selected hypothetically, as mentioned in table (1).
- 4.10.1.3 Using ten equations for studying the biological and toxicological activities for (17) compounds. The following figures are attached in this chapter
Fig.1,2,3 Spatial diagram of DFP, GB, GD in xy and xz planes
Fig.4 CNDO/2 Electrostatic potential contour maps for compound (16) table No.1
Fig.5 CNDO/2 Electrostatic potential solid map for compound (16) table no.1 (all viewing directions are 25 degrees downward from horizontal).

4.10.2 Toxicological activity of different products at 1985 - 1988

4.10.2.1 The Toxicological activity of any agent was calculated from the following studies:

- Chemical study: This was carried out to get the enzyme (acetylcholine esterase) inhibition.
- Calculation of any LD50 by inhalation chamber using test animals.
- Calculation of LD50 by static test, using test animals and compared with that obtained from inhalation chamber calculation.

4.10.2.2 Conclusion :

LD50 was calculated according to type and quantity of test animals, area exposure to agent and volume of contaminated area.

4.10.3 Toxicological evaluation

4.10.3.1 The Chemical study:

Chemical warfare agents which brought from the Research and Development Center to toxicological evaluation department was studied from the chemical point of view which includes the effect of the chemical agent on

Acetyl Choline Esterase in animal blood and in blood serum. (ELLMAN noted with some modification). Different concentrations of the chemical agent ranging between 0.001-0.005 mg (within five points) are prepared to be added into 20 ml of animal blood and to 20 ml of blood serum. After adding the essential material for substrate enzyme reaction like Acetyl Choline, color agent is added. Records are written down every single minute for 15 minutes by using UV spectrophotometer, up to the end of the reaction which begins as a result for the chemical agent existence. After marking the records of the chemical agent different concentrations, the quantity that has to be used in inhalation chamber can be calculated in order to specify the LD50 for the animals used in inhalation experiment.

4.10.3.2 Calculation of the LD50 by using inhalation chamber. Depending on the result obtained from the chemical study the quantity of the chemical agent used in the inhalation chamber is specified and also the following points were to be taken in consideration:

- The volume of the inhalation chamber.
- Speed of air circulation in the chamber.
- Kind of animals used.
- Number of animals.
- Weight of each animal.
- Lung capacity and speed of breathing.
- Period of exposure to the chemical agent is between 15-20 minutes.
- The animals used in the inhalation experiments were, white mice (20), Guinea pig (10), Rabbit (5).

After the experiment (period of exposure inside the inhalation chamber), the number of dead animals and also the animals affected for more than 60 percent were calculated. Then the LD50 is calculated after repeating the experiment three times in order to calculate the average.

4.10.3.3 From the toxicological evaluation of the agents, the LD50 of these agents were found as in the table below.

NO	Agent	LD50 mg/kg
1.	Tabun	90
2.	Sarin	25
3.	Sarin derivative from ip-cyclo hexanol	10
4.	Sarin derivative from ip-cyclo hexanol	30
5.	Ethyl Sarin	45
6.	ThioSarin	25
7.	DFP	95
8.	VX	3

4.10.3.4 Static tests :

The purpose of these experiments was to calculate LD50 in the field. The chemical agent is calculated, depending on the followings:

- The results of the chemical study.
- The results of inhalation experiment LD50.
- The area specialized for conducting of the experiment.
- The assumed altitude of the experiment is 4m as wind speed is normal.

The animals were hung in net wire cages on height of 1m, distributed in a half circle form at five points from the circle center (explosion point). The period of exposure to the cloud ranges between 15- 20 minutes. LD50 of each species used in the experiments is calculated depending on casualties number, the number of the animals that were effected in a percentage of 60%, and also depending on the information mentioned above.

4.11 Pesticides Research 1985-1987

4.11.1 Formulation of DDVP and Malathion 50% EC and 25% UIV. Active ingredient i.e DDVP or Malathion were dissolved in Xylene with stirring, then a proper amount of emulsifiers was added to the mixture. The following successful data were obtained:

50% EC 25% UIV

4.11.1.1

DDVP	50%	1. DDVP	25%
Tensofix 7438	5%	Caster oi	5%
Tensofix 7453	5%	Xylene	70%
Xylene	40%		

4.11.1.2

Malathion	50%	2. Malathion	25%
Berol 942	3%	Caster oil	5%
Berol 943	1.2%	Xylene	70%
Berol 944	0.8%		
Xylene	44%		

4.11.2 Formulation of Propanil 1989

A proper amount of the active ingredient (Propanil) was added to the solvent (isophoron) with mixing followed by addition of XN6, XN10 and xylene, to get a proper formula:

Propanil	36%
XN6	7.5%
XN10	2.5%
Isophoron	15%
Xylene	39%

4.11.3 Formulation Kemo-Paf 1989

Active ingredient (Peremethrin) was dissolved in a proper amount of methanol followed by the addition of calcium carbonate, to get the following formula :

Peremethrin	0.5%
Calcium carbonate	99.5%

4.11.4 Syntheses of active ingredients of pesticides 1989

4.11.4.1 Dalapon

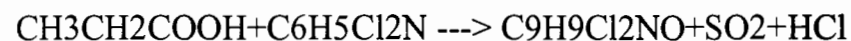
It was synthesized by chlorination of propionic acid in the presence of thionyl chloride at 105-150 C.

4.11.4.2 DDVP

It was synthesized by reaction of anhydrous chloral and trimethylphosphide at 50 C.

4.11.4.3 Propanil

It was synthesized by reaction of propionic acid and 3,4 - dichloroaniline in presence of thionyl chloride at 90 C.



4.11.4.4 Kemo-Rat (Rodenticide) 1989

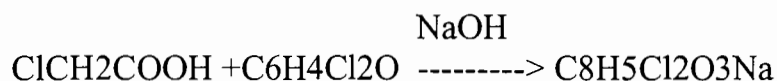
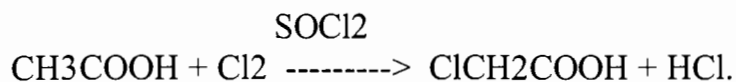
It was formulated by addition of the active ingredient (Brodifacum) proper amount of wheat or corn in presence of red pigment.

4.11.4.5 Zinc phosphide (Kemo sam) 1989

It was synthesized by reaction of zinc metal and red phosphorous at high temperature 400 degree centigrade.

4.11.4.6 2,4-D / 2,4-Dichlorophenoxyacetic acid (Na-salt) 1989

It was Synthesized reaction of 2,4-dichlorophenol with chloro acetic acid followed by addition of sodium hydroxide solution.



4.11.4.7 Syntheses of chloral $\text{Cl}_3\text{C}.\text{CHO}$ 1986

4.11.4.8 Syntheses of P-nitro-m-cresol: 1989

It was synthesized by the nitration of m-cresol to use it as intermediate for summation.

4.11.4.9 Syntheses of Tri ethylphosphate: 1989

An attempt to consume the unused POCl_3 into useful material were proposed. One of these proposals were to prepare above compound and to test its biological effects on insects. No further step was taken.

4.11.4.10 Syntheses of 3,4-Dichloroaniline: 1989

Joining with Petroleum Research Center, an attempt to synthesize this material in lab scale only was conducted. This compound regarded as starting material for stam pesticide.

4.11.4.11 Syntheses of 2-Chloro-Acetoacetanilide 1989

This compound regarded as intermediate for Dorspan pesticide. It was recommended to stop the research due to the multi step reaction for this pesticide.

4.11.4.12 Syntheses of $(\text{RO})_2 \text{PSCl}$: 1989

These chemicals where ($\text{R}=\text{CH}_3$ or C_2H_5) regarded as a starting materials for number of pesticide such as Malathion and Parathion and to consume unused P_2S_5 , the trial for preparation of these compounds use either PCl_3 with (S) or POCl_3 with P_2S_5 to synthesize PSCl_3 to be reacted with different alcohols.

4.11.4.13 Lime sulfur 1989

It was synthesized by reaction of sulfur and calcium oxide in water at 90-100 degree.

4.11.4.14 Syntheses of 2-(N,N-dimethylamino) ethanol:

It was proposed to Syntheses this material to consume the unused N,N-dimethylamine to be useful starting material for pesticide.

4.11.4.15 Biological study of pesticides

The following scheme has been adopted for evaluation of different pesticides.

Formulated pesticides

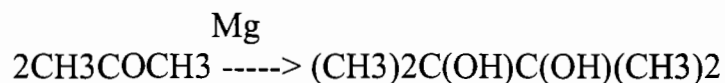
Biological evaluation	Physical and
*Phytotoxicity	Chemical tests
*Preliminary toxicity	and storage life screening test and LD50
*Field evaluation test	
in coordination with	
related governmental	
offices.	
*Recommendation	
*Mass production	
*Marketing	

4.12 MISCELLANEOUS

4.12.1 Researches Related to C.W. programme

4.12.1.1 Syntheses of Pinacolyl alcohol 1987 - 1988

4.12.1.1.1 Syntheses of pinacol hydrated by reduction of acetone

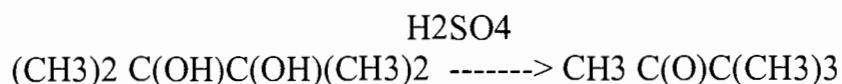


It was synthesized by adding 2 mole of acetone to one mole of Mg turnings at 58-60 C following by cooling the mixture to 10 C, the product was filtered to remove the excess acetone. The following data were obtained.

Purity 90% -

Yield 50%

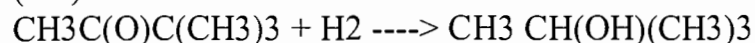
4.12.1.1.2 Syntheses of pinacolone



pinacol hydrate was hydrolyzed by conc. H₂SO₄ to get pinacolone. The product was obtained in purity of 60-70%.

4.12.1.1.3 Syntheses Pinacolyl alcohol 1988

It is prepared by hydrogenation of pinacolone using hydrogen gas in an autoclave of one liter capacity at 120 bar & 180 C in presence of Copper chromate as catalyst (2%)



Purity = 90 - 95 %

Yield = 90 %

4.12.1.1.4 Syntheses of pinacol by ele

Pinacol was try to be prepared by electro-Syntheses of mixture of acetone + isopropanol, using Pt electrodes. Within a (1-2)hrs. Pinacol was obtained of(1-2%) as indicated by GC analysis.

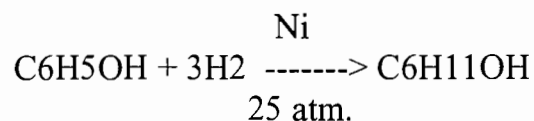
4.12.1.2 Syntheses of ethylene chlorohydrin 1989

Chlorine gas was bubbled in column containing distilled water, ethylene gas was bubbled through the same column till chlorohydrin was formed in 6-8% purity, the product was extracted by ethyl acetate, the following data were obtained:

Purity = 60 %

Yield = 50%

4.12.1.3 Syntheses of Cyclohexanol 1988 - 1989

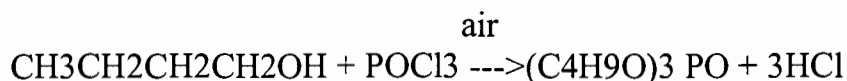


It was synthesized by hydrogenation of phenol in 1 lit capacity autoclave reactor at 150-250 C and 25 atm. pressure, using 2% of rany nickel as catalyst. Capacity reactor 1 liter. The product was found with

Purity = 95 %

Yield = 90 %

4.12.1.4 Syntheses of Tributylphosphate (TBP)



One mole of POCl_3 was added to 3 moles of n- butylalcohol and the temp. of the reaction raised spontaneously. Evolved HCl gas removed currently by using dry air through the mixture.

4.12.1.5 Determination of SO_3 stabilizer : 1987

The transferring of SO_3 from Al-qaqa to a Falluja-2 site faced a problem of freezing of SO_3 . Number of chemicals were tested to be a stabilizer for liquid SO_3 , CCl_4 was recommended as stabilizer for transporting this material.

4.12.1.6 CS-Spraying canister: 1988

According to the request from Interior Ministry, spraying canister for liquid CS were manufactured and sent to above Ministry to be tested as self defence tool. No further step was taken.

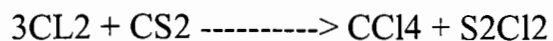
4.12.1.7 Syntheses of Bis(2-cyanoethyl) amine ($\text{CNCH}_2\text{-CH}_2$)) $_2\text{-NH}$:

An attempt to synthesize this material and investigated the toxicological effect on lab animal was carried out. It was found it has a toxic potency on certain animals.

4.12.2 Researches for Civil Industry.

4.12.2.1 Syntheses of carbon tetrachloride 1988

CCl_4 was prepared from CS_2 & Cl_2



To a mixture of CCl_4 & S_2Cl_2 at 1:1 ratio CS_2 was added followed by Cl_2 bubbling at 50-60 C. After 2 hr. the mixture was distilled to get CCl_4 with a purity 99% and yield 70%.

4.12.2.2 Syntheses of Phenol 1987

Phenol was used in medicine, pesticides, for this purpose phenol research was done.

The following steps were used to obtain phenol:

4.12.2.2.1 A vapor of benzene was passed through a hot sulfuric acid which was placed in a flask. Benzene layer that condensed by a chilled condenser was recycled and the water layer was separated, the product was collected as sulphonic acid.

4.12.2.2.2 In stainless steel pot mixture of 3 mole of NaOH pellets and 1 mole of Benzene sulphonic acid was fused at 350 C for 15 minutes with mixing.

4.12.2.2.3 The product from step above was dissolved in sufficient quantity of H₂O and CO₂ gas was bubbled until neutralization took place the upper layer was separated from the mixture as phenol. It was distilled under reduced pressure.

Purity = 80%

Yield = 45%

This research was stopped due to complexity and multi-step procedure.

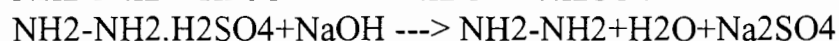
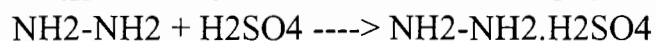
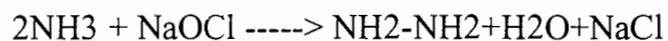
4.12.2.3 Syntheses of Ethyl Acetate 1988

Ethyl acetate was used for medicine and insecticide. Absolute ethanol was added to the concentrated acetic acid which placed in a flask dropwisely under control of the reaction temperature. The mixture was stirred for one hr. and the product was distilled and dried;

Purity 95%, Yield 70%.

The research was carried out on lab. scale only.

4.12.2.4 Anhydrous hydrazine 1987



A mixture of (30-33%) ammonium solution, 10% gelatin solution and (8-10%) NaOCl was placed on evaporating dish. The mixture was heated and boiled until 1/3 of the original volume was left, the solution was cooled, filtered, and then precipitated by adding conc. H₂SO₄ to cool the solution, to form hydrazine sulfate (NH₂-NH₂·H₂SO₄).

In the distilling flask, equimolar amount of hydrazine sulfate and sodium hydroxide were mixed with small amount of water, heating the mixture and directly distilled the hydrazine. The product was obtained with

Purity = 85%

Yield = 15%

4.12.2.5 Syntheses of dibenzo-18-crown-6 Ether

A mixture of 0.3 mole of catechol, 200ml of 1-butanol and 0.3 mole of sodium hydroxide pellets was refluxed under nitrogen gas for 30min. at 110C. A solution of 0.16 mole of bis(2-chloroethyl)ether diluted with 15 mil of 1-butanol was added drop-wise, and the mixture was refluxed for the one hr. The temp. was lowered to 90 C, and 12 gm of sodium hydroxide pellets was added . Refluxing was continued for 30 min., and 22.2 gm of bis(2-chloroethyl)ether diluted with 15 mil of 1- butanol was added drop-wise over two hrs. Refluxing was continued for 16 hrs. Concentrated HCl (2.1 mil) was added and then the excess butanol was rapidly removed by distillation. The product was washed with water, filtered and dried.
Yield = 40 %

4.13 Procurement of Precursor Chemicals

- List of all chemicals procured for R & D on V-agents:

1. MPS
2. P2S5
3. Diisopropylamine
4. Ethylene oxide
5. Disopropylaminoethanol
6. Dimethylaminoethanol
7. Diethylaminoethanol
8. PC13

The procurement of Lab. chemical reagent or fine chemical were obtained from the following companies.

Company	LC No.	Chemical
Merck	83/3/357	Lab.chemical
Ridel de hein	83/3/371	Lab.chemical
Fluka	84/3/1346	Lab.chemical
Fluka	87/3/526	Lab.chemical
Fluka	84/3/39	Lab.chemical
Fluka	85/3/238	Lab.chemical
Fluka	85/3/783	Lab.chemical
Fluka	85/3/1114	Lab.chemical
Fluka	86/3/479	Lab.chemical
Fluka	86/3/726	Lab.chemical
B.D.H	86/3/1049	Lab.chemical
Fluka	86/3/257	Lab.chemical
B.D.H	86/3/899	Lab.chemical
Fluka	86/3/913	Lab.chemical

Tafisa	87/3/219	Lab.chemical
Fluka	85/3/494	Lab.chemical
WET	85/3/771	MPS

Application Research:

1. One of the Departments of R&D Center was equipped with Buchi glass reactor, autoclaves (5-10) liter capacity, particle size analyzer, decanter, spray dryer, pilot distillation unit, liquid-liquid extractor and other useful equipments) to conduct the following experiments and tests:
 - a. Scaling up of the procedures carried out for production (as a pilot plant) such as process of tabun, sarin and their precursors.
 - b. An attempt to collect some thermodynamics data such as heat capacity , enthalpy, heat of reaction which are useful in plant design, but these data were not applicable because all the plans were multipurpose reactors and already exist, and for the lack in experience of personnel in that field.
 - c. Determination of the particle size of the precipitated salts in order to choose the proper way for filtration in production processes.
 - d. Corrosion tests (lost weight method MDD) to measure the effect of corded materials on other materials to have an idea for the construction materials of plants, ammunitions.
2. In order to confirm the optimum condition for production processes, the scaling up of the procedures carried then at H1 pilot plant.

There were many activities carried out at R & D directorate / MSE, since 1982 which were significant regarding the main CW programme and there were no records left to give an accurate account of those activities as the R & D structure was totally destroyed and the records kept inside the laboratories remain under the rubble. During the visit of UNSCOM team 129 to MSE, some documents were excavated by the team which mention some of those activities. Since then a seminar was undertaken in which all the personnel who worked in the R & D directorate previously took part and the following account is the result of the activities remembered to the best of there recollection.

Support and consultations given to the R&D directorate / MSE from local sources

- 1- Cooperation for synthesis of Tributyl phosphate with College of Engineering, Dept. of Chemical Engineering, University of Baghdad. (1990).
- 2- Cooperation for and identification of some derivatives of psychological compounds with Pharmacy College, Baghdad University (1988-1990).
- 3- Cooperation with P.R.C for synthesis and identification of:

- Pinacol hydrate
- Pinacol alcohol
- MPS
- UDMH
- Choice of agents using molecular design .
- Measuring of particle size of sodium chloride as by product after filtration, of tabun (1986).

4- Analysis of purity of NaF at Phosphate Est. in 1985.

5- Analysis of scanning NMR spectrums C13,H1 (90 MH2) for some intermediates and final agents at Dept. of Chemistry, Al-Mosul University (1985).

6- Measuring heat capacity (CP) at P.R.C in .1986 for Sarin, Tabun, MG.

7- Analysis of VX by using mass spectrum at T.R.C in 1987.

8- Analysis of MPS using GC- mass at TRC in 1989.

Pilot Plants

1- MSE received 200 lit pilot plant (St.St) from SDI. It was modified at applied Dept. in R&D for synthesis of S2Cl2, and used to produce about 1000 Kg. of S2Cl2 in 1987.

2- MSE received 200 lit (St.St) pilot plant from SDI. It was modified at applied Dept. to produce about 60 kg. of MG in 1987.

3- MSE received 200 lit (St.St) pilot plant from SDI. An attempt to use it for synthesis of tabun, and this process was failed. This pilot plant was modified to produce chloropicrine in 1987.

4- R & D Directorate imported 5 lit autoclave reactor which was used for synthesis of choline, chloro hydrine in (1987 and 1988) and UDMH in (1987, 1988, 1989 and 1990).

Few Kgs. of choline and chloro hydrine was produced by this reactor.

5- Installation of local pilot plant (50 lit capacity) by using buchi reactor for synthesis of Thionyl Chloride at applied Dept. in R&D at the end of 1986.

6- Installation of pilot plant (pilot Atomizer) at applied Dept. in R&D to synthesis DMPH using methanol and PCI3 as starting material (capacity 10 lit/hr) in 1989.

Only two experiments were carried out using this pilot plant.

7- Installation of pilot plant for synthesis of TDG with capacity of 50-60 lit, using H₂S gas , only one exp. Was carried out in 1986.

8- Installation of pilot plant capacity (20 lit) at Salah Al-Din Dept. for synthesis of pyrophosphate from the pyrolysis of DMPH, only few kgms were produced in 1988.

9- Installation of pilot plant with capacity 30 kgm/batch to synthesis zinc phosphide, later on this pilot was used to produce P₂S₅ (only one exp. was carried out to synthesis P₂S₅) in applied Dept. in 1987.

10- Fractional distillation apparatus (imported) was installed at applied Dept. with capacity 10L. Later on used for distillation of alcohols and CCl₄.

11- 300 Kg. of crude MPS was distilled in applied Dept. to get about 100 Kg. of pure MPS using buchi pilot plant (50lit capacity) at the end of 1987 and beginning of 1988.

External samples received by MSE

- 1- Sample of 1/2 Kgm of BZ from Egypt in 1985.
- 2- Sample of MG (IRANIAN) from a shell in 1985 from captured munition.
- 3- Sample of spray can of CS in 84-85.
- 4- Ampule of DFP at 1982 as standard for analytical purposes.
- 5- 30 lit of phenol fromaldehyde resin for coating shells used in the filling of MG and Sarin in 1986.
- 6- MPS (10ml) fluka in 1986 as standard for analytical purposes.
- 7- Organo phosphorous samples from fluka used as internal standard for GC.

External Experience support and know-how

- 1- An expert from united phosphorous ltd./India visited MSE for explaining, procedure for analysis of PCI₃ and POCl₃ in (1989).
- 2- Know-how of Choline from chlorohydrine (Exomint co. 1988).
- 3- Maintenance and installation of instruments by engineers from the following, companies.
 - a. GC , Karl Kolb / W.G.
 - b. CHN, Heraeus / W.G.
 - c. IR, Perkin Elmer / U.S.A.
 - d. HPLC, IR, AA and UV, Pye Unicam / U.K.
 - e. Balances, Karl Kolb /W.G.
 - f. Particle size analyzer, Coulter Counter Company / U.K.

Joint activities of MSE with other Establishments.

- 1- synthesis of zinc chloride (ZnCl_2) to the Batteries Industry Est. by using waste zinc, and HCl . PH of the solution controlled using NH_3 gas ($\text{PH}=3$) (1989-1990).
- 2- Extraction and purification of silver powder to the Batteries industry Est. and use the pure silver in silver batteries at 1990.
- 3- 1 Kg. of DMPH was sent to TRC.(1988).
- 4- Micro analysis (CHN) to Post graduate students (PH.D & Msc), working at Baghdad, Mosul, Basrah Universities (1984- 1990).
- 5- Supply many different fine lab. chemicals to post graduate students, at Universities in (1983-1990).
- 6- Synthesis of ethyl chloride
To a mixture of AlCl_3 (75g.) and FeCl_3 (84 g.), (267 g.) of ethanol was added within 2 hrs. The reaction mixture was heated up to 120 C and the product condensed at (-20 C), the product was collected with purity 70% and yield 80%. This research was carried out to Al Qaqa Est. in 1989-1990.
- 7- Conversion of Dalapon (solution) to Dalapon powder by using spray drier in Dept. of Chemical Eng. Dept. Engen College, Baghdad University in 1989.
- 8- Tricresyl phosphate was synthesized in lab.scale (3-5 Kg.) for Al-Qaqa Est.as additive for propellant production in 1989,1990.
- 9- N,N-Dimethyl hydrazine (UDMH).(1989,1990).

a. From Dimethylamine hydrochloride: To a solution of dimthylamine hydrochloride (150gm) and H_2SO_4 (11 g.), (200 g.) of NaNO_2 solution were added at room temp. The solution was distilled, filtered and the precipitate was washed with water, the product obtained was nitroso dimethylamine (NDMA). The reduction of NDMA by hydrogenation reaction was carried out by using catalyst Pd/C (5%). The reduction took place in an autoclave (2 lit cap.) by reaction of H_2 gas and NDMA (50 g.) in presence of (3-6 g.) of Pd/C . The product was filtered, distilled and analyzed by IR, GC and RI. The product (UDMH) was collected with purity 95% and yield 85%.

b. UDMH from acetyl hydrazide (1989-1990)

The first step include synthesis of acetyl hydrazide. Hydrazide hydrate 85% (70 g.) was added to (135 g.) of ethyl acetate during 30 min. in autoclave. The mixture was heated up to 120 C at 2 atmospheric pressure and stirred for 5 hrs at this temp. The product was collected with purity 95% and the second step was carried out by adding, (240 g.) of acetyl hydrazide to (9.5 g.) of glacial acetic acid and 5.5gm of Pd/c (5%). The mixture was pressurized at (8 atm.) with H₂ gas and heated to 90C with stirring Methyl Formate (175 g.) was continuously pumped into the mixture over 5 hrs. All attempts failed to get UDMH by this path. This project was carried out for Al.Qaqa Est. during (1989-1990). Synthesis of UDMH was carried out in cooperation with PRC.

11- Synthesis of Crown ethers, TBP for extraction of uranium for IAEC (1989).

12- Synthesis of TMT/Tetramethyl Thiuram disulfide or TMTD

This project was carried out as rubber accelator



(170 g.) of dimethyl amine hydrochloride dissolved in 114 ml water, 40% NaOH solution was added at temp below 15 C . The mixture of (79 g.) of CS₂ and 50 ml of isopropanol was added at 22-25 C the mixture was stirred for 20-30 min. Chlorine gas was passed through the mixture was stirred for 20-30 min. Chlorine gas was passed through the mixture at 35 C with cooling till the PH=2-3 The precipitate was filtered, washed with cold water and dried, the product was filtered collected with yield 85%, only 700 kgm was produced for the batteries industry Est.

13- Synthesis of Benzoyl peroxide

It was synthesized by addition of 36% NaOH solution (1 mole) and (1 mole) of Benzoyl, chloride to a reaction flask containing 20% of hydrogen peroxide (1 mole) at (0-8) C. The reaction mix. was kept for 12 hrs, filtered and the precipitate washed with cold water and alcohol, the product was collected with purity 95% and yield 85%. This product was supplied to Al.Qaqa Est. and SDI (1990).

14- (22 kg.) of Adamsite, chloropicrine, spoilt MG, CS (unknown quantities) were sent to chemical corp as a samples to test protection gear.

Colour codes and Samples designation for agents & precursors synthesized in R&D

1. Tabun designated Red , GF till 1987.
2. Cyclohexanol sarin designated as grean, GF.
3. Mustard designated as yellow , MG, S1, S2, S3, S4, S5, S6, H.
4. Sarin designated black, GB ,GA.
5. VX designated as blue ,SO,SM,SN,SJ
6. VX salt designated as D Syrup.
7. Adamsite designated as DM.
8. CS designated as white .
9. Soman designated as Z.
10. BZ (Egypt) designated JB 339.
11. Lewesite designated LW.
12. Mixture of sarin and Cyclo Sarin designated as black-green, GB,GF,Mixt.
13. Sarin-sec butanol designated as GS.
14. Mixture of sarin-sarin sec.butanol designated as GB-GS.
15. Sarin - cyclo pentanol designated as CG.
16. Sarin - cyclo hexanol (S-sulfur) designated as GBX. or Thio sarin.
17. Sarin - cyclo pentanol designated as (S-sulfur)
18. Di isopropyl phosphoro fluoridate designated as DFP.
19. Nitrogen mustard designated as NMG.
20. Sarin - isobutanol designated as NB-GB
21. Methyl phosphonyl chloride designated as MPF,DF,PF.
22. Methyl phosphonyl chloride designated as MPC,DC,PC.
23. Mixture of MPF & MPC designated as RTF.
24. Sarin-isopentanol designated as NP-GB
25. D4 designated as DX.
26. Thiodiglycol designated as TDG.
27. Dimethyl methyl phosphite designated as DMMP.
28. Trimethyl phosphite designated as TMP,MTP.
29. Thiocholine designated as choline -SH
30. Choline designated as choline - OH
31. Monoester (C₂H₅O)(CH₃) P(O)Cl designated as monoester (O)
32. Monoester (C₂H₅O)(CH₃) P(S)Cl designated as monoester (S)
33. Hydrazine designated as H or UDMH
34. Tributyl Phosphate designated as TBP.
35. Nogos = as DVS or DDVP.
36. Diazinone = = D.
37. Malathion = = M.
38. Propanil = = stam (s).
39. Triphenyl Phosphate = = TPP.
40. Samathion = = SM.
41. Xylene = = X.
42. Mixture of Benzene, Toluene and xylene designated as BTX.
43. Dibutyl Phthalate designated as DBP.
44. Tetra ethyl pyrophosphate designated as TEPP.

45. Trichloro acetic acid = = TCA.
46. Fly killer designated as killer 1 and killer 2.
47. Isomers of Tabun designated as NJ5, NJ6, NJ8, NJ9.
48. Ammonium acetate designated as A2,A3.
49. Magnesium oxide designated as B1.
50. Chloroform designated as C1.
51. Ethanol designated as C2.

Biological assay

In the Biological assay dept., the activities of all the chemical agents and some precursors were studied by two methods

1. Chemical assay by the effect of the agent or precursor on acetyl choline enzyme and measuring the LD50.
2. Biological assay using Inhalation chamber.

- LD50 of sarin was fixed as a standard for the calculation of LD50 for other agents and precursors.
- Table below shows the activities of the agents and precursors comparing with sarin as standard agent.

(Table)

C	Name	Year	assay
1.	Sarin	84-90	active
2.	Tabun	82-86	=
3.	Vx	87-90	=
4.	Vxo	87-90	=
5.	Vx salt	=	=
6.	Soman	85-88	=
7.	Sarin-cyclo Hexanol	87-90	=
8.	Mix.Sarin+cyclo- Sarin	87-90	=
9.	Sarin-sec butanol	88-90	=
10.	Mix.Sarin-sec + butanol Sarin	88-90	=
11.	Sarin-cyclo pentanol	=	=
12.	Diethyl Sarin	88-90	inactive
13.	Thio Sarin	88-90	Low active
14.	DFP	85-90	active
15.	Sarin-iso butanol	88	=

16.	Sarin-iso pentanol	88	Low active
17.	choline-Sh choline-OH	87-90	inactive
18.	Monoester(O) monoester(S)	87-90	=
*19.	BZ (J339)	88	active
**20.	Nogos	87	=
* active as insecticide.			
** active as psychological agent.			

Activities at quality control and analytical Dept.

Produced and synthesized agents and precursors were analyzed in quality control and analytical Dept.

The table, below shows the type of chemicals, identification technique, frame time and instruments used for analysis.

	Name	Received From	Expected Date	Type of analysis							
				GC	HPLC	I.R.	U.V.	CHN	General Anal	NMR	Others
	Sarin	R&D,P,F,S	83-90	+		+	+	+	+	+	
	Tabun	R&D,P,F,S	81-89	+		+	+	+	+	+	
	Mustard	R&D,P,F,S	80-90	+		+	+	+	+	+	+
	VX aget(Vxo, Vx sah)	R&D,P,A	87-88-90	+		+	+	+	+	+	
	Adamsite	R&D	86-87		+	+	+	+			
	CS	R&D,P,F,S	80-90		+	+	+	+			
	Soman	R&D	85-88	+							
	Bz-Egypt	R&D	83-88		+	+	+	+			
	American BZ	R&D	83-88		+	+	+	+			
	Lewisite	R&D	86-87		+		+	+			
	Sarin (Cyclohexanol)	R&D,P,F,S	87-90	+		+	+	+	+		
	Mix (GB cyclohexanol & GF)	R&D,P,F,S	83-90	+		+	+	+	+		
	Sarin (sec-butanol)	R&D	87-90	+		+	+	+	+		
	Mix GD & GS	R&D	87-90	+					+		
	Sarin (cyclopentyl)	R&D	87-89	+		+			+		
	Sarin -S (Cyclohexanol)	R&D	87-89	+		+			+		
	Sarin -S (Cyclohexanol)	R&D	87-89	+		+			+		
8	DFP	R&D,P,S	85-90	+		+	+	+	+		
9	Chlorpecrin	R&D,P,S	86-90	+		+	+	+	+		
0	N-Mustard	R&D	86-87	+					+		
1	Sarin(Isobutyl)	R&D	87	+					+		
2	Sarin (Isopentanol)	R&D	87	+					+		
3	MPF	R&D,P,S	83-90	+		+			+		
4	MPC	R&D,P,S	83-90	+	+	+			+		
5	D4 or Dx	R&D,P,S	80-90	+		+			+		
6	Thiodiglycol	R&D,P,S	80-90	+		+			+		
7	DMMP	R&D,P,S	83-90	+		+		+	+		
8	Trimethyl phosphite	R&D,P,S	83-90	+		+			+		
9	POCl3	R&D,P,S	83-90	+		+			+		
0	PCl3	R&D,P,S	83-90	+		+			+		
1	S2Cl2	R&D,P,S	80-90	+		+			+		
2	SCI2	R&D,P,S	80-90	+		+			+		
3	Thionyl chloride	R&D,P,S	85-90	+		+			+		
4	Mix MPF & MPC	R&D,P,S	83-85	+					+		

5	Choline - SH	R&D,P,S	87-90	+		+			+		
6	Choline - OH	R&D	87-90	+		+					
7	Mono - ester-O	R&D	87-90	+		+					
8	Mono - ester-S	R&D,P	87-90	+		+					
9	Diester	R&D	87-90	+		+					
0	MPS	R&D,P,S	87-90	+		+			+		
1	Pinacol alcohol	R&D	87-90	+		+					
2	Cyclo pentanol	R&D	87	+		+					
3	PSCl3	R&D	88-89	+		+			+		
4	Water in Alcohol	R&D,P	86-90	+							
5	DMPH	R&D,P	83-89	+		+					
6	Diisopropanolami no R&D ethanol	87	+		+						
7	Trimethyl phosphate	R&D	89	+		+					
8	Tammilin	R&D	89	+		+					
9	Ethylene glycol	R&D	90	+		+					
	// s										
0	(CH3O)2 -P \ cl	R&D	90	+		+			+		
1	Hydrazine	R&D,others	88-90	+		+					
2	Tricresy (phosphate)	R&D,S	89-90								
3	(OC2H5)2P(O)C L	R&D	87-90	+		+					
4	Isopropyl amine	R&D	87-90	+		+					
5	MePCl2	R&D	88-90	+		+			+		
6	&- cyclopentyl mandelic acid	R&D	84-85		+	+					
7	Triphenyl phosphate	R&D	89-90	+		+					

R & D = Research & Development Depts

S = Stores

P = Production sites

A = Applied Dept

F = Filling sites

2. Many agents, precursors and starting materials were distilled and used as standard samples in analytical Dept.

Sarin PCl3

Tabun Monoester

MG

MPF

MPC

D4
POCl₃
DMMP
TDG
MPS

3. Many starting materials or fine chemicals Lab. were analyzed as shown is the list below.

1. Phenol
2. Nitro benzene
3. Aniline
4. Xylene
5. Chloro benzene
6. Nogose
7. Malathion
8. Permethrin
9. 2,4- Dichlorophenol
10. Benzyl Chloride
11. Benzoic acid
12. Benzyl cyanide
13. Phenyl acetic acid
14. Sepazol
15. P- Nitro Phenol
16. P- Nitro chlorobenzen
17. Stam-34
18. Elsan
19. Benzoyl chloride
20. Benzyl alcohol
21. Benzal dehyde
22. P- Nitro - m - Cresol
23. Lindane
24. Chemo Paf
25. Ethyl acetate
27. Chealating agents
28. ZnCl₂
29. NH₄Cl
30. Na₂CO₃ + NaHCO₃

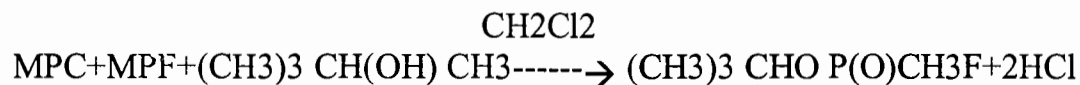
Additional researches in R&D.

1. Soman agent (Z)

In 1985 after the success in production of MPC and MPF for Sarin, it was thought that synthesis of soman can be carried out in the same procedure, using same technique. From the literature, it was found that toxicity of soman was more than Sarin, all these things encourage to synthesize soman.

In a round bottom flask, 0.5 mole of MPC, 0.5 mole of MPF were mixed with 100 ml of CH_2Cl_2 as a solvent. One mole of pinacol alcohol was added to the mixture drop-wisely at 40 C. The mixture was refluxed for 1 hr. The product was concentrated under reduced pressure. The product was collected with 60% purity and yield 45-50% only 2-3 experiments at 1 mole scale were carried out at 1985.

Again in 1988 an attempt was carried out in the same procedure to synthesize soman. The research was stopped again because of the antidote of soman was not available, and pinacol alcohol was not available in mass bulk. Many attempts were tried to import pinacol alcohol at 1985, 1988, 1989 but failed, and for this reason, many attempts were carried out to synthesize pinacol alcohol as shown in FFCD 4.12.1.1 to 4.12.1.1.4



2. Synthesis of MPS from MePCl_2 (1989) MePCl_2 , was synthesized from methane, PCl_3 , CCl_4 air in oven at 500 C. The product contain mixture of 20% MePCl_2 and PCl_3 , POCl_3 & MPC. The product was sulphurized in presence of catalyst at 50-60 C. The product was a mixture of (75- 80%)MPS, PSCl_3 , PCl_3 and POCl_3 , only two experiments were carried out.

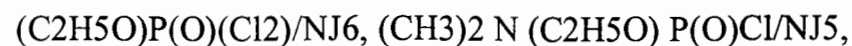
3. Few experiments were carried out to synthesize $(\text{MeO})\text{PCl}_2$ from the reaction of PCl_3 and methanol at 0-5 C, the product was collected with 70% purity and 40% yield. The attempt was carried out to convert $(\text{MeO})\text{PCl}_2$ to MPC by heating, but the attempt was failed (1987).

4. Synthesis of some isomers of Tabun (1986)

It was found during the analysis of tabun by GC, some peaks for by products were appeared through the synthesis of tabun to identify these peaks, these compounds were synthesized in

Salahaldin Dept., to compared those compounds with peaks appeared in GC spectrum

These compound are:



$(\text{C}_2\text{H}_5\text{O})_2\text{P}(\text{O})\text{Cl}$ / NJ8, $(\text{CH}_3)_2\text{N}(\text{C}_2\text{H}_5\text{O})_2\text{P}(\text{O})$ / NJ9

5. Synthesis of MG from SCl_2 and C_2H_4 (1985)

MG was synthesized using tubular glass reactor by pumping of C_2H_4 gas on SCl_2 at 0-5 C in a period of 30 in ., the product was collected with purity 30-40% and yield 20%. Only few experiments were carried out to synthesize MG by this procedure.

6. Synthesis phencyclidine (PCP)

1-(1-Phenyl cyclo hexyl piperidine)

a. Synthesis of piperidino cyclo hexyl carbon nitrile (PCC)

$\text{C}_6\text{H}_{10}\text{O} + \text{C}_6\text{H}_{10}\text{N} + \text{KCN} + \text{HCl} \rightarrow \text{PCC}$.

100 ml of pyridine added to a mixture of 84 ml conc. HCl and 200 ml of chilled water, Then (68 g.) of KCN in water and 104 ml of Cyclo hexanone were added to the mixture during 2 hrs, the reaction mixture was left over night, filtered washing with water, dried product quantity (182 g.) with purity 95% of PCC.

b. Synthesis of gringard reagent mixture of bromo benzene and ether was added to mixture of (17.3 g.) of Mg and 300 ml of dry ether.

c. Synthesis of PCP.

Mixture of (152 g.) PCC ,100 ml dry ether and 100 ml of benzene was added to gringard reagent gradually with stirring. The reaction mixture was refluxed for 1 hr at 40 C, separation and purification were carried out. The product PCP was collected with purity 90% and yield 70%

d. Nitration of PCP

H_2SO_4
 $\text{PCP} \xrightarrow{\text{HNO}_3, \text{O C}} \text{M-Nitro PCP}$

1-[1-(m-nitro phenyl) cyclohexyl]

Yield 63 %

e. Reduction of M-Nitro PCP

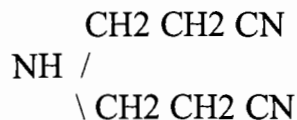
Sn / HCl m-Amino PCP
 m-nitro PCP -----3)-1]-1 <-amino phenyl)cyclo hexyl]
 piperidine
 yield 78 %

7. Synthesis of MG from vinyl chloride, H₂S using UV light , only one or two experiments were carried out. The research was stopped due to difficulty in getting suitable UV max wave length for the reaction (1990)

8. Synthesis of Sarin-Tert. Butanol by using ter. butanol instead of isopropanol and in same procedure (1988).

9. Synthesis of Mixture of DFP and MG in salah AL-din Dept. at 1988.

10. Synthesis of Bis (B-Cyano ethyl) amine



This compound was expected to be psychological potency agent.

11. Chloro acetyl chloride as intermediate for chloro aceto- phenone.

Additional civil researches work in R&D.

1. Synthesis of trichloro acetic acid (TCA). TCA was synthesized by oxidation of chloral using Conc. HNO₃ at 50 C and 120 C. TCA used as a herbicide agent.

2. Synthesis of thio phosphoryl chloride (PSCl₃) 1988,1990

a. By the reaction of PCl₃, S, AL at 140 C purity 68%.

b. By the reaction of PCl₃, S and catalyst at 130 C. Purity 90 %. This compound used as a starting material in synthesis of insecticides.

3. Distillation of B.T.X (1989)

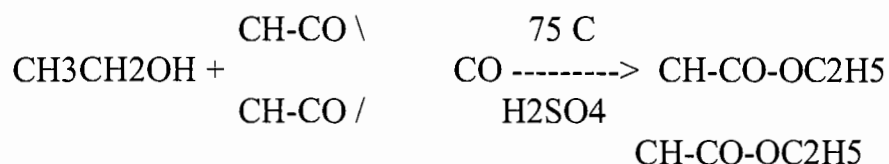
a. Benzene, toluene, Xylene mix was available in Iraq, Successful attempt was carried out to get Xylene from the mixture by normal distillation at 130-140 C and by fractional distillation.

b. Only one batch was distilled at diah plant this solvent was used as a solvent in the formulation of insecticides.

4. Only one batch was produced of Dalapon in Diha plant in 1989.

5. Synthesis of diethyl maleate 1988

Diethyl maleate was the active ingredient for malathion insect. It was synthesized by addition of ethanol (150 gm) to maleic anhydride (50 gm), then addition of H_2SO_4 (conc.) at 75 C. The product was distilled with purity 97%, yield 90%.



6. Synthesis of Malathion (1988)

Active ingredient of Malathion S(1,2-dicarboxy ethyl)-o,o- dimethyl dithio phosphate was synthesized by addition of diethyl maleate to a mixture of methanol and P_2S_5 at 80- 85 C, the mixture product was distilled and collected with purity 83%.

7. Synthesis of Aluminium phosphate (ALP) 1988-1989

Mixture of Aluminium powder (Al=3.5 kg) and red phosphorous (5 kg) was heated at 900 C in a furnace for about 1 hr, the product was collected after cooling with purity 70% and yield 75%.

8. Heating Sacks

Solution of sodium acetate hydrate was packed in poly ethylene Sack and fixed by spring working to crystalize the solution, this bag elevated heat reached to 60 C for 1 hr. and then the temp. decreased to 40 C, the bag, was heated again in water bath and used once again (1990).

The Production Buildings and the Equipment Installed

5.1 During 1983 - 1990, several production plants were constructed and the required equipment were installed in order to produce chemical agents and their precursors. Some of the plants (H1,2, Malik, Mohammed) were designed, constructed and furnished by foreign companies (such as P8, P7, H3) on request of MSE as a multipurpose plants, others were designed and installed by the technical cadre of MSE. Some equipments were designed by foreign companies and locally manufactured and installed by MSE staff.

5.2 The multipurpose plants were used to produce different chemical agents and their precursors, concerning that many modifications were carried out and many equipment were added to each plant in order to fulfil the requirement of each production process. Many technical problems arose during production such as corrosion, unsuitable construction materials (which were replaced from time to time) and the lack of sufficient utilities in plants affected the products where many batches were spoiled. In 1987 each plant was used to produce a specific precursor or chemical agent.

5.3 The Iraqi designed plants were used to produce the final agents in general, these plants were assembled by using the imported general equipment which satisfy the production processes although those plants were not equipped with the necessary equipment such as vacuum and control instrumentation.

5.4 In 1985 three sites were constructed at Falluja (Falluja I, II and III) as integrated general chemical production site without installation for any specific production, those sites were used for installation of chlorine, pesticides (POCl_3 & PCl_3) TMP, and thionyl chloride plants. These plants were designed by foreign companies (except thionyl chloride production plant) and installed by MSE staff. The idea behind the construction of these sites was the production of general chemicals for commercial purposes in addition to provide the chemicals needed for CW programme.

Site name: Heberger 1 (Mutasim 1 at 1987)

History:

H1 Pilot Plant was designed and constructed by Heberger Co. The equipments were imported and installed by Pilot Plant company on a request of MSE as a multipurpose plant which fulfil the requirement of the production of some precursors such as DMMP, MPC and D4. Also this plant (H1) was used as Pilot Plant for scaling up the synthesis of precursors achieved by R & D.

Equipment:

Equipment	Qty	Type	Description
Reactor	2	Glass	100 L capacity with heating coil glass with stirrer
Reactor	2	Glass	200 L capacity with heating coil with stirrer
Reactor *	1	H.C	400 L capacity
Distillation	2	Glass	3 m x500 mm glass rushing column rings
Storage tank	1	PP	2400 L. for gas washing
Column	1	Glass	200mmx3.5M
Top condenser	2	Glass	1 m2 area
Top condenser	4	Glass	0.5 m2 area
Receiving	2	Glass	100 L vessel
Ditto	4	Glass	30 L
Tank	2	PVDF	2 m3

Service:

Heating unit	2	Thermal oil 60 KW
Cooling system	1	Air cooled 30 ton
Ditto	1	Ethylene 20 tons glycol
Compressor	2	Screw type
Vacuum pump	2	Water ring 20 m3/hr

Civil works:

Designer - Heberger
Execution party - Heberger

Technological works:

Designer - Pilot plant
Execution party - Pilot plant

* One hastalloy reactor of 400 L capacity was added in stade of 100 L glass reactor.

Materials produced:

1. D4 : Second half of 1983 till 3rd quarter of 1985.
2. DMMP: End of 1985 till second half of 1987.
3. MPC : First half of 1985 till second half of 1987.
4. Formulation of NP (catalyst used for production of MPC).

Site name: Heberger II (Al - Mutasim I at 1987)

History :

H2 pilot plant was designed and constructed by Heberger Co. The equipments were imported and installed by pilot plant company on a request of MSE as a multipurpose plant which fulfil the requirement of the production of some precursors such as DMMP, MPC and D4. Also this plant (H2) was used as pilot plant for scaling up the synthesis of precursors achieved by R & D.

Equipment:

Equipment	Qty	Type	Description
Reactor	2	Glass	100 L capacity with heating coil glass with stirrer
Reactor	2	Glass	200 L capacity with heating coil with stirrer
Reactor *	1	H.C	400 L capacity
Distillation	2	Glass	3 m x500 mm glass rushing column rings
Storage tank	1	PP	2400 L. for gas washing
Column	1	Glass	200mmx3.5M
Top condenser	2	Glass	1 m2 area
Top condenser	4	Glass	0.5 m2 area
Receiving	2	Glass	100 L vessel
Ditto	4	Glass	30 L
Tank	2	PVDF	2 m3

Service:

Heating unit	2	Thermal oil	60 KW
Cooling	1	Air cooled	30 ton system
Ditto	1	Ethylene	20 tons glycol
Compressor	2	Screw type	
Vacuum pump	2	Water ring	20 m3/hr

Civil works:

Designer - Heberger
Execution party - Heberger

Technological works:

Designer - Pilot plant
Execution party - Pilot plant

* One hastalloy reactor of 400 L capacity was added In stade of 100 L glass reactor.

Materials produced:

1. D4 : Second half of 1983 till 3rd quarter of 1985.
2. DMMP: End of 1985 till second half of 1987.
3. MPC : First half of 1985 till second half of 1987.
4. Formulation of NP (catalyst used for production of MPC).
5. In the second half of 1986 an attempt to distill crude sarin. The attempt failed due to the inefficient equipments.

Site name: Thionyl Chloride plant (Al- Mamun) Falluja II

History:

A plant for production of (SOCl₂) was installed at Falluja/2 by SEPP technical cadre using the available equipment in the MSE. The plant was operated, with many technical difficulties therefore, it was stopped in 1988.

This plant was destroyed during the bombardment of Falluja site

Equipment:

Reactor	st.st.	1	1 m3, jacketed, stirrer
Reactor *	G.L	1	4m3
Top condenser	st.st.	1	3.5m2
Reactor	G.L.	1	1.6 m3 jacketed stirrer
Reactor	G.L.	2	2.5 m3 jacketed stirrer
Distillation	G.L.	2	350 mm x 4 m ceramic column rushing rings
Top condenser	G.L.	2	20 m2 shell & tube
top condenser	H.C	1	20 m2
Top condenser	H.C	2	5 m2
Heat exchanger	H.C	1	5 m2
Heat exchanger	Gra- phite	1	15 m2
Receiving	G.L.	1	800 L vessel
Ditto	G.L.	3	500 L
Storage tank	G.L.	3	4 m3
Storage tank	G.L.	1	10 m3 (SO3)
Storage tank	G.L	1	2 m3
Storage tank	G.L	1	6 m3
Storage tank	G.L	1	3 m3
Storage tank	Haller	2	5 m3
Drying unit	G.L	1	Storage tank 200 L G.L distillation column 200mm G.L ceramic R.R. to dry chlorine gas.

Services:

Chiller	Carrier	1	140 ton
Chiller	Subcool	1	15 ton
Heating unit	Thermal oil	1	175 KW
Compressor	Screw type	2	5 m3/hr
Compressor	Screw type	1	5 m3/hr
Vacuum pump		2	20 m3/hr

Civil works:

Beneficiary : SEPP
 Designer : W.E.T. German
 Executing party : W.E.T. German
 Starting date : 1986
 Execution date : 1987

Technological Works:

Design : SEPP Staff
 Executing party : SEPP Staff

Additions & modifications:

* Damaged during the installation. A unit for production of SO₃ was added to the plant. This unit was operated, and the product was not in a good specification, for this reason, the plant was stopped.

Materials produced:

Thionyl chloride at the first quarter of 1988 till the beginning of 1989.
 Site name : P7 plant (Al - Mutasim - 4 at 1987)

History:

This plant was designed and installed by SEPP technical cadre according to the data from R & D using the equipment available at the MSE. The plant was ready for production in the end of 1984.

Equipment:

Reactor *	3	G.L.	2.5 m3 jacketed stirrer
Reactor **	2	Tefizel coated	3 m3, with hastalloy coil for cooling
Top condenser	1	H.C	20 m2 - shell & tube
Receiving tank	1	H.C	800 L
Storage tank	1	H.C	1m3 jacketed for st. (from Ahmed1) material
St. tank St. materials	1	PVDF Cilcote	2 m3/ with candles for cooling
Storage tank St.	2	PVDF	2 m3

materials			
Storage tank	1	Haller	5 m3
Storage tank	1	G.L	800 L.
Heat exchanger	1	H.C	7.5 m2
Centrifuge	1	Batch basket with pp. cloth filter	250 L\ with rotating st.st.
Scrubber	1	PP Cilcote	10 m3 storage tank (PP) 500 mm, Cilcote 3.5 m height (PP) tolerate.

Services:

Chiller	1	Halla	40 ton water coole
Chiller	1	SUK	15 ton air cooled
Chiller	1	Carrier	25 ton air cooled
Chiller	1	Train	73 ton water cooled
Heater	1	Elec trical candle	30 KW
Compressor	2	Sular	50 m3/hr air dryer
Vacuum pump	1	SiHi	20 m3/hr water ring

Civil Works:

Beneficiary: Al-Hassan Ibn Al-Haitham

Execution Party: project 1/75 - The State Company for Construction Contracts

Designer: Abdul Wahab Al-Niami Office-Baghdad

Starting Date: 1975

Execution Date: Half of 1983

Technological Works:

Beneficiary: SEPP

Designer: SEPP Staff

Execution Party: SEPP Staff

Starting Time: 1984

Execution Date: 1984

Additions and Modifications

1. The addition of centrifuge unit and some modifications carried out in order to produce tabun.
2. A glass lined reactor of 2.5 M3 capacity was installed instead of the damaged reactor.
3. A tefezil coated reactor of 3M3 capacity was installed instead of the second damaged glass lined reactor.

4. A graphite heat exchanger of 50 m² was added instead of 10 m² monel.

* 2.5 m³ glass lined reactor was used as a buffer for filtration process of tabun.

** One tefzil reactor was used instead of the damaged glass lined reactor. The second one was installed instead of the tefzil reactor which was damaged during the test of the mixer.

Materials produced :

1. Sarin : end of 1984 till first quarter of 1985.
2. Tabun : second quarter of 1985 to 2nd half of 1986.
3. Sarin : second half of 1986 till the 3rd quarter of 1988.
4. Sarin : 2nd quarter of 1990 to the beginning of 1991.

Site name : Heberger/3 (Al- Mutasim 1 at 1987)

History:

A glass reactor 500 L capacity was installed in H3 plant to be used for the production of DMMP, in 1987 a monel reactor was installed to be used for the production of DF & sarin at the same site.

Equipment:

Reactor	1	Glass	500 L capacity, heating coil
Reactor	1	Monel	1.4 m ³ stirrer, jacketed
Top condenser	1	Glass	10 m ²
Distillation col.	1	Glass	3 m height, glass rasching rings
Top condenser	1	H.C	7,5 m ² from Ahmed Plant
Top condenser	1	H.C	5 m ²
Receiving tank	1	H.C	400 L from Ahmed 1 Plant
Tank	1	G.L	4 m ³
Tank	1	G.L	0.8 m ³
Tank	2	PVDF	2 m ³
Scrubber	1	PP	Storage tank 2m ³ (PP), col. 500 mm, 3.5 height (PP) tolerate.
Heat exchanger	1	Graphite	25 m ² area

Services:

Chiller	1	Train	50 ton, sub cooled
Heater	2		30 KW for each
Compressor	1	Screw type	50 m ² /hr/silica gel air dryer
Vacuum	2	SiHi	25 m ³ /hr water ring

Civil Works:
Beneficiary: SEPP
Designer: Heberger

Executing Party: Heberger
Execution Date: 1983

Technological Works:
Beneficiary : SEPP
Designer : SEPP
Execution Party : SEPP
Execution Date : 1985 - for glass reactor and 1986
for the Monel reactor.

Materials produced :

1. DMMP : end of 1985, 1986 till first half of 1987.
2. NP : several batches during 1987, 1988.
3. MPF : during 1987 and first half of 1988. then stopped until 1990 when production of MPF started in second quarter of 1990.
4. Sarin: during 1987, 1988 then stopped and started in 1990 until the beginning of 1991.
5. Few batches of GF (cyclosarin) were produced during 1988 then stopped.
6. GF - GB : during 1988 and stopped till second quarter of 1990 when production started again.
6. PSA : (para tolouene sulphonic acid) which was used in process of production of MPF (NaF salt process) in 1985 out door.

Site name: P8 (Bin Hayan I at 1987)

History:

The idea to install P8 plant was to produce mustard. The equipments were installed by the technical cadre of SEPP, using second hand equipments brought from SDI. Later new equipments were installed instead of the second hand to increase the production capacity.

Equipments:

Reactor	4	G.L.	Capacity 2.5 m3 each with stirred 125 rpm jacketed
Storage tank for starting materials and Separation	2	G.L.	20 m3 capacity for each
Storage tank for st. materials	2	C.S.	4 m3
Storage tank for product	1	C.S.	10 m3 capacity
Storage tank for st.Materials	2	C.S.	45 m3 for NaOH

Feeding tank st. materials	4	C.S.	1.5 m3
Feeding tank st. materials	2	C.S.	7.5 m3
Scrubber	2	P.P.	Storage tank 10 m3 (PP), column 500 mm, 3.5 m height pp, tolerate
Heat exchanger	1	Graphite	50 m2 (for scrubber)
Heat exchanger	1	H.C	2.5 m2
Separation tank	1	G.L.	10 m3

Services:

Chiller	1	DAIKIN	80 ton, water cooling
Chiller	2	Carrier	140 ton air cooled
Heater	1	GEKA	300 KW thermal oil 250 C
Heat exchanger	1	C.S.	20 m2 (secondary) thermal oil
Elec. Heater	1	Elect.	200 KW for thermal oil heating
Heat	1	CS	10 m2 for water heating exchanger to reactor
Compressor	3	Solar	50 m3 bar with dryer (screw type)

Civil Works:

Beneficiary : Al-Hassan Ibn Al-Haitham Establishment

Designer : Abdul Wahab Al-Niami Office, Baghdad

Executing Party: The State Company for Construction Contracts

Execution Date : Mid of 1983

Starting Date : 1975

Technological Works:

Beneficiary : SEPP

Designer : SEPP Staff

Executing Party: SEPP Staff

Execution Date:

1st step: 1983

2nd step: 1984

3rd step: 1986

Modifications, additions after installing:

The defect of the reactors and then installed by second step reactor.

Materials produced:

1. MG : from the second half of 1983 till 1988 when the production stopped. And in the end of 1990 mustard was produced.

2. Vx : was produced in the end of 1987 (one batch only) by using monoester method.

Site name : Mohammed plant(Mutasim 3 at 1987)

History:

This plant was installed for the production of precursors for sarin and tabun. Some information were given to Pilot Plant company to help them in designing this plant, which consisted of 4M3 production capacity (two separate reactors) having the same services, cooling, heating, compressed air and vacuum each reactor provided with distillation column, heat exchanger and receiving vessels.

Equipment:

Reactors	2	GL	2 m3 with stirrer of hastalloy designed for mixing solid and liquid reactants
Reactors *	3	G.L	2.5 m3
Distillation column	2	Glass	500 mm diameter, 4 m height, ceramic rushing rings
Top condenser **	3	Glass	25 m2 cooling area
Storage tank for st. materials	3	PVDF	6 m3 capacity
Storage tanks product	2	PVDF	2 m3 capacity
Storage tank caustic	1	CS	45 m3 capacity
Storage tank	1	G.L	6 m3
Storage tank	3	G.L	4 m3
Vessel	4	G.L	800 L
Scrabber	1	CS Coated with rubber	2 m3 storage tank with column 500 mm diameter 4.5 m height rubber coated, p.p. rushing rings, 25 m2 graphite heat exchanger
Receiving vessel	4	Glass	200L
Heat exchanger	1	H.C	1.5 m2
Heat exchanger	1	G.L	12 m2
Solid feeding unit	1		With crushing screw type provided with compressors

Services:

Chiller	2	Carrier	120 ton, air cooled outlet temp 12 C inlet 7 C ethyleneglycol
Heater	1		500 KW thermal oil with 5m2 heat exchanger

Compressor	3	Screw	50 m ³ /hr with dryer type
Vacuum pump	4	SiHi	25 m ³ /hr 50 m bar

Civil works:

Beneficiary : Research Center 922/SEPP

Designer : Heberger/Civilian

Ludwig Hammer/ Mechanical, electrical
and air conditioning

Execution Party: Heberger

Starting Time : 1982

Execution Time : 1983

Technological Works:

Beneficiary : SEPP

Designer : Pilot Plant

Executor : Pilot Plant

Starting Time : 1984

Execution Time: 1985

* In 1986 the two glass lined reactors (2m³) were damaged and replaced by two 2,5 m³ glass lined reactors, and the third was used as a buffer.

** Replacement of one top condenser instead of damaged one.

Materials produced:

1. D4 : 3rd quarter of 1985 till 3rd quarter of 1986.
2. MPC : during the second half of 1987 till 2nd half of 1988 when the production stopped. In 1990 some batches of MPC were produced. The equipments of the plant were dismantled to be used in Al-Tahadi project.
3. Tabun : In 1986 attempts to produce tabun were carried out.

Site name : Malik plant (Bin Hayan II at 1987)

History:

This plant was designed as a multipurpose plant. The site was modified to produce precursors for sarin and tabun. Some information were given to Pilot Plant company to design the plant. The plant containing two reactors (production capacity of 3.2 M³) containing two distillation columnswproduction utilities such as cooling, heating, comp. air and vacuum.

Equipment:

Reactor	2	G.L.	1.6 m3 with stirrer, variable speed, jacketed
Dist. col.	2	G.L	800 mm diameter, 3 m height ceramic rushing rings
Condenser	2	H.C	Shell & tube, 20 m2 area
Receiving vessel	4	Tefezil	800 L. jacketed
Scrabber		C.S. rubber coated	2 m3 tank C.S. rubber coated, col. 500 mm 4.5 m length, p.p. rushing rings, heat exchanger 25 m2 graphite
Heat exchanger	1	H.C	1.5 m2
Steam ejector	1	Ceramic	Graphite heat exchanger with ejector, with Steam generator
Storage tank	3	PVDF	6 m3
Storage tank	2	G.L	2 m3
Storage tank	2	G.L	4 m3
Storage tank	1	G.L	6 m3
Storage tank	1	G.L	3 m3
Receiving tank	2	PVDF	2 m3 for product
Storage tank	1	C.S.	45 m3/NaOH storage to be used for scrubber

Services:

Chiller	2	Carrier	120 ton, air cooled
Sub cool.	1	Carrier	50 ton
Heater	1	GEKA	500 KW, thermal oil
Heat exchanger	2	C.S	5m2
Compressor	3	Screw	50 m3/hr with air dryer type silica jel.
Vac. Pump	4	SiHi	Watering 25 m3
Steam jet Vac. System	1		50 mbar, 50 m3 / hr

Civil Works:

Beneficiary : SEPP

Designer : Heberger

Executing Party: Heberger, Laudwig Hammer sub contractor for mechanical and electrical work

Starting Date : 1982

Execution Time : 1983

Technological Works:

Beneficiary : SEPP

Designer : Pilot Plant

Executing Party: Pilot Plant

Starting Date : 1984

Execution Date : 1985

Additions & modifications:

Some modifications and additions were carried out on this site for the production of tabun and the following items were added :

1. Centrifuge (st.st.) 1000L capacity.
2. Reboiler shell & tube (st. st.), 25 M2 area.
3. Reactor, glass lined, 2.5 M3 to be used as a buffer for the filter.
4. A chlorine gas cylinder was modified as autoclave to be used for production of cholin (outdoor).

Materials produced :

1. DMMP : 2nd half of 1987, first half of 1988.
2. MPC : 1986 + 1st half of 1987.
3. Tabun : end of 1986, beginning of 1987.
4. Cholin : end of 1987 till beginning of 1989.
5. MPS : distillation of MPS at the end of 1987 and beginning of 1988.
6. Vx : concentration of Vx at the beginning of 1988.
7. Vx : An attempt to produce Vx (at March 1988).

Site name : Dhiaa Plant (Bin Hayan 3 at 1987)

History:

The idea to install Dhiaa plant was to increase the production capacity of sarin and its precursors. A Training course was carried out by three German engineers from Pilot Plant company to help in the designing work in 1985. Many problems appeared during the designing work, the problems arose since the company was not informed about the exact nature of the production. After that the German engineers left the site and the Iraqi staff, chose the suitable equipments. Many problems appeared in the plant, later the plant was modified to produce Vx and its precursors, which also proved unsuitable. Later the site was modified to produce pesticides.

Equipment:

Reactor	2	GL	2.5 m3 with stirrer jacketed
Reactor	2	GL	1.6 m3 with stirrer jacketed
Reactor *	1	C.S.	1 m3 with stirrer jacketed
			Teflon coated
Distillation col.	4	GL	2 (400 mm x 4 m) 1 (350 mm x 4 m) 1 (350 mm x 5 m)
Top condenser	4	H.C.	20 m2 area
Heat exchanger (reboiler)	2	H.C.	25 m2 area
Storage Tank (Final product)	3	G.L.	1.4 m3, jacketed
Storage tank (final product)	1	G.L.	4 m3, jacketed
Storage tank (Intermediate)	3	PVDF	2 m3
Separation tank	1	G.L.	4m3 jacketed
Separation vessel	1	Glass	100 L.
Receiving vessel	3	G.L.	800 L. jacketed
Receiving vessel	1	G.L.	500 L.
Scrubber	1	P.P.	2 m3 storage tank (PP), col. 500 mm diameter 3.5 m height, tolerate, (PP) heat exchanger 10 m2 area
Scrubber	1	G.L.	2 m3 tank, 7 m col. height, tolerate heat exchanger graphite 25 m2
Scrubber	2	st.st	3 m3, 500 mm diameter (st. st) col. 4 m height, ceramic ring, heat exchanger/2 graphite type 10 m2 cooling area.
Heat exchanger	2	H.C	2 m2
Storage tank St. materials	2	C.S.	5 m3
Storage tank	1	C.S.	5 m3 (Haller coated)
Feeding tank	1	PVDF,	6 m3 cilocote
Feeding tank	1	S.S.	2 m3, stirrer
Storage tank	1	G.L	3 m3
Storage tank for NaOH	2	C.S	45 m3

Services:

Chiller	4	Carrier	140 ton water cooler system
Chiller	2	Carrier	140 ton sub-cooler system
Heating unit	1	700 KW	Thermal oil system
Heating unit	2	750kgm/hr	Steam generator
Compressor	2	Sollar	50 m3/hr with silica gel dryer

Vac. Unit	2	Ceramic	40 m3/hr for each to 50 m bar/water ring
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Civil Works:

Beneficiary - SEPP

Designer - Heberger - Civilian works
Laudwig Hammer (Mechanical, Electrical,
air-conditioning works)

Execution Party - Heberger
Laudwig Hammer

Starting Date - 1983

Execution Date - 1984

Technological Works :

Design - SEPP staff + Karl Kolb staff

Execution - SEPP staff

Starting Date - 1985

Execution date - 1988

* Not used and dismantled and returned to the stores before the production of Vx in 1988.

Materials produced:

1. MPS : Three batches in 1988.
2. Vx : Three batches in 1988 and two batches in 1990.
3. Stam : 1989, 1990
4. Dalapon: 1990.

Additions and modifications:

St. st. spray dryer 0.5 m3 capacity was added for the production of Dalapon in 1990.

Site name : Ahmed/1 plant (Al Mutasim II at 1987)

History:

After the success of research on the synthesis of precursors of sarin and tabun, there was necessity to install a plant for the production of these precursors. Some information were given to Pilot Plant company to execute a multipurpose plant with two reactors of capacity 1 m3 with utilities such as heating, cooling, distillation column and top condenser.

Equipment:

Reactor	2	H.C	1 m3, heating jacketed, cooling coil, stirrer
Dist. col.	2	H.C	350 mm, 3.5 m, ceramic R.R.
Cond.	2	H.C.	7,5 m2, shell & tube
Heat exchanger	2	H.C.	2.5 m2, shell & tube, to vapor capturing
Heat exchanger	2	H.C	20 m2, shell & tube
Heat exchanger	1	H.C	1.5 m2, shell & tube
Receiving storage tank	4	H.C.	400 L.
Separation tank	2	H.C.	100 L.
Scrubber	2	St.St.	Scrubbing of gases yield from reaction, 2 storage tanks, col. s.s. 200 mm s.s. 2 m2
Storage tank starting materials	2	PVDF vertical	2 m3
Storage tank for product	2	PVDF horizontal	2 m3
Storage tank	4	PVDF Horizontal	6 m3, storage of starting materials
Storage tank	1	H.C.	6 M3
Storage tank (cooled)	2	PVDF	2 m3, for product storage, provided with cooling candles 5 m2
Filter	2	Centrifuge	250 L for product filter 900 rpm, cloth filter of Teflon
Screw conveyor	1	S.S. reactor	2.5 ton/hr to convey the st. materials to the

Services:

Chiller	1	Sabru	220 ton, water cooled.
Chiller	1	Sabru	60 ton, water cooled (sub cooling)
Heater	1	GEKA	750 KW, thermal oil 300 C heat exchanger 5 m2
Vac.	4	SiHi/ W.R	25 m3/hr-50 m bar
Compressor	3	Screw type	50 m3/hr air dryersilica
Burner	1	Air gas burner	Control room, blowers 50 000 m3 hr- ducts rubber coated 1400 mm

Civil Works:

Beneficiary : A-Hassan Bin AL-Haitham

Designer : Abdul-Wahab Al-Miami

Execution Party: 1/57

Execution Date : 1983

Starting Date : 1975

Technological Works:

Beneficiary : SEPP

Designer : Pilot Plant

Execution Party : Pilot Plant

Date of Execution: 1983

Additions & Modifications:

1. One of the reactors was damaged and replaced by another 1.6 M3 glass lined reactor.
2. The gas washing unit was replaced by new Cilcote (poly propylene) unit because of the storage tank and column corrosion of the old unit.

Materials produced:

1. MPF : end of 1984 and 1985.
2. MPC : end of 1985, 1986.
3. MPF ; 1986.

Site name: AHMED-2 plant (Al - Mutasim II at 1987)

History:

A twin of Ahmed /1.

Equipments:

Reactor	2	H.C	1m3, jacketed, heated by thermal oil, cooled by coil, provided with variable speed stirrer
Dist. col.	2	H.C	350 mm x 3.5 m, with ceramic rri
Top condenser	2	H.C	shell & tube 7.5m2
Heat exchanger	2	H.C	shell & tube, 2.5m2, for vapor capturing
Storage tank	4	H.C	400 L, for product
Storage tank	2	H.C	100 L, for volatile vapors
Scrubber	2	st. st.	2 m3 storage tank st.st, column 200 mmx1.5m, heat exchanger 2.5.m2
Storage tank	2	PVDF	2 m3, for starting materials- vertical

Storage tank	2	PVDF	2 m3 for product Horizontal
Storage tank	1	H.C	6 m3 for starting materials
Storage tank	2	PVDF	2 m3, cooled, for product
Filter	2	centrifuge	250 L, 900 rpm, variable speed, cloth filter Teflon
Storage tank	4	PVDF	6 m3 for starting materials

Services:

Chiller	1	Sabru	220 ton, water cooled
Chiller	1	Sabru	60 ton, water cooled, sub cool
Heater	1	GEKA	750 Kw, thermal oil, heat exchanger 5M2, 300 C
Vac. pump	4	SIHI	water ring, 50 mbar,
Compressor	3	screw type	With Ahmed/1
Burner	1		with Ahmed/1

Civil works:

Beneficiary : Al-Hassan Ibn Al-Haitham Establishment

Designer : Abdul Wahab Al-Niami office

Execution party: 1/75

Execution date : Mid of 1983

Starting date : 1975

Technological Works:

Beneficiary : SEPP

Designer : Pilot plant

Execution date : 1984

Additions & Modifications:

The change of the top condenser.

Materials produced:

1. MPF : 1985, first quarter of 1987, 1987, 1988.
2. Sarin : 2nd half of 1986.

Site name : AHMED - 3 plant

History:

This site consists of two units, which were installed by the Iraqi technical cadre for the production of MPC, later on it was used for the distillation of PCl_3 and production of DMPH.

Equipments:

Reactor	2	G.L	2.5 m3, variable speed stirrer, Jacketed
Dist.col.	2	G.L	800 mm X 3m, pall rings
Condenser	2	H.C	20 m2 shell & tube
Receiving vess.	4	G.L	1.4 m3, jacketed
scrubber	1	P.P	2 m3 storage tank, column 500 mmx3.5m, (PP) rashing rings
Storage tank	1	G.L	6 m3

Services:

Chiller	2	carrier	120 ton, air cooled
Heater	1	GEKA	with Ahmed/1
Vacuum pumps	2	ceramic	6M3/hr. 50 mbar.vac.
Compressor	1	Screw sollar	with air dryer (silica jel) type

Civil work:

Beneficiary : SEPP

Designer : SEPP-staff

Execution party: SEPP- staff

Execution date : 1987

Technological works:

Designer : SEPP

Execution party: SEPP-staff

Starting date : 1987

Execution date : 1988

Materials produced :

1. MPC : 1st quarter of 1988.
2. Distillation of PC13 at 1988, 1989, 1991
3. Deptrix : 1990

Site name: ALCOHOL DISTILLATION UNIT

History:

A package unit for distillation of alcohol was installed by GIG to obtain absolute alcohol.

Equipments:

Dist. column	4	st. st.	200 mm x 5m
Heating vessel	4	st. st.	60 L, 30 Kw
Pumps	2	PVC	dosing
Vessels	2	glass	100 L
Vessels	2	glass	60 L
Heat exchanger	2	st. st.	double pipe
cooling unit	1	carrier	5 ton
compressor	1		

Civil works:

Design : SEPP

Execution : SEPP

Technological works

Design : GIG

Execution : GIG

Site name: A+B plant

History:

A contract between SEPP and WET company to obtain the know-how and the technology for production of PCl_3 and $POCl_3$ was signed. SEPP started with the technological and construction works in 1987 and completed the plant in 1988. No commissioning took place, due to the some missing parts in the imported equipment.

Equipments:

Reactor	2	Nikel	5 m3 for $POCl_3$, PCL_3
Dist. col.	1	Nikel	1m x 3m
Heat exchanger	1	Nikel	20 m2
Scrubber	1	P.P	2 x 20 m3 storage tank, 1.5 m x 3m dist. column
Melter	1	st.st.	10 m3 storage tank, for phosphorus
Storage tank	2	c.st.	30 m3 & 20M3 for phosphorus
Heat exchanger	2	c.st.	heating & cooling the unit
Storage tank	1	G.L	20 m3 for $POCl_3$ storage
Storage tank	1	c.st.	90 m3 for $POCl_3$
Pumps	5	c.st.	feeding pumps

Services:

Cooling	1	Chiller	water cool
Heating	1	Boiler	thermal oil
compressed air	1	compressor	
Oxygen production unit	1		

Civil works:

Beneficiary : SEPP

Designer : WET

Execution party: SEPP

Execution date : Dec. 1988

Starting date : Sep. 1987

Technological works:

Beneficiary : SEPP

Design & supply: WET

Execution party: SEPP

Starting date : Sep. 1987

Execution date : Oct. 1988

Site name : TMP plant

History:

In 1987 a contract between KIM -KHALEEG and SEPP was signed to buy the (know how), civil and technological works to install this plant at Falluja\2. The civil works were started at the end of 1987, but the technological works were not executed completely because of the start of the war.

Designed production capacity: 1000 ton\year

Equipments:

Reactor	1	st.st.	1 m3, Jacketed, provided with stirrer
Heat exchanger	1	st.st.	10 m2, spiral
Decanter	1	st.st.	2 m3. for separation of aqueous from organic layer
Dist. col.	1	st.st.	350 mm x 5m
Dist. col.	1	st.st.	500 mm x 6m
storage tank	2	c. st.	32 m3, 45 m3 for starting materials, ammonia and ethanol
Heat exchanger	2	st.st.	10 m2

top condenser	2	st.st.	5 m2
Pumps	4	st.st.	Feeding

Services:

cooling unit	1	carrier	20 ton
comp. air unit	1	Sultzer	
Nitrogen gas unit	1		
Heating unit	1		thermal oil

Civil works:

Beneficiary : SEPP

Designer : KIM-KHALEEG

Execution party: SEPP-staff

Execution date : 1989

Starting date : 1988

Technological works:

Beneficiary : SEPP

Designer : KIM-AL-KHALEEG

Execution party: SEPP staff

starting date : 1989

execution date : Not executed

Site Name: PYROPHOSPHATE

History:

This plant was installed to produce pyrophosphate from DMPH, using the available equipments in the establishment.

Equipments:

Reactor	1	st.st.	1 m3, jacketed
Top cond.	1	st.st.	5 m2 area

Services:

Heating unit	1	thermal oil	30 kw
cooling unit	1	air cooled	70 kw

Civil works:

Designer : SEPP

Execution party : SEPP

Technological works:

Designer : SEPP - staff 1989

Execution party : SEPP - staff 1989

Site name : AL-TAHADI - plant

History:

After the success achieved in the production of DMPH at Ahmed 3 for the production of Deptrex (insecticide) The order was to install a plant to be used to produce DMPH in large quantities. This site was executed depending on the equipments from Mohammed plant and some other which are available in the establishment stores. The equipments were installed at the end of 1990 and work ceased when the war broke out.

Equipments:

Reactor	3	G.L.	1.6 m3, jacketed, provided with stirrer.
Dist. col.	2	Glass	350 mm x 3.5 m, ceramic rashing rings (from Mohammed Plant)
Dist. col.	1	G.L.	350 mm x 3.5 m barrel saddle .
Top cond.	3	H.C.	20 m2, shell & tube
Receiving vessel	2	Glass	200 L. capacity (from Mohammed plant).
Scrubber	2	C.st. haller coated	tank 2 m3, column 500 mm x 3 ceramic rashing rings
Heat exchanger	2	Graphite	25 m2 (for scrubber)
Receiving vessel	4	G.L.	800 L, for distilled products jacketed
Heat exchanger	1	H.C.	20 m2
Storage tank	1	G.L.	10 m3

Services:

Chiller	1	Carrier	140 ton, water cooled
Heating unit	1	Geka	175 K.W., thermal oil, 300c
Vacuum	2	H.C. Sultzer	With storage tank 100 L. capacity H.C., 250 m3/h 10 - 15 mbar
Compressed air unit	2	Screw type	25 m3 with silica gel

Civil works:

Beneficiary : SEPP
Designer : SEPP staff
Execution party :
Execution Date : Not executed

Site name : DMPH plant

History:

This plant was installed in Ahmed 3 to produce DMPH.

Equipments:

Reactor	2	G.L.	1600 L. provided with stirrer 125 rpm, jacketed (one of them from Ahmed/1)
Dist. col.	2	H.C.	350 mm x 3.5 m, ceramic rashing rings (from Ahmed/1)
Heat exchanger	1	H.C.	7.5 m ² (from Ahmed/1)
Vessel	1	Glass	100 L. capacity
Top condenser	1	H.C.	20 m ² (from Ahmed/1)
Receiving vessel	1	H.C.	400 L. (from Ahmed/1)
Receiving vessel	1	G.L.	1.4 m ³
Storage tank	1	G.L.	4 m ³ - horizontal
Storage tank	1	G.L.	4 m ³ - vertical
Storage tank	1	G.L.	6 m ³ (for PC13) from Ahmed \3
Storage tank	1	C.St.	5 m ³ (for ethanol) Haller coated
Storage tank	1	G.L.	10 m ³
Heat exchanger	1	H.C.	25 m ²
Scrubber	1	C.St.	Haller coated, 2 m ³ storage tank, column 500 mm x 3.5 m tolerate, 25 m ² graphite heat exchanger

Services:

Cooling : Collaborated with Ahmed/3
Heating : Collaborated with Ahmed/3
Compressed air : Collaborated with Ahmed/3

Vacuum 3 Sultzer 250 m³/hr, 15 mbar

Civil Works:

Beneficiary : SEPP
Designer : SEPP staff

Execution Party: SEPP staff
Execution Date : 1988
Technological Works:

Beneficiary : SEPP
Design : SEPP
Execution Party : SEPP

Execution Date : 1988

Site name : Dichloro Benzene

History:

After the end of the war at 1988, SEPP started to produce industrial civil products. For this reason this plant was designed to produce 1,2 or 1,4 dichloro benzene which are used to produce stam and the other uses in general. This plant was not completed because of the failure to produce the crystalizer.

Equipments:

Reactor	1	G.L.	4 m3, jacketed, provided with stirrer
Dist. col.	1	G.L.	500 mm x 3.5 m, barrel Saddle
Top condenser	1	H.C.	20 m2, shell & tube
Storage tank	1	G.L.	2 m3, jacketed for starting materials

Services:

Cooling	
Heating	Collaborated with Ahmed/3 and
Compressed air	DMPH site

Civil Works:

Beneficiary : SEPP staff
Designer : SEPP staff
Execution Party : SEPP staff

Starting Date : 1988
Execution Date : 1988

Technological Works:

Designer : SEPP

Execution Party : SEPP

Starting Date : 1988

Execution Date : Work stopped in 1989 because the crystallizer did not arrive at the site

Produced Materials: No produced materials took place

Site name: Heberger - 4 (Inhalation chamber)

History:

Inhalation chamber with 3M3 capacity was installed by Pilot Plant Company at H4 in 1985.

Equipments:

Chamber	1	3 m3
Compressor	1	
Dosing pump	1	
Sampling unit	1	
Inhalation rooms	3	0.5 m3 capacity
control unit	1	
Injector	3	100 ml.

Services;

Chiller, Moving carriage, blowers (3)

item	plant	plan name		Chem. Prod.	Time Frame	usual code color / name	building No	
		b. 1987	a. 1987				UNSC.	Iraq
1.	Heberger (1)	H1	Mutasim (1)	D4 DMMP MPC NP-cat.	983-985 985-987 985-987 985-987	---/ D4,Dx ---/ DMMP,DMP ---/ MPC ---/ NP		
2.	Heberger (2)	H2	Mutasim (1)	D4 DMMP MPC NP-cat. Dist.of sarin	983-985 985-987 985-987 985-987 1986 one attempt	---/ D4, Dx ---/ DMMP,DMP ---/ MPC ---/ NP Black / GB		
3.	Heberger (3)	H3	Mutasim (1)	DMMP NP-cat. MPF sarin cyclo-sarin GB / GF mix. PSA DFP	985-987 987-988 987-988 1990 987-988 990-991 1988 1988 1985	---/ DMMP,DMP ---/ NP ---/ DF, MPF Black / GB green / GF ---/ GB, GF ---/ PSA ---/ DFP		
4.	Thionyl Chloride	----	Al Mamun	SOCI2 MPC MPF PYRO	988-989	---/ SOCI2 ---/ MPC ---/ MPF, DF ---/ PYRO		
5.	P7	P7	Mutasim (4)	Sarin Tabun	984-985 986-988 990-991 984-986	Black / GB Red / GF		
6.	P8	P8	Bin Hayan- 1	Mustard Vx-agent	983-988 1990 1987	yellow /MG, H Blue / Vx		
7.	Mohamad	Mohamad	Mutasim (3)	D4 MPC Tabun	985-986 987-988 1990 1986	---/ D4, Dx ---/ MPC Red / GF		
8.	Malik	Malik	Bin Hayan- 2	DMMP MPC tabun Choline MPS (dist.) Vx (conc.) Vx (prod.)	987-988 1988 1986 987-989 1987 1988 1988	---/ DMMP,DMP ---/ MPC Red / GF --- / Choline --- / MPS Blue / Vx Blue / Vx		
9.	Dhiaa	Dhiaa	Bin Hayan- 3	MPS (dist.) Vx Stam Dalapon	988,990 988,990 989-990 1990	---/ MPS Blue / Vx --- / Stam --- / Dalapon		

10.	Ahmed- 1	Ahmed- 1	Mutasim (2)	MPF MPC	984-986 985-986	---/ MPF, DF ---/ MPC		
11.	Ahmed- 2	Ahmed- 2	Mutasim (2)	MPF Sarin	985-988 1986	---/ MP, DF Black/ GB		
12.	Ahmed- 3	-----	Ahmed- 3	MPC PCI3 (dist.)	1988 988-989 1991	---/ MPC ---/ PCI3		
13.	Cs prod. unit	Cs- unit	Bin Hayan- 4	Cs	983-988	White / Cs		

CHAPTER - VI -

Production of Chemical Warfare Agents

6.1 Mustard:

Mustard was produced by two methods:

Method (A) : Reaction of TDG with thionyl chloride

Thionyl chloride was added to TDG in flow rate that the temp. didn't exceed (60C), Reflux for (2hrs) at (70C) to complete the reaction and get the product.

Method (B): Reaction of TDG with PCl_3

TDG was fed to the reactor and cooled to (15-20C) the PCl_3 was added in flow rate that the temp didn't exceed 60C, reflux for (1hr) then the mixture pumped to a tank where water was added in order to separate the acid from mustard.

6.1.1 Production at Al-Rashad site

6.1.1.1 In the 2nd half of (1981) Mustard was produced at Al-Rashad by using four rotary evaporator reactor (50 L capacity, practically 30 L) the production rate about (50-60 Kg/day, only two reactors used for each batch). The total quantity produced (10 ton).

6.1.1.2 In (1982) a Stainless steel reactor (100L capacity, production rate 80 Kg / day) and a porcelain lined reactor (500 L, 300 Kg /day) installed at Al-Rashad in addition to the four rotary evaporator reactors to produce mustard. The production capacity at that time about 430 Kg/day and the total quantity produced about (75 ton).

6.1.1.3 The produced mustard pumped to carbon steel barrels of (200 L) capacity then the barrels stored at Al- Ikhader.

6.1.2 Production of mustard at MSE site.

6.1.2.1 In the 2nd half of (1983) mustard was produced at P8 production plant (Bin - Hayan/ 1 later) by using two porcelain lined reactors of (1000 L) capacity, 750 Kg/batch (for-each reactor) at the same time the production of Mustard continued at Al-Rashed site by using the porcelain lined reactor only, because of the damage caused by corrosion of stainless steel reactor and the metal parts of the rotary evaporator reactors.

The total quantity produced about 150 ton.

6.1.2.2 In (1984) the production of mustard was continued at

P8 -production plant (1.5 ton/day) then stopped in the 3rd quarter when two glass lined reactors (2.5 M3 capacity) installed at the site to raise the production capacity to 4 ton / day. The production by using the new reactors started at December. The total quantity produced about (240 ton).

6.1.2.3 In (1985) the production continued at P8 (4 ton/day) until the 3rd quarter when the site was shutdown for two month, then the production started at the end of the year by using one reactor only. The total quantity produced about (350 ton).

6.1.2.4 In (1986) only one reactor was used in P8 production site during the first quarter, then the site was shutdown due to shortage in thionyl chloride. The total quantity produced (350 ton).

6.1.2.5 In (1987) mustard was produced by method B (TDG + PCL3) at P8 production plant (4 ton/day). During the 4th quarter two more glass lined reactors (2.5 m3) were added to the plant and the production capacity increased to (8 ton/day). The total quantity produced about (899 ton).

6.1.2.6 In (1988) the production continued during the first half of the year by using two of the above (1.3.5) reactors (4 ton/day) and the site was shutdown. The total quantity produced (494 ton).

6.1.2.7 In the end of (1990) mustard was produced at P8 - plant (8 ton/day). The total quantity produced about (280 ton)

6.1.2.8 The produced mustard pumped to a chlorine gas cylinder (about 800 Kg) after changing of its valves, then the cylinders stored at bunkers. In (1988) two storage tanks (carbon steel, capacity of 45 M3) installed at P8 site to store Mustard instead of cylinders.

6.1.3 The production process of Mustard was affected by:

- The availability of starting materials.
- The damage of equipment caused by corrosion need a long time to be replaced (e.g reactors, pipes, pumps ... etc.). Since there is no standby equipment on site.
- Polymerization , burning (production by method B) of the product during production or storage.
- Pollution and decontamination.

6.2 Tabun:

6.2.1 Production of D4

6.2.1.1 In (1982) D4 was produced at Al-Rashed by using (Buchi - 50 L) from the reaction of dimethylamine hydrochloride (DMA-Hcl) with excess POCl₃ by heating the mixture then the excess pocl₃ distilled at normal pressure and D4 distilled under vacuum.

6.2.1.2 In the 2nd half of (1982) D4 produced at Al-Rashed by 4(Buchi-50 L , production capacity 20 Kg/day). The total quantity produced about 7 ton.

6.2.1.3 In the 2nd half of (1983) D4 produced in H1 -pilot plant at MSE site using two glass reactor of 100 L capacity (production capacity 80 Kg/day). The total quantity produced about 10 ton.

6.2.1.4 In (1984) production of D4 continued at H1 & H2 -pilot plant (Al-Muatasim 1 later), the two glass reactor at H1 plant of 100 L capacity replaced by new two glass reactors of (200 L capacity) the production capacity increased to 240 Kg/day and the total quantity produced about (50 ton).

6.2.1.5 In (1985) a Hastalloy-C reactor (400 L capacity) installed in place of one of two glass reactor (200 L) at H1-plant, production of D4 started in the 2nd quarter with production capacity of 150 Kg/day. in 3rd quarter D4 produced in Mohammed plant (two glass lined reactor 2M3, production capacity 1,5 ton /day) the total production capacity of D4 at that time about 1650 Kg/day. The total quantity produced about 150 ton.

6.2.1.6 In (1986), D4 produced in MOHAMMED plant only (AL_MUATASAM 3 later) until the 3rd. quarter when the production of D4 stopped. The total quantity produced about (180 ton).

6.2.1.7 The produced D4 pumped to P.E barrels (200 L capacity).

6.2.2 Production of TABUN

6.2.2.1 In (1982) Tabun was produced in a lab. scale at ALRASHAD, by cooling the mixture of Sodium cyanide, alcohol and chlorobenzene as a solvent to about 0°C, then D4 added in a constant flow rate. Then the product as slurry (Tabun + Salt) which separated among time to get Tabun by decantation.

6.2.2.2 In (1984) Tabun was produced by using sixteen (16) glass reactors (Buchi-50 L, production capacity 20L) installed at the R&D labs. with production capacity of 320 L/day. During the 1st. half then the production of Tabun transfer-red to P7-plant in production capacity of 1 ton /day (the production at P7 continued for one month only). The total quantity produced about (60 ton).

6.2.2.3 The produced Tabun pumped as a slurry to a barrel of (200 L capacity) which separated during time.

6.2.2.4 In 2nd. quarter of (1985) production of Tabun started at P7 (production capacity / 1 ton /day) then the production stopped at the plant because the damaged in stirrer of the reactor which was replaced and production started again. The total quantity produced about (70 ton).

6.2.2.5 In (1986) production of Tabun continued at P7 plant (some attempts to produce tabun had been carried out at Mohammed and Malik plant but these attempts were not succeeded) by using a centrifuge which had been installed at P7 site to filtrate the slurry, the process accompanied by many technical problems the centrifuge basket filled with salt and water used to wash it, the traces of water remaining in the centrifuge, hydrolized Tabun. Due to those problems the production of Tabun was stopped during the second half. The total quantity produced about (80 ton).

6.3 SARIN

6.3.1 Production of sarin precursor

6.3.1.1 Dimethyl methyl phosphonate (DMMP)

6.3.1.1.1 In (1984) DMMP was produced by using two glass reactors (Buchi 50 L capacity , practically 30 L) from the thermal treatment of (Trimethyl phosphate) TMP in presence of methyl Iodide & KI. The production capacity about (60L), the production transferred to H1 - pilot plant (Al- Muatasim 1 later) using a HC - reactor (400 L capacity, production capacity 350 L / day) quantity produced about (15 ton).

6.3.1.1.2 In (1985) the production was continued at H1 - pilot plant (production capacity of 350 L/day). The total quantity produced about (60 ton).

6.3.1.1.3 In (1986) a glass reactor of 500 L capacity installed at H3 -pilot plant in addition to the production capacity at H2- the production capacity raised to 750 L/day (850 Kg/day) and the total quantity produced about (250 ton).

6.3.1.1.4 In the second half of (1987) DMMP was produced in Malik plant (Bin Hayan 2 later) by using two glass lined reactors(1.6 M3, production capacity 1.5 ton) production capacity 6 ton/day (two batches) in addition to the production at H3 at the first half. The total quantity produced about (586 ton).

6.3.1.1.5 In the first half of (1988) the production continued at Malik plant at the same production capacity (6 ton/day) and the total quantity produced about (114 ton). Then the production of DMMP stopped.

6.3.1.1.6 The produced DMMP pumped to TMP empty barrels 200 L capacity and stored at bunkers.

6.3.1.1.7 The production of DMMP was affected by the purity of TMP. Some times TMP distilled in order to be used in production.

6.3.1.2 Production of MPC (Methyl phosphonyl chloride).

6.3.1.2.1 In (1984) the production of MPC started up by using four glass reactors (Buchi, 50 L, practically 30 L) from the reaction of DMMP with excess thionyl chloride in the presence of pyridine as catalyst. Heated to 60C and DMMP added in a constant a flow rate, after the end of the addition the mixture refluxed for (2) hrs, then the excess of thionyl chloride distilled at normal pressure, and MPC distilled under vacuum. The production capacity about 112 Kg/day. The total quantity produced 25 ton.

6.3.1.2.2 In the 1st half of (1985) MPC was produced at H2, (Al-Muatasim 1 later) with production capacity of 200 Kg/day. then MPC production transferred to Ahmed plant (AL Muatasim / 2 later) by using a Hastalloy - C reactor (1 M3 capacity, production capacity 300 Kg/day). The total quantity produced about (60 ton).

6.3.1.2.3 In (1986) MPC produced at Ahmed plant (Al-muatasim 2 later) by using one glass lined reactor (1.6 M3 capacity, production capacity of 500 Kg/day) in addition to the production of MPC at H1 - plant using the glass reactor only (200 L, 130 Kg/day). The total quantity produced about (90 ton) .

6.3.1.2.4 In the first half of (1987) MPC production continued at H1 and Ahmed plants of the same production capacity . In 2nd half of the year the production of MPC transferred to Mohammed site (Al-Muatasim 3 later) by using two glass lined reactors (2,5 m3 capacity, production capacity of 2 ton/day. The total quantity produced about (229 ton).

6.3.1.2.5 In (1988) the production of MPC continued at Mohammed and Malik plant until the 2nd half of the year. The total quantity produced about (285 ton).

6.3.1.2.6 In (1990) the production of MPC was resumed at Mohammed and Ahmed 3 plant, the total quantity produced (75 ton). Another quantity of about (19) ton of MPC was produced from pyrophosphate.

6.3.1.2.7 The produced MPC pumped to the thionyl chloride empty barrels (200 L capacity) and stored at bunkers. The MPC production stopped in 1990.

6.3.1.3 Production of MPF (methy phosphonyl fluoride).

6.3.1.3.1 MPF was produced by two methods (method A). Fluorination of MPC by NaF and chlorobenzene as a solvent (method B). Fluorination of MPC by HF gas.

6.3.1.3.2 In the end of (1984) MPF produced by (method A) at Ahmed plant (Al-Muatasim 2 later) During the commissioning of the plant, with many technical problems concerning the feeding NaF to the reactor or to get rid of salt. After the distillation of MPF. A few batches produced by this method, and the production continued in the plant by using one reactor (HC-1M3, production capacity 300 Kg/day) by method B. The total quantity produced (10 ton).

6.3.1.3.3 In (1985) the production continued in Ahmed plant (Al-Muatasim 2 later). The total quantity produced about 30 ton.

6.3.1.3.4 In the 1st quarter of (1986) the production of MPF started by using two HC - reactor (production capacity 600 Kg/day). The total quantity produced about (34 ton).

6.3.1.3.5 In the 2nd half of (1987) a monel reactor (1.4 M3, production capacity 400-500 Kg/day) in H3- pilot plant in addition to the production at Ahmed plant. The total quantity produced about (127 ton).

6.3.1.3.6 In the 1st half of (1988) the production continued and the total quantity produced (229 ton) then the plant shutdown and the production of MPF stopped.

6.3.1.3.7 In (1990) MPF produced at Ahmed and H3 plant. The total quantity produced about (100 ton).

6.3.1.3.8 The produced MPF pumped to a P.E lined barrels (200 L , capacity) and stored in Ahmed site in order to be send to P7 site.

6.3.1.4 Production of Sarin

6.3.1.4.1 In (1984) Sarin was produced by a glass reactor

(Buchi , 50 L capacity) by mixing of MPC with MPF (1=1 mole) in dichloromethane as solvent with stirring, isopropyl alcohol added to the mixture in flow rate that the temp. didn't exceed (40°C). at the end of addition of alcohol, the Hcl gas removed by bubbling with dry air to get the product (Sarin).

6.3.1.4.2 In December (1984) the production of Sarin was started at P7 (Al-Muatasim 4 later) by using glass lined reactor (2.5 M3 , production capacity of 500-600 Kg/batch) the process take along time about (48- 60 hr) to get rid of Hcl by bubbling. The product (Sarin) pumped to P.E lined barrels (200 L). The total quantity produced about 5 ton.

6.3.1.4.3 In (1985) the production continued at P7 Plant until the end of 2nd quarter when the production stopped (the plant used to produce tabun). The total quantity produced about (30 ton). The product pumped to chlorine gas cylinders because the shortage in P.E lined barrels and stored at bunkers, during storage the cylinders filled with sarin corroded, then Sarin filled in Aluminum containers (2 M3 designed for rocket fuel).

6.3.1.4.4 In the 2nd half of (1986) production of Sarin started at P7 plant with the same production capacity (500-600 Kg/batch). The total quantity produced about (40 ton).

6.3.1.4.5 In (1987) the glass line of the reactor damaged , a new reactor (Tefezeel lined 3 M3) installed at the plant and the production of Sarin started at the 2nd half with production capacity of (2 ton / batch). The total quantity produced about (209 ton).

6.3.1.4.6 In (1988) the production process changed by adding I.P alcohol to MPF only, without bubbling in P7 and H3 plant , the production capacity by this process about (6 ton/day , 3 batches) the total quantity produced about 430 ton also cyclohexanol was used to produced (cyclic Sarin) the total quantity produced of cyclic sarin about (394 ton).

Thereafter the production of Sarin was stopped until 1990.

6.3.1.4.7 In the second half (1990) Sarin produced in H3 pilot plant -(Al-Muatasim 1) using monel reactor (1.4 M3, production capacity for (2) batches 1 ton /day) in addition to the production of Sarin at P7 plant. the total quantity produced (117 ton). The production of Sarin stopped in the beginning of (1991).

6.4. VX (CH₃) (OC₂H₅) P(O) (SCH₂ CH₂ N (IP)₂

6.4.1 VX was produced by two processes, process (A):
The reaction of monoester (CH₃) (OC₂H₅) P (S) (Cl) and
choline HOCH₂CH₂ N (C₃H₇)₂

Process (B):

The reaction of methyl phosphonyl sulphide MPS, choline and ethyl alcohol.

6.4.2 Production of VX Precursors:

6.4.2.1 Production of MPS:

6.4.2.1.1 In the end of 1987 MPS was produced at Mohammed plant (1.6 m³, glass lined reactor), from the reaction of MPC and P₂S₅, the first batch was polymerized, due to the improper conditions, a manipulation of production process carried out, two batches of MPS was produced, the crude MPS (from the two batches) was transferred to Malik plant for distillation to obtain MPS of purity (85-90%) the total distilled quantity of MPS about (700 kgm) which was used to produce monoester.

6.4.2.1.2 In the beginning of 1988 the production of MPS continued at the same procedure (production of MPS at Mohammed plant and distillation at Malik plant) the total quantity of MPS produced of purity (85%- 90%) was about (1322) kgm.

6.4.2.1.3 In February and March 1988 MPS was produced and distilled, two fractions were collected 820 kgm of purity > 80% and (1000 kgm) of purity (71-78%). Then the total quantity redistilled to collect (792 kgm) MPS of purity more than 90% and 690 kgm of purity (54-75%).

6.4.2.1.4 In May 1988 three batches of MPS were produced at Dhiaa plant, the crude MPS produced and distilled at the same plant. The total quantity of distilled MPS (of purity 90%) about 2000 kgm.

6.4.2.1.5 During storage MPS purity decreased. Analysis of MPS show that the purity decreased from 92.5% to 76% within twenty three days.

6.4.2.1.6 The produced MPS filled in a barrel (of 200 L. capacity polyethylene coated).

6.4.2.1.7 The yield of MPS about 25% and the stoichiometrical ratio (1 MPC gives 1.1 MPS) practically (3.6 MPC gives 1 MPS).

6.4.2.2 Monoester (CH₃) (OC₂H₅ P (S) (Cl):

In the end of 1987 two attempts to produce monoester were conducted. The first attempt was carried out at Mohammed plant. MPS and Benzene (as solvent) were mixed in the reactor, ethanol was added in a flow rate that the reaction temp. didn't exceed 45°C. When all the quantity of alcohol added, dry air was bubbled to expel HCl formed.

This attempt failed, the product was polymerized due to the elevation of temp.

The second attempt carried out at Malik plant (after the failure of the first attempt in Mohammed plant) by the same procedure.

The quantity of monoester produced about 400 kgm (of purity 50%) after the removal of benzene and this quantity was used to produce VX by process A.

6.4.2.3 Choline HOCH₂CH₂ N (iP)₂

6.4.2.3.1 In the end of 1987 choline was produced from the reaction of diisopropyl amine and ethylene oxide in presence of 10% HCl as catalyst by using a modified chlorine gas cylinder as autoclave (760 L capacity, 42 bar designed pressure) outdoor Malik plant, the diisopropyl amine and HCl were added to the cylinder, ethylene oxide was injected (with 40% excess) to the cylinder, all the valves were closed the mixture was heated to 90°C the pressure raised to 12-14 bar, when the pressure decreased the heating stopped, after cooling two layers were separated (organic and aqueous layer).

The organic layer (choline) was collected, (120) kg. (of purity 90-95%) per batch. The total quantity produced in 1987 about 4400 kg.

6.4.2.3.2 In the first quarter of 1988 choline was produced by the same procedure (with production capacity of 120 kgm) the total quantity produced about 2400 kgm when the production stopped. Production of Choline started again in the fourth quarter of 1988 with production capacity of 360 kgm/day (3 batches daily).

The total quantity produced of choline until the beginning of 1989 about 58100 kgm and the production stopped.

6.4.3 Production of VX (CH₃) (OC₂H₅) P (S) (OCH₂CH₂ N (iP)₂

6.4.3.1 In the end of 1987 and the beginning of 1988 the production of VX was started from the reaction of monoester and choline (process A) at (P8) site (for verification purpose see a letter from MES to MIC in Dec. 1987 asked to postpone an officer who was involved in production process of VX from the promotion test). Choline (300 kgm) and benzene as solvent (200 L) were mixed in a reactor (2.5 m³ capacity). Monoester (350 kgm of purity 50%) was added in a flow rate that the

reaction temperature didn't exceed 40°C, after the addition of monoester the mixture was stirred for 4 hrs to complete the reaction. A sample from the reaction mixture was taken for analysis after hydrolyzed it with sodium carbonate solution showed that the purity of VX about 20%, and after two hours of stirring the analysis of another sample was 18% VX stirring for another 2 hours decreased the purity to 12%. A solution of 20% sodium carbonate was added and the organic layer was separated, about 600 kgm (12% VX) which transferred to Malik plant to remove the solvent under vacuum.

The remaining quantity (400 kgm. of purity 18%) was filled in three BR-500 bombs, to investigate the purity of Vx and the effect of the mixture on the shell within time, after one month the purity of Vx decreased to 1%.

Many technical problems raised during the process such as temp. control, dosing rate and the lack of efficient equipments at production plants. Therefore only one batch was produced by this method.

6.4.3.2 In addition to the technical difficulties accompanied the process of monoester and the decreasing of Vx purity during a short period of time, R&D started a set of experiments from 16 Feb. to 5 March to find another pathway for the production of Vx the reaction of MPS, choline and ethanol, process was suggested from R&D to be used in production of Vx.

6.4.3.3 In March 1988 an attempt to produce a batch of Vx was carried out by process B, at Malik plant (one reactor 1.6 m³ capacity), the mixture of choline (282 kgm purity 94%) and ethanol (86 kgm) was cooled to 5°C, MPS (248 kgm 92%) was added in flow rate that the reaction temp. didn't exceed 45°C (addition time of MPS about 21 hrs), after the addition of MPS the mixture was stirred for two hours for completion of reaction. A solution of 20% sodium carbonate was added to hydrolyze the salt, two layers were separated the organic layer and the aqueous layer (the time of separation about 36 hrs) 350 kgm of Vx of purity 37% was collected and filled in chlorine gas cylinder and stored at the same site. After a short period of time Vx purity was decreased, the chromatogram of GC for the analysis of the samples of Vx showed the formation of a compound (with retention time less than Vx) during the time, after three weeks the purity of Vx decreased to about 3%.

6.4.3.4 Discussions about the results of above attempt to produce Vx suggested that the degradation of Vx within a short time may be due to the long time of process (57 hrs, for addition and separation) depending on the available equipments at Malik plant. A decision was taken to produce Vx at Dhiaa plant and using the reboiler to control the reaction temperature during the addition of MPS.

6.4.3.5 In April 1988, some modifications at Dhiaa plant conducted in order to be suitable for the production of Vx.

6.4.3.6 In May (1988), three attempts to produce Vx at Dhiaa plant by process B. The following table shows the quantities of precursors used and the results of the three attempts:

Attempt No.	Qty of precursors used (kg)	Addition time of MPS (hrs)	Separation time(hrs)	Purity of Vx%	Qty of produced Vx kgm
	Choline MPS EtOH				
1.	581 525 172 (94%) (86%)	3.5	36	23	600
2.	581 525 172 (94%) (90%)	6	24	33	520
3.	581 497 192 (94%) (90%)	15	12	41	550

(See the technical report of Vx in the verification chap. document No.IV.2).

The produced Vx filled in chlorine gas cylinder and the purity of Vx checked, the results are shown in the following table:

Date of Analysis	Purity of Vx % without chloro- benzene	with chloro- benzene	Batch No. (Attempt No.)
20.5.1988	33	-	3 (attempt No. 2 at Dhiaa plant)
30.5.1988	-	26	3 (2)
4.6.1988	-	7.5	3 (2)
7.6.1988	-	7	3 (2)
24.5.1988	41	-	4 (3)
30.5.1988	-	38.5	4 (3)
4.6.1988	-	32	4 (3)
7.6.1988	-	37	4 (3)

(See document No.IV.2, in the verification chap.)

The purity of Vx of batch No. 4 also decreased (after 7.6.1988, and didn't appear at the technical report to the D.G. in June) to 5% in July 1988. The produced Vx of the three attempts in Dhiaa plant were stored in the same plant.

6.4.3.7 Technical report to the D.G. of MSE concluded that the results of the attempt in Malik plant and the third attempt at Dhiaa plant gave good results of quality, purity and yield of Vx although there is differences in addition time and separation time, the report suggested the production of Vx in two other attempts at Dhiaa plant, the first attempt by using the reboiler and the second one without reboiler and the same quantities of precursors of the previous attempt at Malik plant and the quantities of the third attempt at Dhiaa plant in order to decide the proper time for the batch of production (this suggestion was not executed).

6.4.3.8 The results of the (5) attempts of production of Vx were discussed by the R&D and production seniors and decision to stop the production of Vx since there were many reasons i.e. the instability of the produced Vx, the large quantities of MPC used to produce MPS and the technical difficulties during the production process. The seniors of R&D and production suggested to produce Vx at the time when there is a need for it and to intensify the efforts to produce the G-agent instead. According to that, all the activities of production of Vx and its precursors (except the production of Choline) were stopped in July 1988.

6.4.3.9 In April 1990 by order of Hussain Kamil to resume the Vx activity two attempts for production of Vx were carried out at Dhiaa plant by process B without the addition of Na₂CO₃ (depending on the suggestion of production report to produce Vx-HCl). About (1400 Kg.) of the produce of MPS from 1988 was redistilled. A quantity of (800 Kg.) were used to produce Vx. 1500 kg. of Vx-HCl was produced (free Vx) of purity 33% and filled in chlorine gas cylinder, after two months the purity of Vx decreased to 1%, the production stopped. The quantity of spoilt Vx was kept in two Chlorine cylinders until May 1991 when they were unilaterally destroyed.

6.4.4 List of all chemicals procured for the production or intended production of V-agents.

Name	L/C No.	Date	Qty/ Ton	Supplier	Manufacturer
P2S5*	86/3/1145	1988	250	KIM-KHALIG	Excel/Bombay

Diisopropyl-amine *	86/3/1145	1987	200	KIM-KHALIG	Hochest
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Diisopropyl-	---	1988	50	WECO	W.G
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amine

Ethylene- 88/3/812 1988 39 WECO W.G
oxid

Chloroethanol* 86/3/1145 1988 202 KIM-KHALIG Srinvas chem.
ind. Bombay

- * 1. Letter from Mr.Kamal Soudi to National Monitoring Directorate at 23.5.1995
- 2. Document from Kim-Al-Khaleeg showing the importation of precursor chemical to (SOCl) Al-Muthana.

6.4.5 Personnel involved in V-agent activities at all stages:

Personnel responsible or involved in the decision making process to work on V-agents 'involved in the R & D of V-agents 'production of V-agents and the destruction of the unused precursors:

		Ph.D	M.Sc.	B.Sc.	Tech.
1.	Personal responsible or involved in the decision making process to work on V-agents.	-	-	1*	-
2.	Involved in R&D of V-agents	2	4	14	14
3.	Production of V-agents			2	14
4.	Destruction of the unused precursors	-	-	1	20
1* = General Manager of Muthana State Establishment.					

6.4.6 Fate of the produced Vx & it's precursors

6.4.6.1 P2S5

The total quantity of P2S5 imported was 250 ton .about 8 ton of that quantity was processed to produce MPS the fate of the remaining quantity of P2S5 (242 ton) after cease fire was as follows :

157 ton (stored at Dijla store) was destroyed by the Iraqi side in Summer 1991 at Saqlawia (N 33 23 , E 43 42) by mixing P2S5 with sand in 5 different pits in the

same area as shown in the attached diagram these areas were inspected by different teams from UNSCOM also samples were taken from different pits for verification. A quantity of 85 tons of P2S5 was destroyed through bombardment by allied action. (75 ton) was stored at Falluja /III (store No. 2) and (10 ton) was destroyed at Dhiaa plant. Inventory list of chemicals shows storage of P2S5 in different storage sites (see the verification chapter document No. II.1).

6.4.6.2 Diisopropyl amine (DIPA)

6.4.6.2.1 The total quantity of DIPA imported was 250 tons. (40 tons) of that quantity was processed to produce Choline. The fate of remaining quantity was as follows:-

A total quantity 174 tons of DIPA was destroyed through bombardment by allied action as shown below:-

109.5 tons was burned during the bombardments of Falluja /I (store No. 3).

44.5 tons was destroyed at Falluja / III (store No 1 & 2). This fact was confirmed by UNSCOM (the second CW inspection team). The location of these stores were shown in the attached diagram.

10 tons was destroyed at Mohamadiyat storage sites. See also inventories of 1990 (doc. No. II.1, the Verification chapter) where quantities and places of storage were given.

6.4.6.2.2 (12 tons) of DIPA was transferred to modern paints industries Co. in 1991.

6.4.6.2.3 (22 tons) of DIPA was destroyed under the supervision of UNSCOM.

6.4.6.3 Choline

6.4.6.3.1 (55 tons) of Choline was destroyed by Iraqi side in Summer 1991 by Choline was drained from barrels into open pit area near Sammara.

6.4.6.3.2 Inventory list of chemicals in Dec. 1990 confirm the storage of 55 tons Choline (which was destroyed as mentioned in 6.4.6.3.1.

The site was visited by the chemical group in Oct. 1995 and soil samples were taken for verification purposes (see also doc. No. IV.3, the verification chapter).

6.4.6.4 Chloroethanol

6.4.6.4.1 About 200 tons of Chloroethanol was destroyed by burning during the bombardments of Falluja I & III.

6.4.6.4.2 (2 tons) of Chloroethanol was destroyed under the supervision of UNSCOM in 1993.

6.4.6.5 MPS

The remaining quantity of produced MPS (about 1625 Kgm) was destroyed by the Iraqi side, by adding water to the barrels of MPS at Dihaa sites in Summer 1991 (see doc. No. IV.3, the verification chapter).

6.4.6.6 Vx

6.4.6.6.1 (400 Kgm.) of Vx of purity less than 1% which produced from monoester, and filled in three BR.500 aerial bombs was destroyed in 1988 by drainage the bombs in the grave yard and treated the drainage area with NaOH soln.

6.4.6.6.2 (330 Kgm.) of Vx (of purity less than 1%) which produced in Malik plant was destroyed by concentrated NaOH soln. which was added to the chlorine gas cylinder containing the spoiled Vx in 1988.

6.4.6.6.3 About (1670 Kgm.) of Vx of purity less than 1%, which produced at Dhiaa plant in 1988 and left at the site since 1988, was discarded in 1990 by adding NaOH solution to the cylinders (3 cylinders). These cylinders were transferred to Bunkers until the destruction with other cylinders in 1993.

6.4.6.6.4 About (1500 kgm) of Vx two chlorine cylinders of purity about 0.03% which produced on April 1990 at Dhiaa plant were left at the site until 1991 and then destroyed in the grave yard by adding conc NaOH solution after a period of time the cylinders were drained at the grave yard and the empty cylinders were destroyed with other cylinders and barrels in 1993.
(see verification chapter doc. No. IV.3 & IV.4)

6.5 Production of DFP

In a reactor of 1.4 m³ (H₃) (225 Kg.) Sodium Fluoride mixed with (225 l) isopropanol and (150 l) benzene (solvent). (180 l) D₄ was added for 3-4 hrs. at 40-50 C. Through the duration of reaction suddenly a vigorous reaction was happened and most of reactants blocked the pipes. Only Four attempts were carried out. The total quantity produced about 2.25 ton.

The reason for stopping production of DFP was difficulty of separation of DFP from salt and the low purity of the produced DFP.

6.6 Production of some precursors:

6.6.1 Production of DMPH:

DMPH was produced at the second half of 1989 and the beginning of 1991 in Ahmed plant, the total amount of DMPH produced was 75 tons (crude) of purity 60 - 65 %. The purpose of production of DMPH during 1989 - 1st half of 1990 was to produce Deptrix, after that, the purpose was changed to produce MPC.



Procedure:

PCl₃ was distilled in Ahmed (3) by using a reactor of 2.5 M³ capacity, the distilled PCl₃ was transferred to 4m³ storage tank (glass lined), the methanol was added in another storage tank of 5m³ capacity. Nitrogen gas was compressed on the two storage tanks of the starting materials (methanol and PCl₃) to control the flow rate of the reactants. The mixture was passed through a vessel reactor.

In this vessel reactor the reaction was carried out and keep the temp. at 90C, then the product mixture passed to another reactor of 1.6 m³ capacity, in this reactor the mixture was heated to 75C for 1hr. One ton of crude DMPH was produced per each batch of (60-65)% purity. The product was transferred to distillation reactor, the distilled amount were 400L for each batch with purity (85 - 95)%. The total distilled amount produced was 38 tons.

6.6.2 Materials used:

1. PCl₃ - 92 tons (104 tons with purity 86%).
2. Methanol - 95 tons

6.6.3 Production of MPC from pyrophosphate

6.6.3.1 Production of pyrophosphate

It was carried out In Dhiaa (out door), at reactor of 200 L capacity (stainless steel).

Many batches were produced, and after that the production transferred to H2 for more efficient equipments. The amount produced was 22 tons. (This was produced during the second half of 1990).

Procedure:

The DMPH was added in the reactor with a few amount of water as catalyst, the reactants were heated for many hrs. until the temp. raised to 220 C. we had seen that sudden and quick arise in the temp. of the mixture was happened.

The reaction was highly exothermic.

After that the reaction mixture was cooled (not below 250C) and drained to be stored.

6.6.3.2 Production of MPC

MPC was produced in Dhiaa plant in 1990 using pyrophosphate and SOCl_2 . The amount of MPC produced was 19 tons of purity about 75%.

Procedure:

To produce (750)kgm of MPC(75%) used. pyrophosphate = 750 kgm.

SOCl_2 = 1500 kgm.

The total quantity processed of pyrophosphate was 19 ton.

- The pyrophosphate was melted.
- Half the amount of SOCl_2 was added to the reactor.
- The melted pyrophosphate was added to the reactor with stirring.
- The remaining amount of SOCl_2 was added by dosing, stirring, heating to 90C for 2hrs., then the produced MPC was distilled and analyzed.

6.6.4 Production of Thionyl Chloride

6.6.4.1 In (1988) Thionyl Chloride was produced at Falluja II site according to the following route:

6.6.4.1.1 Sulfur Chloride was produced by chlorination of sulfur with chlorine gas (supplied from rayon state establishment) by using stainless steel reactor.

6.6.4.1.2 Sulfur Chloride was reacted with sulfur trioxide (supplied from Al QAQA) in presence of FeCl_3 or SbCl_3 as catalyst to get crude thionyl chloride which was distilled to get thionyl chloride of purity (80-90)%.

6.6.4.2 The production process accompanied by several technical difficulties such as, corrosion, polymerization and handling of sulfur trioxide.

The production product (Thionyl Chloride) was contaminated with Sulfur which separated during storage. Concerning these difficulties the production stopped at 1989.

The total quantity produced was about (70) tons.

CHAPTER VII

Research and Development of munition of Iraq's chemical weapons programme

CW - Munitions

Aerial bombs production project :

The ideas to produce aerial bombs started in 1984 in order to meet the establishment needs of such bomb. The historical progress at this project are as follows:

In 1984 a contract was signed with The Spanish company ITE to supply raw material for manufacturing of aerial bombs. (12000) bombs type L.D (low drag) caliber 250, have been received under the signed contract, which were designed to be filled with white phosphorous. The Spanish side did not provide the know-how or the technological procedure for the production of the bomb.

The detail of 12000 (Twelve Thousand) bombs are as follows:

A- 2000 (Two Thousand) bombs :

These parts of the bombs were ready for assembling. This type was used for training on the bomb assembling to obtain the production know how in order to produce it later. The total quantity produced about 1600 bomb (one thousand six hundred)... the remaining quantity was rejected.

B- 10000 (Ten Thousand) bombs :

These bombs consisted of unfinished materials which included metal plates and un-machined forged parts of the bombs with a full set of moulds to form the bombs parts.

The above-mentioned materials were received at the beginning of 1985. Subsequently, the machines and equipment required for manufacturing the bombs were imported through a contract signed with the German company (Schwander Co.) to supply general purpose machines to assemble the 2000 (Two Thousand) bomb (LD-250) which were imported in 1985 as a semi-product.

The imported machines were as follows :

- a. 1- (2) CNC lathe machines.
- 2- (2) Roll bending machines.
- 3- Gear shear machine.
- 4- Circular shear machine.
- 5- Two spot welding machines.
- 6- Spinning lathe machines.
- 7- Profile bending machines.

b. Along with the raw materials a specialized welding machine was imported from ITE (silver welding machine) to weld the head, of the bombs to be filled with white phosphorous.

The trial production started at the beginning of 1986, to assemble (2000) semi-product bombs type LD caliber 250 designed for filling with white phosphorous. The production was implemented by the available equipment and the TIG welding machine, see diagram No.1-A-B-C.

In 1986 a contract was signed with ITE company to supply specialized machines and equipments in order to produce the 10000 (Ten Thousand) bomb (LD-250) which was imported in 1985 as a raw material. The imported machines were as follows :

- a. Hydraulic press 100 Tons.
- b. Hydraulic press 400 Tons.
- c. Circular submerged arc welding machine.
- d. Longitudinal submerged arc welding machine.
- e. Rotary transfer machine.
- f. Assembling tools and equipment.

The following unspecialized machines were imported from Schwander a German company to meet the production requirements:-

<u>Requirements</u>	<u>Qty.</u>
a. Robot welding machine.	1
b. Bending machine.	1
c. Tig welding machine .	3
d. (MAG) turning machine operated by CO2	2
e. Spot welding machine .	2
f. Hack saw.	2
g. Circular saw .	2
h. Various drilling machine	2

Purchasing of the following machines from local markets as complementary machines for the production requirements:-

<u>Requirements</u>	<u>Qty.</u>
a. Mechanical press 250 Tons	1
b. Mechanical press 63 Tons	3
c. Mechanical press 40 Tons	1
d. Production lathe machines	4

The mass production of the 10000 (Ten Thousand) bombs type LD-250 which were imported as raw materials, started in the first quarter of 1987.

Those bombs were modified to meet the establishment requirements, by the following modifications.

a. The first modification :

Cancellation of silver welding operation for the top nose parts and welded the steel cover booster directly with the top nose, there was no need to fill the white phosphorous from the head as the standard filling methods but to make a side filling hole.

b. The second modification :

Short hand the metal parts of the bombs top nose from four parts to one part and welding the fin directly with the bomb body that there is no need to fix it with bolts since the steel booster cover is not to be entered from the bomb head and fixed by a press as in W.P filling technology. See diagram No. 2.

From both modifications only 8300 (eight Thousand three hundred) bomb were produced ... and the raw material which was un-machined still at the Aerial bomb workshop. The total quantity produced about 8300 bomb (eight thousand three hundred)..which consider a part of the total quantity procured as a raw material (10000) . the remaining quantity was rejected.

c. The Third modification :

To overcome the problem of corrosion of the bomb after filling with chemical agents and to prevent leakage during storage which cause contamination. A modification were carried out to produce Aluminum canister to be filled with agent and inserted inside the bomb to avoid the direct contact between the agent and the body of the bomb.

Three canister were modified to be inserted inside each bomb. These canister were manufactured in the State Establishment for mechanical industry only four aerial bomb type LD-250 were modified in Feb. 1988 at the aerial bomb workshop in Al-Muthana, these modification include:

- a- A base plate was introduced in the rear end of the body of the bomb for the purpose of inserting the canister.
- b- The length of the booster was increased.

These modifications affected the stability of the bomb and the modification was cancelled. See diag. (2-B)

- d- The Fourth modification :

In anticipation for an order for the field evaluation of what was called radiation weapon (See the report section IX chapter XIV) 100 pieces of Muthana-4 aerial bombs were produced, 75 of which were sent to Al-Qaqa for completion.

The modification consisted of the introduction of a base plate at the rear end of the body and the booster length was reduced.

The fourth modification was made to allow for the introduction of the explosive central core in which the shortened booster tube is introduced. And the irradiated material surrounded by a lead shield could also be introduced for the base and sealed with the base plate. A part from the two modifications mentioned above M-4 was exactly the same as the LD-250.

The modifications were carried out in the aerial bomb workshop/ MSE using the same materials.

The remaining 25 pieces of Al-Muthana-4 bombs were unilaterally destroyed in Summer 1991. See diag. (2-C) .

The fate of the 75 pieces of M-4 sent to Al-Qaqa is as follows:-

- Al-Qaqa Est. in preparation for the order for field tests evaluation proceeded to make 20 lead shield jackets 9 of which were filled with lead and remainder were left empty.
- As no order for the bombs came all the materials and parts remained at Al-Mughira workshop at Al-Qaqa which was severely damaged during the war.

- In 1992 during the reconstruction phase of Al-Qaqa the debris of Al-Mughira workshop were cleared and the damaged empty components of M-4 were sent to Badr S. Est. as scrap metal for the foundry (See doc. IX.3 chap. XIV).
- The 20 empty jackets including the 8 filled with lead are still at Al-Qaqa S. Est. when this report is made.
- The Aluminium tubes for the Zirconia were also made at Al-Mughira workshop about (100 pieces) which were sent to IAEC but no irradiation activity was carried out as no order to pursue the project came and the tubes presumably went for Al-scrap when the debris of IAEC were cleared as they could not be found when this report was prepared.

Aerial bomb (AALD-500) :

A Contract was signed with the Spanish company ITE in the first quarter of 1988 to supply 10000 (ten Thousand) bombs (AALD-500) as raw materials in addition to the following machines and equipment:

- a. Hydraulic press 400 Tons.
- b. Hydraulic press 100 Tons.
- c. Mechanical press 400 Tons.
- d. Circular submerged arc welding machine.
- e. Two sets of dies.
- f. Assembling tools and equipment.

The above-mentioned items received after the Iraqi-Iranian war ended, so only 329 (Three Hundred Twenty Nine) bombs type (AALD-500) were produced to test the equipment and dies, see diagram No. (3).

Aluminium Aerial bomb (DB-0).

The mechanical industries state establishment (MISE) at Iskanderia were producing Aluminium containers for the Air force since 1984. The container was similar to the Spanish type N drop bomb.

In 1988 the container was subjected to tests by MSE for possible use as a large capacity aerial bomb and consequently 61 such container designated (DB-0) were received. However, various validation tests as a possible weapon showed that it was unsuitable for safety reasons. The idea was abandoned. The MISE diaries show that from 1984 up to the of Iraq-Iran war (4572) pieces were produced including 61 sent to MSE.

Aluminium Aerial bomb (DB-2) :

After the failure of the container (DB-0) another sample was chosen which was a modification of the Russian bomb SKS-360. This was given the name DB-2. A sample was manufactured by reverse engineering using the available equipment in the drop tank workshop at the State Establishment for mechanical industries.

The metal also changed to aluminium and after conducting tests on the bomb it was accepted and the production started in the first quarter of 1988, (1389) bombs were produced - See diagram No. (4-A and B).

The quantities of the aerial bombs produced depended on the quantity of raw materials available for manufacturing this type of container at the State establishment for the mechanical industries.

However, by the time the quantity was completed by the end of the first quarter of 1988 there was no need for this type of weapon. The empty containers of DB-2 remained in storage till the end of the war in 1991.

The fuse used for the aerial bomb DB-2 was impact fuse type MF-1000 of Spanish origin.

The aerial bomb DB-2 was designed to be filled with Sarin.

Aerial Retard bomb (R-400) :

In April 1990 MIC through its Air-force and Navy Armament Department began to investigate selection of a weapon that could be used for low level deep penetration flight to be used with CW agents. Thus the (BRIP-400) Spanish conventional bomb available with the Air-force was selected for reverse engineering of the body assembly. Two bombs were sent to Nassr Establishment for that purpose and 24 samples were made and tested. The tail unit together with the parachute were not made and available tail units at the Air-force were used. The R-400 were more suitable for use with modern aircraft both Russian and Western and after the successful tests 1000 pieces were ordered in May/June 1990 followed by 24 pieces for quality control tests.

The production of the R-400 was carried out in June, July, and the order completed and delivered in July 1990. (See Verification Chapter Doc. V.4)

The bombs were filled with alcohol only over a period from July till beginning of Aug. 1990 and dispersed at various air- bases where they could be

integrated with the tail units at the bases at the time required. The remaining component for forming the binary were delivered in Jerry cans for adding prior to use.

Artillery shell 130 mm :

In 1983 Hutten state Establishment supplied the chemical programme with 4000 (four Thousand) artillery shell 130 mm as empty casing, the chemical programme requested Hutten to modify the booster (increase the length of the booster).

Aluminium Warhead for 122 mm Rocket :

Due to corrosion problems faced in filling the Rocket 122 mm warhead with chemicals since it was manufactured from Carbon steel,. Aluminium was suggested as an alternative material for the warhead. Project 144 was asked to produce samples which were tested and accepted.

About 16000 warheads were produced and then in August 1988 the production was stopped.

In 1990 the production was reactivated and a new design was made using two aluminium canisters inside a carbon steel warhead. 4500 pieces were made by project 144 and delivered to Al-Muthana. (See doc. V.13 attached in the verification chapter (XIV) which show the quantity received and the quantity rejected and sent back to project 144.

In May 1988 Project 144 offered to design a cluster warhead for CW agents to be used on the missile Luna. A mock-up prototype was made and the Project was abandoned for lack of interest.

Other ideas presented by Project 144 for binary systems but were not pursued further were conversion of warheads for C-24, 107 mm rockets. No prototype were produced.

Al-Hussain Missile Chemical Warhead :-

In April 1990 MIC instructed Al-Muthana and Project 144 to investigate possible use of Al-Hussain warhead for CW agents. Tests were conducted in April and May 1990 beginning with static tests and then flight tests using water, oil and spoilt sarin. (For details see Ch. VIII).

The chemical agent chosen by Al-Muthanna State Establishment for Al-Hussain was sarin (GB/GF). The concept also involved a primitive binary munition in which an alcohol precursor would be loaded into each warhead. Prior to launching a DF precursor would be added to the alcohol, which would mix together to produce sarin.

Although initial studies indicated that the best results could be achieved by a warhead exploding above the ground. However, the fusing system for Al-Hussain would have to be changed. No proximity fuse was available in Iraq, nor could one be procured in a timely fashion. Therefore, the decision was made to retain the existing fuses used in the conventional Al-Hussain.

Two flight tests were conducted in 8 and 18 April of 1990, one warhead with inert material (oil and water) and the 2nd test with active material, the 1st test failed and the 2nd test was successful *.

The tests were considered successful, and instruction was given to project 144 to initiate production of warheads.

Manufacture of the Chemical Warheads:-

After the success of the field tests, an agreement was reached between Al-Muthanna State Establishment and Project 144 to initiate production of warhead. About (80) eighty containers for the sarin agent were manufactured, 40 each from stainless steel and aluminium, in which five of containers were consumed for ground test, (3) used with warheads for static test, and (2) containers were used for the purpose of Hydrostatic test inside Project 144.**

(20) containers were rejected by the quality control since they failed during the pressure test. The aluminium type was chosen since it can resist corrosion and can be filled with chemical agent and stored for a long time, while the stainless steel container was chosen since it can withstand different stresses during flight and due to the ease manufacturing compared with aluminium.

However, only 75 warheads were produced*, of the 75**, (54) represented modified Soviet 8F44E warheads and (21) were indigenously produced warheads. The Soviet warheads were modified at Project 144 located at Al-Taji and Al-Qa'qa, while the manufactured warheads were produced solely at Al-Taji. The warheads were produced in several batches***.

* See diaries No. (3) on 8.4.1990 and No. (5) on 18.4.1990 , 18.4.1990 from Scud File that were received from UNSCOM on 24.2.1994.

** For more details, see section 3.5, 3.12 of chapter III of Project 144 of missile FFCD.

*** See document no.1 attached at the end of section 7.2 (missile FFCD).

There were no difference between the design of the chemical warhead and the conventional of Al-Hussain warhead, except five chemical warheads which were modified to be similar to the design of warhead of Al-Hussain short version missile, anyhow this modification did not affect the design and dimensions of the chemical agent container. The material used for manufacturing the warhead were the same material used for manufacturing the 8F44 warheads, except for alternative were used as insulator instead of the paper cloth which was used in the original warhead. This material was also used in manufacturing the conventional warhead which was started end 1987 - beginning of 1988.

All (75) chemical and biological warheads were received by Al-Muthanna State Establishment, with final delivery being made in Dec. 1990, where the process of filling and storing the chemical warheads were being carried out. Fifty of which were filled with CW agent and (25) filled with BW agent. Thirty four of the CW warheads were filled with alcohol and were distributed to storing areas, while (16) warheads filled with sarin agent and considered to be ready.

Operational Aspects of the Chemical Warheads:-

According to the plan, the launcher, technical battalion personnel, and a fueled missile with guidance equipment installed would rendezvous with the Muthanna team at pre-determined location nearby (2-3) km away from the launch site. At that time, the Muthanna team would oversee the up-loading of the chemical warhead onto the Al-Hussain Missile, once up-loaded, the launcher would proceed to the launch site for normal launch operations.

The chemical warheads, for the Al-Hussain Missile were never intended as a first strike weapon, but rather as a deterrence against attack as well as a retaliation weapon.

*** (19) Soviet made warheads destroyed under supervision of CDG and 35 warheads were destroyed by Iraqi side in Summer 1991. (21) Iraqi made warheads were destroyed as follows (11) under supervision of CDG and (10) by Iraqi side in Summer 1991.

DIAGRAM NO. (1-A)

Aerial bomb caliber 250 / first generation

DIAGRAM NO. (1-B)

Aerial bomb caliber 250 / first generation

DIAGRAM NO. (1-C)

Aerial bomb caliber 250 / first generation

DIAGRAM NO. (2-A)

Aerial bomb caliber 250 / second generation

DIAGRAM NO. (2-B)

Aerial bomb caliber 250 / Third modification

DIAGRAM NO. (2-C)

Aerial bomb caliber 250 / Fourth modification

DIAGRAM NO. (3)

Aerial bomb caliber 500

DIAGRAM NO. (4-A)

Aluminium aerial bomb type DB-2

DIAGRAM NO. (4-B)

Aluminium aerial bomb type DB-2

DIAGRAM NO. (5)

Aerial parachute bomb - type R-400

DIAGRAM NO. (6) & ANNEX (2)

Special container of Al-Hussain warhead.

CHAPTER VIII

Field tests of CW munition and modification:

- 8.1 Generally the following points were observed as a procedure for conducting field experiments of chemical munitions:-
 - 8.1.1 Test site selection and preparation of munition for experiments.
 - 8.1.2 Stands or props are used to support the munition according to type and the requirement to simulate air burst of proximity fuse. 5 m height for aerial bombs etc.
 - 8.1.3 The special equipment for decontamination, detection and the special materials for protection are prepared.
 - 8.1.4 Warning signs to be prepared in the experiments area such as flags to indicate the area or the contaminated observation area, the experiment area. And the area down wind.
 - 8.1.5 Preparing animals in the area of the experiment like (rabbits, pigs, dogs and donkeys).
 - 8.1.6 Conducting surveillance for the site of the experiment to be sure of the nonexistence of shepherds or other persons.
 - 8.1.7 The munition are carried on a truck which must be accompanied throughout the trip from Al-Muthana Establishment to the area and as follows:-
 - 8.1.7.1 An escort to protect the convoy during transport.
 - 8.1.7.2 Decontamination vehicle to deal with sudden accident that may happen during transport.
 - 8.1.7.3 Fire fighting vehicle.
 - 8.1.7.4 Ambulance with (2) medics.
 - 8.1.8 The convoy should pass through uninhabited route avoiding cities and housing complexes in addition it should not stop in the way except in very high emergency cases.

- 8.1.9 When the convoy and the people concerned with the experiment arrive to the place, distribution of the animals are to be done after numbering the cages according to a diagram in order to know the effect on the chemical agents on the animal with respect to their position from explosion area.
- 8.1.10 Arming or fusing the munition in a way which should be very close to detonation position.
- 8.1.11 Surveying the surrounding area in 3 KM. depth against wind direction and 10 KM. with wind direction to protect the area and to be sure of the nonexistence of strangers.
- 8.1.12 The time for the explosion is chosen so that the wind must be suitable (2-3 m/s).
- 8.1.13 Protective clothes are worn by all participants during handling of chemical agents.
- 8.1.14 Preventing any person to enter or leave the area through the experiment.
- 8.1.15 After the explosion the members concerning with taking samples enter the area and collect samples from the air and soil according to previous existed program.
- 8.1.16. After taking the samples, animals are taken from the area after the decontamination.
- 8.1.17 The area is completely decontaminated while the remains are buried in a suitable pits, the unexploded bombs are treated if any.
- 8.1.18 The results of the experiment are studied on the light of the samples taken from the area and the effect of the chemical agents on the animals are also noticed.
- 8.1.19 Several experiments are carried out at Al-Muthana site.
- 8.1.20 Types of munitions that tests were carried out on them are:-

- Aerial bombs	250	filled	CS
- Aerial bombs	250	filled	Sarin
- Aerial bombs	250	filled	Phosphorus
- Artillery shell	130mm	filled	MG

- Artillery shell	130mm	filled	Tabun
- Artillery shell	155mm	filled	Sarin
- Rocket warhead	122mm	filled	Sarin
- Aerial bombs	R-400	filled	Sarin
- Al-Hussain warhead		filled	Spoiled Sarin

(the site of the test AL- MUHAMMDIATE)

8.2 Artillery shell 130 mm:

8.2.1 Many static tests to study the effect of explosive materials on the liquid material dissemination were conducted. The quantity of explosives inside the modified cup at the shell head was changed or adding atube filled with explosives (booster) then the quantity of the explosives to be changed.

Many static tests on artillery shell 130 mm filled with oil and then with Mustard was conducted. The result was positive.

Those tests were conducted at Al-Mohammadiat site, in beginning of 1983.

8.2.2 In the beginning of 1983 a real firing test was conducted on (13 shell) 130 mm modified bombs filled with Mustard (containing a cup and a booster) with the use of a impact fuse and proximate fuse at Al-Mohammadiat site. The result was positive.

8.2.3 Static test was conducted using artillery shell (25 shell) 130 mm filled with Tabun at Bahar Al-Najaf site in the end of 1982 This test was repeated in 1983 in the same site (with 100 shell). The result was negative.

8.3 Artillery shell 155 mm

8.3.1 In 1983 some static tests using artillery shell 155 mm in Italy with SNIA-BPD company were conducted to confirm the optimum size of booster and the quantity of explosive required to explode the shell and dissemination of liquid.

8.3.2 Static test have been conducted for artillery shell 155 mm Italian origin) to know the required quantity of explosives to split the shell and dissemination the liquid as required.

The test were conducted at AL-Mohammadiat, in 1984.

8.3.3 Another static test were carried out using Artillery shell 155mm filled with Sarin at Al-Mohammadiat in 1984.

8.4 Mortar shell 120 mm , 82 mm.

8.4.1 Static tests were conducted by using mortar shell 82 mm and 120 mm, after filling them with oil, then with (CS) liquid. In addition a static test and firing test with CS powders were conducted at Jerf Al-Sakar area in the end of 1982 and in the beginning of 1984. The result was positive.

8.5 Smoke Rockets:

8.5.1 A static and real firing tests for Egyptian smoke rockets, 3 Km range with CS powder were conducted at Jerf Al-Sakhar area in 1983.

8.5.2 A real firing experiment for Egyptian smoke rocket, 3 Km range with CS powder was conducted in 1987, at Jerf Al-Sakhar area. However the results were negative.

8.6 RPG-7 Grenade Field test were conducted in beginning of 1983 using RPG-7 Grenade filled with liquid (light oil) at Jerf Al- Sakhar area. In addition to other test for RPG-7 filled with CS Powder conducted at Al-Muthana in the beginning of 1988. The result was positive.

8.6 Rocket 122 mm

8.6.1 A static test were conducted at Jurf Al-Sakhar in 1985 to check the quantity of the explosives required for spreading the liquid materials (oil) and the area which will be covered with the liquid materials. In this test it was used Italian warhead firos / 25 (carbon steel warhead). The result was positive.

8.6.2 A firing test was carried out using Rocket 122mm filled with oil at Jurf Al-Sakar,in 1985. using firos / 25, the result was positive.

8.6.3 A test was conducted by launching rocket 122 mm (Sakar 30) at Jurf Al-Sakhar area by using warheads filled with colored liquid to know the dissemination. The test was carried in 1988 . The result was positive.

8.6.4 During 1984, 1985 and 1986 static and dynamic test conducted in Egypt with Arab organization industries, by using 122mm rocket (sakar 18, sakar 30) to confirm the suitability of rocket heads to carry liquids in addition to know the optimum size and the quantity of explosives

required to split the head and dissemination the liquid (oil) also to know the dissemination of canisters in the rocket head (sakar 30) the results was encouraging the number of rocket used about (50-60 head of sakar 18 and about 15-20 of sakar 30).

8.6.5 In 1984 a number of static and dynamic tests were conducted in Italy with SNIA company by using 122 mm - rockets (firos) to confirm the suitability of rocket heads to carry liquids in addition to know the optimum size of boosters and quantity of explosives that required to split the head for dissemination of the liquid (oil) the number of head used (6 heads for static test and 6 heads for dynamic tests).

8.6.6 A firing test for sakar / 18 rocket containing plastic canisters filled with Sarin, were carried out in Al-Razaza at 1987. The result was positive.

8.6.7 A static test was conducted, in April 1988, on a group of rocket warheads 122 mm (firos /25 with canister) filled with Sarin to know the stability and time period of the agent on the ground. The test was conducted at Al-Muthana.

8.6.8 The Iraqi (Aluminium) warhead for rocket 122 mm:

8.6.8.1 A number of Aluminum warheads for rocket 122 mm were manufactured by project 144 static test for warhead filled with oil and other liquids were conducted at Al- Muthana in 1987 to determine the quantity of the explosives and the dispersing of oil.

8.6.8.2 A firing test were conducted at the beginning of 1988 by using Aluminium warhead for rockets 122 mm filled with oil to determine the quantity of the explosives, required for dissemination and the depth to which the rockets penetrates into the ground. The results were negative due to separation of the warhead from the motor.

After conducting a modification, then real launching test were carried out after filling the warheads with a light oil and the results were positive.

Another set of 122 mm warhead was manufactured after conducting a modification, then firing test were carried out after filling the warhead with oil the results were encouraging, the tests were carried out at Jurf Al-sakar site in the beginning of 1988.

8.6.8.3 A firing test for the aluminium warheads filled with sarin agent was carried out to know the dissemination of the agent and the results were positive. The test was carried out at Al- Muhammadiat in 1988.

8.7 The Russian SCUD R-17 Missile and Al-Hussain Warhead:

8.7.1 In 1985 Iran began using scud missiles against Baghdad and other cities. It was felt necessary to investigate the possibility of their using CW agents filled R-17 warhead. For that purpose a training warhead of the Russian SCUD R-17 missile was modified in order to study the ability of using it in carrying liquid material instead of solid material. After the modification and the study of center of gravity and the stability of the warhead. A static test was conducted by using the booster of the bomb BR-500 to know the quantity of the explosives required for spreading the liquid. This experiment was conducted at Al-Muhammadiat in summer 1985.

At the beginning of July 1985 there was an attempt by Al-Qaqa S. Est., according to request from Al-Muthana Est. to discharge a real warhead received from the Armed Forces. The attempt didn't succeed and the missile was damaged at that time (according to diary No. 13 on 5 June 1985). The attempt was repeated again at the beginning of August 1985 after receiving another real warhead from the Armed Forces, after the success of discharging the warhead a necessary modification was conducted. A launching test for warhead filled with (water) was carried out. The missile was launched from Al-Habania towards Al-Razaza lake. The result was positive. No further tests were made after that.

8.7.2 In May 1990 a dynamic field test was conducted by launching two Al-Hussain missile one filled with Oil and the other with the spoiled sarin. The launching process was conducted from Tal-Afar area at the north of Iraq, and the target point was at Al-Salman area at the south of Iraq. The warhead separated from the body above the target area and it didn't explode. While in the second launching the warhead reached the target and exploded and the material was spread in certain area and samples were taken for analysis. The result was positive.

8.8 OTHER TESTS

8.8.1 Smoke generators from the armed forces were used to spray CS liquid to be used at battle field at that time the test was conducted at Al-Hasua area in 1982. The result was positive.

8.8.2 In 1983 a test conducted on artillery shell 130 mm using a modified booster cup which was fixed to the shell by pressing. This booster cup contained a valve produced by Kozan Company in order to fill the shell with phosgene gas procured from Al-Qaqa state establishment. However the results was not positive because it was difficult to control the gas filling equipment and no further tests were made.

8.8.3 In 1987 2-3 of allways fuse were manufactured at Al- Qaqa, which explode on impact on the ground. Reverse engineering methods was adopted to manufacture the valve of Rocket sakar 30 (Egyptian) the tests was conducted at Al-Muthana in 1988 by dropping a small Aluminum canister from 10 m height supplied with all ways fuse. The result was positive.

8.8.4 A static test was conducted by burning gas air mixtures using LPG gas using 20 large vehicles filled with LPG gas (gas transfer vehicle). Twenty pipelines were lined to cover the area. The gas was burnt by a flame . The results were negative due to technical reasons and the inability of covering the area in a complete and homogeneous way. The test was carried out at Al- Muhammadait area in 1988.

8.8.5 Smoke canister tests

8.8.5.1 A test for smoke canister containing (10% Adamsite + 10% CS + 80% smoke generation chemicals) carried out at chemical proving ground in 1988. The result was not encouraging.

8.8.5.2 Smoke canister of 10% adamsite & 90% smoke generation chemicals and a smoke canister of 10% & 80% smoke generation chemicals were tested at chemical proving ground in 1988. The result was not encouraging.

8.9 Binary systems artillery shell .

At the end of 1983 the researches on artillery shells binary systems were started with (10) prototypes of Spanish bomb (155 mm), which contain two containers of carbon steel, each container was supplied with two valves to control the two holes in the container base and also control the mixing of the liquid . The results were negative, so that the system was cancelled at that time.

At the end of 1987 and at the beginning of 1988 the researches on artillery shell binary system were started depending on the information of some military literature which explain that the shell consisting two canisters separated by

rapture disk which is destroyed by set back force during the firing and the sarin precursors mixed together during spinning to get sarin which disseminated when the shell exploded.

8.9.1 152 mm shell Binary System Tests:-

8.9.1.1 Joined team from MES and Hutteen S.E.(Hutteen was chosen because the experience in artillery shells and there is a firing range in Jurf Al-Sakar) were started the work by using an empty 152 mm (propaganda shell) which was in hand at that time in addition existence of A Gun for firing test at the firing range.

8.9.1.2 In (1988) a firing test was conducted by using about twenty 152 mm shell (1-2 shell in each test) after the manufacturing of canisters in Hutteen S.E. as in fig (1) the tests were aimed to :

- Checking that the rapture disk was destroyed and the liquids in the canisters were mixed (one of the canisters filled with colored water and other with water).
- The exploding of shell by using different size of boosters to choose the optimum one.
- Assurance of sarin formed from the mixing of its precursors (which were filled in the canisters)

8.9.1.3 In 1988 Thirty Aluminum canisters were manufactured at Hutteen (R&D workshop).

8.9.1.4 In Sept. (1988) a firing test carried out at Jurf Al- Sakar using twelve (152 mm) shells & three Guns, the Aluminium canisters were filled with Sarin precursors.

The test zone assigned as a circles of a radius (50-250m) from the center which assigned by shooting about 2-3 conventional shells. Animals such as (Mice, dog, Guinea Pig) distributed at the test zone in the circles around the center, after that 15 shell were shot at test zone, after half hour the symptoms on the animal at the test zone were recorded, samples from soil & air were collected. The result was positive.

8.9.1.5 Binary system using shell /152 mm (mustard) 1988. A test was carried out by launching two projectiles - 152 mm converted to contain two aluminum containers filled with mustards raw materials (TDG &

Thionylchloride). One projectile was not supplied with explosives to determine mustard quantity produce during flying. The front part of the projectile smashed due to crush which caused knocking the rear part out . After analyzing the sample purity of mustard was 39%. That is, the result of the test was negative. The other projectile did not hit its target due to its explosion during flying. It is thought that the explosion occurred due to vigorous reaction and high temperature.

The previous test repeated to obtain mustard by converted munitions/152 mm which contained fuse, booster and (1-5) disk to determine the suitable number for explosion. The results were negative since the bombs were exploding five seconds after launching such system was abandoned due to the above reasons.

8.9.2 155 mm shell Binary System Tests:-

8.9.2.1 At the end of 1988 the results of the previous tests on 152 mm were made use of in testing 155 mm extended range shells (with basebleed) and the results were compared.

8.9.2.2 In 1989 a firing test conducted at Al-Mohamdyat by using 120 shells (155 mm) with canisters filled by Sarin precursors i.e (DF&IP). And six Guns (GHN-45) the test zone assigned by a circles of different radius animals (mice, dogs ...) were distributed in the test zone. The symptoms on the animals at the contaminated area were recorded and samples from soil & air were collected, the result was positive.

8.9.3 Binary system using rocket / 122 mm. The test was carried out in 1989 at one of the workshop of Al-Muthana by using plastic container made of polypropylene. The two parts of the container are separated by mechanical valve controlling the separation of the two compartments. In this experiment a turning machine of low speed (100-200 rpm.) was used.

The test was carried out by using precursors (isopropanol & DF) with speed of 100 Rpm. for 40 seconds depending on the average of rocket rotation speed. The results were positive.

In the light of the above, a number of aluminum containers were manufactured with a ball made of carbon steel (weight 150 g) for rupturing the separating wall between the containers, as in fig. (2). A test of launching modified warheads / 122 mm filled with colored liquid The results were encouraging. The test was reconducted with DF & isopropanol by launching five rocket with out explosives. The results were encouraging but not reliable enough for production. These tests were carried out in 1990.

8.10 Aerial Bombs:

8.10.1 Aerial bombs 250, 500 (Spanish type). A number of static test were conducted by using the aerial bombs filled with oil at Al- Muhamadiat area in 1983, 1984. The results were encouraging. In addition to that dynamic tests were conducted by using aerial bombs filled with oil at Al-Muhamadiyat and Al-Razaza sites and the results were encouraging. Then a number of tests were carried out using different liquids with different densities to guarantee the validity of the bombs, the spreading of the chemical materials. The tests continued to 1985. A dynamic test was conducted in Al-Muhamadiat site using aerial bomb 250 filled with liquid CS agent to determine the spreading of the agent. The test was carried out in 1984. Another dynamic test was conducted in Al- Razaza site using aerial bomb 250 filled with sarin agent in that area several caravans were distributed inside which animals were put. The test was carried out in 1987. The result was encouraging.

Determination of temperature formed on the body of the bomb due to friction during flying in 1985 a test was conducted using two LD-250 bomb (Spanish) one filled with oil and the other with water. Temperature measuring strips were fixed inside and outside (in front and the middle of the bomb body) to determine the temp. reached inside and outside the bomb during flying SU- 22 (air craft) at tactical altitudes for half an hour. The result was acceptable.

8.10.2 Al-qaqa bombs 250, 500 A number of dynamic tests were conducted at Al-Habania airfield with the cooperation of Al-Qaqa StateEstablishment in 1987. The results were negative and the tests were abandoned.

8.10.3 Al-Muthana bombs 250 Flight test have been conducted in 1987 on Al-Muthana bombs which were manufactured in Al-Muthana. The bombs were filled with oil and other liquid (Simulant). The results were encouraging. A static test was conducted at Al-Muthana using bombs filled with white phosphorus in 1987. The aim of the test was to study the specification of phosphorous and its ability to generatesmoke for tactical purposes. A dynamic test was conducted using Phosphorus in 1988. The test was conducted at Al-Muhamadiat . The results were negative since the smoke dissemination was not homogeneous and not dense enough.

8.10.4 Aerial Bomb / CB-250 In 1987 cluster bomb / CB-250 manufactured by Al-Noaman factory of fiber glass 18 bomblet made of (AL) by Al-

Noaman factory, were modified. The bomblet are closed cylinder of 3.5 L. capacity and equipped from the rear side by a ordinary fuse for CB bomb manufactured by Al-Noaman factory as in (Fig. 3 and fig.3.a) several test were conducted for studying the possibility of using those bomblets.

The first test were to drop the bomblet from different altitudes (10,20,30m) to determine the function of bomblet.

In view of those tests, a number of bomblets were manufactured and arranged inside the cluster bomb / CB- 250. In summer of 1987 flying test was carried out for two bombs /CB-250 charged with 18 bomblet full of a liquid (oil). Another test was conducted for dropping two bombs/CB-250 on airstrip 37. the results were negative because some of the fuses did not operate due to insufficient altitude. The tests were abandoned. An idea was suggested to add another fuse as shown in fig. 3 b. This kind of bomb was never used or attend to be used for VX or biological agent.

8.10.5 Aerial bomb DB-2:

In 1988 a static test for the bomb DB-2 filled with oil was carried out at Al-Muthana and the results were successful.

8.10.6 Aerial bomb (Al-Muthana) with Aluminum canister :

In 1988 four canisters of the aerial bomb were filled with oil, then flying test was conducted with four bombs using SU-22, in Habania air-base, the test was negative because of technical problems, also the tail fin was not stable.

8.10.7 Aerial bomb Nasser-7 :

In the end of 1987 the test was conducted by using Nasser-7 bomb (inert) and a supersonic air craft (MIG-25) was used for the test by (15 min. trip) to determine temp. formed on the body due to friction during flying, the result was negative because of high temp. affecting the agent fig.(6).

8.11 Modified Aerial Bomb for Binary System Al-Noman/CB-250 & Nassar / 250:

In the beginning of 1990 project Dhafir (created earlier to support PC3) was instructed to carry out technical feasibility studies for modifying existing bombs from current production to be used to carry binary CW agents.

The task group worked at Al-Qaqa State Establishment considered two options for the shape of the canisters.

The first option consisted of a large aluminium cylindrical canister divided into two chambers by a membrane to be ruptured by electrically detonated explosive cord. The second option utilized two concentric aluminium cylinders with rupture walls to allow mixing of the two liquid components. In both options a pneumatically driven stirrer fixed in the larger canister supplied with air from air bottle of 8 bar. Two functional models were made and fitted inside current production bombs namely: AL-Noman CB-250 bomb made from fiber glass body and Nassar/250 made from carbon steel fig.(4) and fig.(5). Cold static tests were made using coloured liquids in the CB-250 in July, and in August 1990 Nassar/250 bomb was used. Both tests were inconclusive due to leakages and stirrer damage during membrane rupture by the explosive cord. Although some additional models were made attempting to rectify the problems no further tests were carried out as Al- Muthana did not actively pursue the project. It was finally abandoned in January 1991 and the models produced were destroyed by coalition bombardment of the workshop at Al-Qaqa Establishment.

8.12 MISCELLANEOUS FIELD TESTS OF CW MUNITION & MODIFICATIONS

8.12.1 Aerial Bombs Type SDN (750, 500) 12 bombs of the a. m bombs, manufactured by the Spanish ITE Company, were received in 1986. A flight test was conducted on tbomb SDN-750 and the results were negative. The test was re-conducted at the beginning of 1987, the results were also negative due to instability during the flight after release and cracking on the body of the bomb near the suspension lug which resulted due to the high drag on the hanging points and the carriers.

There fore, the bombs were not accepted and no Contractwas signed with the Company in this field.

8.12.2 Aluminium aerial bomb type ALD-500 (Spanish made) Four (4) prototype Aluminium aerial bombs were manufactured by the Spanish ITE company were received in 1987, for the purpose of observing and making use engineering specification. No contract was signed with the company.

8.12.3 The Spanish Artillery Shells (155 mm):

Ten prototypes of the Spanish shells (155 mm) were received in 1983, which contain two containers of carbon steel. Each container was supplied with two

valves to control the two holes in the container base and also to control the mixing of the liquid. The purpose for using them was for the binary system.

These prototypes were sent according to Iraqi demand. The results were negative and no agreement was achieved with the company.

8.12.4 A prototype of the rocket warhead 122 mm from Boneventure Company:

A prototype of the aluminium warhead type 122 mm was received in 1988 for the purpose of testing. No contract was signed with the Company and the subject was cancelled at that time.

8.12.5 The Egyptian Smoke Rockets D-3000, D-6000:

A co-operation with the Egyptian Sakar Factory was carried out to develop the Egyptian smoke rocket D-3000, D-6000 to carry CS powder instead of the smoke.

Therefore, in 1983 an officer was delegated to Egypt with a quantity of CS powder and a number of tests were carried out in Egypt but they did not achieve the required results. In 1988, the Egyptian side presented an offer in which it explained the success of the development of D-3000, D-6000, but no agreement with the Egyptian side was made in this field.

8.12.6 Sakar 80, 100, 200 Egyptian Made:

During the visits of Iraqi delegations to Egypt in the period from 1984-1987 the Egyptian side expressed readiness to cooperate in development of various rockets of longer ranges than sakar 18 and 30. Those rockets were in the preliminary study phase and no agreement was reached regarding their development. The following data regarding some of those rockets were given to the Iraqi side:-

Sakar-100:

Max range	75 km
Caliber	280 mm
Rocket weight	490 kgm
Warhead weight	150 kgm
Length	5990 mm
Loading type	Multi purposes (anti-personnel, anti-tanks, Mines carrier)
The fins	Movable
Fuel type	Mixture

Sakar-200:

Max range	120 km
Caliber	560 mm
Rocket weight	1500 kgm
Warhead weight	380 kgm (manufactured from the fiber glass)
Length	6335 mm
Loading type	Multi purposes (anti-personnel, anti-tanks. Mines carrier)
The fins	Fixed
Fuel type	Mixture

8.12.7 Prototype of 122 mm Rocket Aluminium Warheads (Spanish Made):

In 1987 ITE Company had dispatched 4-5 samples of 122 mm rocket warheads Spanish made; for tests and evaluation. No agreement was reached for supply.

8.12.8 Unifying of Sakar-30 and Sakar-18 Warhead Containers:

In 1987 the idea was proposed by the Egyptian side during the visit of Iraqi technicians to Egypt. Later on a letter in the form of an offer was received by the Iraqi side, but no agreement was finalized.

8.12.9 The Attempt of Developing Sakar-18 and Sakar-30 Warheads for Spraying:

In 1988 the Egyptians proposed to improve the function of Sakar-30 warhead by changing the allways fuse on the three canisters inside the warhead to a proximity fuse to improve the dissemination of the CW agent. No tests were carried out and no agreement reached.

8.13.10 DROP TANK INVESTIGATION:

In 1988 the idea for modification of the drop tank to be used for spraying C.W. agent was suggested for study by Research and Development Authority and some work was conducted in Al- Muthana but the work was inconclusive and the idea was abandoned in August 1988 when the war with Iran stopped.

In 1990 (end of Nov.) some of Al-Muthana personnel took part in a task for modifying the drop tanks for use in BW activity. Details of the effort are given in the BW FFCD.

The efforts came to nothing as the idea was abandoned due to outbreak of the war and the suspension of all activities.

SUMMARY TYPE OF MUNITIONS, OBJECTIVE AND PURPOSE OF THE FIELD TEST

Type of Muntion	Objective & Purpose	Type of Agent	Type of Test Used	Location Test	Date	Qty. Of Muntion Used	Result
1-Artillery shell 130 mm	a.determination of the effect of booster size on diss- emination of liquid	Oil	static	Jurf Al-Sakar	end of 1982	15-20	positive result
	b.determination of the effect of booster size on diss- emination of Tabun and the effect of Tabun on the lab. animals	Tabun	static	Bahr Al-Najaf	end of 1982	25	positive result
	c.Ditto	Ditto	dynamic	Bahr Al-Najaf	beginning of 1983	100	negativ e result
	d.determination of the effect of booster size-on diss- emination of Mustard and the effect of Mustard on the	Oil & Mustard	static	Al-Muhamadiat	beginning of 1983	10-12	positive result

	lab. animals							
	e.Ditto	Mustard	dynamic	Al-Muhamadiat	beginning of 1983	13	positive result	
2-Artillery shell 155 mm	a.determination of booster size for exploding the shell and dissemination of Agent	Oil	static	Al-Muhamadiat	1984		positive result	
	b.Ditto	Sarin	static	Al-Muhamadiat	1984		negative result	
	c.determination after effect of booster size dissemination of liquid	Oil	Static	Italy(SNIAPD)	1983	10-12	positive result	
3-Morter shell 120 mm 82 mm	a.determination of the effect of booster size-on dissemination of oil & liquid CS.	Oil + liquid CS.	static	Jurf Al-Sakar	end of 1982	10-12	positive result	

	b.Ditto	Ditto	dynamic	Jurf Al-Sakar	end of 1982	10-12	positive result
	c.determination of the effect of booster size on dissemination of powder CS.	CS. powder	static	Jurf Al-Sakar	beginning of 1984	10-12	positive result

	d.Ditto	Ditto	dynamic	Jurf Al-Sakar	beginning of 1984	10-12	positive result
4-Smoke Rocket (D.3000)	determination of the effect of booster size on dissemination of a mixture of CS. & smoke material	CS. powder	dynamic	Jurf Al-Sakar	beginning of 1983	6	negative result
5-RBG-7	a.determination of capability of RBG-7 for dissemination of Agent	Oil	dynamic	Jurf Al-Sakar	beginning of 1983	5-6	positive result
	b.Ditto	CS. liquid	dynamic	Jurf Al-Sakar	beginning of 1983	5-6	positive result
	c.Ditto	CS. powder	dynamic	Al-Muthana	beginning of 1988	20-24	positive result
122 mm Warhead (Firos-25)	a.determination of booster size for dissemination of Agents	Oil	static	Jurf Al-Sakar	1985	5-6	positive result

122 mm Warhead type Sakar-30	b.determination of contaminated area	Oil	dynamic	Jurf Al-Sakar	1985	5-6	positive result
	c.determination of Sarin on ground after its dissemination	Sarin	static	Al-Muthana	1988	6	positive result
	d.determination after effect of booster size dissemination of liquid	Oil	static	Italy(SNIA- BPD)	1984	6	positive result
	e.determination after effect of booster size dissemination of liquid	Oil	dynamic	Italy(SNIA- BPD)	1985	6	positive result
	a.determination distribution of canisters and dissemination of agent	Colored water	dynamic	Jurf Al-Sakar	bof 1988	10-12	positive result
Warhead Rocket 122 mm Saker-18	b.determination after effect of booster size dissemination of liquid	Oil	dynamic	Egypt	1984-1985	15-20	positive result
	a.determination of the effect of explosion to the agent and dissemination of it using lab. animals	Sarin	dynamic	Al-Razazah	beginning of 1987	30	positive result
	b.determination after effect of booster size dissemination of liquid	Oil	static	Egypt	1984	10	positive result

Iraqi Aluminum 122 mm Warhead	c.determination after effect of booster size dissemination of liquid	Oil	dynamic	Egypt	1985	50	positive result
	a.determination of booster size for exploding the warhead and dissemination of Agent	Oil	static	Al-Muthana	1987	10-12	positive result
	b.determination of agent dissemination and type of penetration and pit occurred	Oil	dynamic	Jurf Al-Sakar	beginning of 1988	5 - 6	negativ e result
	c. Modified Iraqi Aluminum 122 mm Warhead	Ditto	Ditto	Ditto Ditto	Ditto		positive result
	d. Ditto	Ditto	Ditto	Ditto Ditto	Ditto		positive result
Scud R-17	e. Ditto	Sarin	Ditto	Al-Muhamadiat	Ditto	10-12	positive result
	a.determination of booster size for exploding the warhead and dissemination of Agent	Oil	static	Al-Muhamadiat	1985	1	positive result
	b.To investigate the capability of this missile delivery mean for CW	water	dynamic	Al-Razazah	1985	1	positive result

Scud Al-Hussain	a.determination of booster size for exploding the warhead and dissemination of Agent	Oil	dynamic	Al-Salman	1990	1	positive result
OTHER TEST	b.To investigate the capability of this missile as delivery mean for CW	Spoiled Sarin	dynamic	Al-Salman	1990	1	positive result
	Artillery shell 130 mm	phosgen	storage test	Al-Muthana	beginning of 1983	10-12	negativ e result
	Always fuze	Oil	droppin g	Al-Muthana	1988	2-3	positive result
	Smoke generator	CS	----	Al-Haswa	1982	1-2	positive result
	L P G	L P G	----	Al-Muhamadiat	1988	20	negativ e result

GAZ Smoke canisters	Generation of smoke mixed with incapacitating agents	1-10% adamsite+ 10% CS+ 80%smoke generation chemical 2-10% 5-6 adamsite 90%smoke generation chemical 3-20% 5-6 adamsite 80%smoke generation chemical	----	Chemical proving ground	1988	5-6	negative result
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BINARY							
Artillery shell 152 mm propaganda	a. Investigation a delivers mean for Sarin using Binary system	Colored Water	Dynami c 4-5 tests	Jurf Al-Sakar	1988	10-12	positive result
	b. Ditto	DF+ISP	dynamic (4-5 tests)	Jurf Al-Sakar	1988	10-12	positive result
	c. Investigation a delivery mean for Mustard using Binary system	DG+PCI3	dynamic (without booster)	Jurf Al-Sakar	1988	4	negativ e result
	d. Ditto	TDG+PCI 3	dynamic (with different	Jurf Al-Sakar	1988	5-6	negativ e result
Artillery shell 155 mm	a. Investigation a delivers mean for Sarin using Binary system	Colored Water	dynamic	Jurf Al-Sakar	1989	10	positive result
	b. Ditto	DF+ISP	dynamic	Jurf Al-Sakar	1989	10	positive result
	c. Ditto	DF+ISP	dynamic	Al-Muhamadiat	1989	150	positive result
binary system warhead 122 mm	a. investigation delivery mean for sarin using binary system	Oil colored water	dynamic	Jurf Al-Sakar	1989	5-6	positive result
	b. Ditto	DF+ISP	dynamic (without explosiv e	Jurf Al-Sakar	1990	5	positive result

*AERIAL BOMB Spanish Bomb 250,500	a.determination of booster size for exploding the bomb and dissemination of Agent	Oil	static	Al-Muhamadiat	1983-1984	4	positive result
	b.determination of stability of the bomb through flying and dissemination of Agent	Oil	dynamic	Al-Muhamadiat	1983-1984	8	positive result
	c.Ditto	Oil	dynamic	Al-Razaza 1984		4	positive result
	d.Investigation of liquid CS dissemination	C.S liquid	dynamic	Al-Muhamadiat	1984	4	positive result
	e.Investigation of agent dissemination	Colored Water & Oil	dynamic	Al-Muhamadiat	1985	4	positive result
	f.Investigation of Sarin vapour effect on lab. animals located inside building	Sarin	dynamic	Al-Razaza	1987	4	positive result
	g.To determination	Oil + water	dynamic	Al-Habania air base	1985	2	positive result

AERIAL BOMB AL-QAQA 250-500	determination the stability of the bomb filled with liquid during flight.	Oil	flying	Al-Muhamadiat	1987	4	negativ e result
AERIAL BOMB AL- MUTHANA 250	a.Ditto	Oil	flying	Al-Muhamadiat	1987	4	positive result
	b.Generation of smoke from explosion of a bomb filled with white phosphors	White phosphor ous	Static	Al-Muthana	1987	4	negativ e result
	c.Ditto	White phosphor ous	dynamic	Al-Muhamadiat	1988	4	negativ e result
Al-Noaman (CB-250)	a.Investigation the capability of modified CB-250 as a delivery mean for C.W	Colored Water	static (droppin g	Al-Muthana bomblet	1988-89	20	positive result
	b.Ditto	Oil	dynamic	Al-Muhamadiat	1987	2	negativ e result Air Strip positive result
Aerial Bomb DB-2	a.determination of booster size for exploding the bomb and dissemination of Agent	Oil	static	Al-Muthana	1988	2	

Muthana 250with aluminum canisters	determination of stability of bomb during flight.	Oil	flying	Al-Muhamadiat	1988	4	negativ e result
Naser-7	determination of temp. for- med on the body of bomb due to the friction	inert material	dynamic	Al-Habannia air base	1986	4	negativ e result
Spanish Bomb SDN-750	Test Proto- type	Oil	dynamic	Al-Habannia air base	1986	4	negativ e result
Spanish Bomb SDN-750	Test Proto- type	Oil	dynamic	Al-Habannia air base	1987	4	negativ e result
BINARY 1-Aerial Bomb Al-Qaqa 250 (Body only)	Investigation a delivers mean for Sarin rapture of the using Binarydisc system	olored Water	Static incompl ete	Al-Qaqa	1989	2-3	
2-Al-Nasser 250 rapturing of the disc and inefficient mixing of liquids	Ditto	Colored Water	Static incompl ete	Al-Qaqa	1989	3-4	negativ e result

3-Al-Noaman CB-250 rapturing of the disc and inefficient mixing of liquids	Ditto	Colored Water	Static incompl ete	Al-Qaqa	1989	3-4	negativ e result
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SUMMARY

Types and Quantity of Munition Used in Field Tests:

- Artillery shells & warheads

<u>Item</u>	<u>Type of Munition</u>	<u>Qty</u>
1.	Artillery shell 130 mm	173-182
2.	Mortar shell 120 mm, 82 mm	40-48
3.	Smoke rocket D-3000	6
4	Artillery shell 155 mm	
5.	RBG-7	30-36
6.	122 mm warhead	16-18 (Firos)
7.	122 mm warhead	10-12 (Sakar-30)
8.	122 mm warhead	30 (Sakar-18)
9.	Iraqi aluminium 122 mm warhead	35-42
10.	Scud R-17	3
11.	Al-Hussain chemical missiles	2

- Binary Artillery shells

<u>Item</u>	<u>Type of Munition</u>	<u>Qty</u>
1.	152 mm	29-34
2.	155 mm	170
3.	warhead 122 mm	10-11

- Aerial bomb

<u>Item</u>	<u>Type of Munition</u>	<u>Qty</u>
1.	Aerial bomb, Spanish bomb 250, 500	30
2.	Aerial bomb SDN-500-750 (Spanish bomb)	8
3.	Aerial bomb Al-Qaqa 250-500	4
4.	Aerial bomb Al- Muthana 250	12
5.	Al-Noaman CB-250	2
6.	Aerial bomb DB-2	2
7.	Al-Muthana-250 with aluminium canister	4
8.	Naser-7	4

- Binary aerial bomb

<u>Item</u>	<u>Type of Munition</u>	<u>Qty</u>
1-	Aerial bomb (Al-Qaqa 250 body only)	1
2-	Aerial bomb (Al-Naser 250)	1
3-	Aerial bomb (CB-250)	1

The Firing Range & Fields :-

1- Jurf Al-Sakher field : It is a regular firing field for artillery and short range missiles (of not more than 35 Km), which belongs to Huteen State Establishment. It is located 25 Km. south west of Huteen Establishment across the Euphrates River.

The coordinates : E: 44 10 N: 32 46

2- Heavy bombers field : A regular field specified for the tests of the Air force only. It is located to the north side of Baghdad -Trebiel road, about 30 Km. to the west of Al-Ramadi.

The coordinates : E: 42 43 N: 33 26

3- Al-Muhammediat field : It is an open irregular uninhabited area for conducting tests of long ranges . It is located on the south side of Baghdad - Trebiel old road, about 60 Km. To the west of Al-Ramadi.

The coordinates : E: 42 38 N: 33 06

4- Al-Razaza site: An open area (irregular field), located to the south side of the parallel road to Al-Razaza lake which lead to Karbala city. Sometimes it used as artillery firing field.

The coordinates : E: 43 53 , N: 32 25

5- Bahar Al-Najaf site: An open and uninhabited area (irregular field), located on the south of Kerbala-Ukhaidher road south of Ukhaidher fortress.

The coordinates : E: 43 36 , N: 32 25

6- Air strip No.37: A regular field for the air force tests, located near the highway of Al-Ramadi-Heet about 30 km to the west of Al-Ramadi.

The coordinates : E: 42 54, N: 33 26

CHAPTER IX

FILLING TECHNOLOGY

9.1 FILLING

9.1.1 There were no specialized equipment for filling of chemical agents in the bombs. The equipment which have been used for filling of various munition were only simple equipment manufactured at AL-Muthana Establishment workshop, volume measurement depended on a standard vessel with a specific volume.

The glass tube fixed on the vessel side was to be monitored visually to fix the required quantity. This procedure was applied on the filling of artillery and aerial bombs. Hence, an equipment for filling with sensors (dosimeter & capacitor types) to estimate the volume, was developed to be used for filling the 122 mm Rocket plastic containers.

9.1.2 During filling problems appeared among which the following

- a. The volume reading was not accurate due to the material adhesion on the glass (specially mustard agent).
- b. Blockages in the joining part between the glass tube and the measurement vessel.
- c. Vision limitation caused by protection clothes worn by workers.

9.1.3 An attempt to install the filling equipment of nerve agent inside a cooled containers was made but was not completed.

9.2 Filling Station:

The filling station was constructed at the southern part of Al-Muthana. The filling station consist of two dual sheds erected during 1983, and three single sheds erected during 1986. The filling activity of different munition

were conducted at the filling station during which filling equipment were used; part of these equipment were manual and another semiautomatic locally manufactured. Also filling equipment was imported from Spain (ITE Company) it was received in 1985 and an attempt to modify those filling equipment were carried out before installation of these equipment but these filling equipment were not used for filling munition.

Then a part of these imported filling equipment were used in semiautomatic filling line which was manufactured locally. Different munition were filled with different

agent in the filling station during the period of the past chemical program and as follows:

- a. During 1983, aerial bomb type Br.250 were filled with Mustard agent.
- b. During 1984, Artillery shell 155 mm where filled with Mustard agent, aerial bomb caliber 250 and 500 where filled both with Mustard and Tabun agent.
- c. During 1985, artillery shell 155 mm were filled with Mustard agent and white phosphorus, Aerial bomb gauge 250 and 500 were filled with Mustard, Tabun and Sarin agent in addition aerial bombs were also filled white phosphorus and Napalm.
- d. During 1986, Artillery shell 155 mm were filled with Mustard agent, aerial bomb gauge 250 and 500 were filled with Mustard and Sarin agent Also 122 mm rocket were filled with Sarin.
- e. During 1987, artillery shell 155 mm were filled with Mustard agent, aerial bomb 250 and 500 were filled with Mustard agent also 122 mm rocket were filled with Sarin.
- f. During 1988, artillery shell 155 mm were filled with Mustard agent and aerial bomb gauge 250 and 500 were filled with Mustard and Sarin also aerial bomb type DB-2 were filled with Sarin in addition 122 mm rocket

were filled with Sarin.

- g. During 1990, artillery shell 155 mm were filled with Mustard agent and aerial bomb gauge 250 and 500 were filled with Mustard agent also aerial bomb type DB-2 were filled with Sarin and aerial bomb type R-400 were filled with mix of alcohol (Iraqi binary) in addition 122 rocket were filled with Sarin. Al-Hussain warhead were filled with Sarin and Iraqi binary.

Note : During 1988 a filling operation were conducted in P8 plant in Al-Muthana, through which aerial bomb 250 and 500 gauge were filled with Mustard agent also an attempted were carried out to install filling line for aerial bomb in Al-Muhammadiate site but it was not completed and no filling operation taken place in that site.

CHAPTER-10

Technical Assistance from Abroad

During the past chemical program support from several foreign companies was sought for the activities: construction, erection, installation, training, consultation and technology transfer at Al-Muthana as follows:

10.1 Construction of Production Building and Stores:

Company	Activity
- W. T. B. - Massar for Reinforcement concert / Egypt - Heberger	Construction of Falluja 1,2,3 Construction of (8) bunkers * Construction of (4) pilot plant H1, H2, H3 and H4 * Construction of production site Malik, Mohammed and Dhiaa
- Schwender	* Installation shelves at the main stores * Installation and training on the machines and equipment of the aerial bomb workshop in Al-Muthana.

10.2 Erection of Production Equipment

Company	Activity
- Pilot plant -	* Erection of pilot plant equipment at H1, H2 and the inhalation chamber at H4 * Erection of Ahmed plant equipment (Ahmed 1 and 2) also erection of Malik and Mohammed production plant equipment. * A joint work was conducted

between the Iraqi-experts
and pilot plant Co. expert
in the executive of DHIAA
project.

* Installation of coating unit
(hallar unit) and training
on coating.

* Erection of filtration unit
(by centrifuge) at Malik
plant.

- Auda

Erection of Chlorine plant at
Falluja 2 / (Al-Ma'moon) site.

- IT

Installation of filling line
for aerial bombs at the
filling station.

10.3 Erection of Utilities and General Equipment

Company
- Warmald

Activity
Erection of fire fighting
system at different sites of
Al-Muthana.

- Prussag

Erection of water treatment
system

Training and erection of the
cooling container.

- Sitac

Erection of water treatment
station

- W. E. T.

Installation of filling line
for insecticide (aerosol cans)

- Karl Kolb

Erection of Scrubber units for
R&D buildings.

10.4 Training

Company	Activity
- Schott	* Training course for glass blowing * Erection of glass pilot plant.
- W. E. T.	* Training course for special welding
-Ludwig hammer	* Training course on how to maintain the electrical equipment.
- Arabian org. industries (Sakar factory)	Assembling 122 mm rocket (Sakar 30) in Al-Shala site
- Buchi	Training on Erection and maintenance of Rotary evaporator type RX-185 (50 L. Capacity).
- Ceilcot	Training on Scrubber unit and maintenance of this unit.
- GIG	Training on Design the production unit.
- Herbert Arnold	Training on equipment of glass workshop
- George Fisher	Training on plastic welding
- FCA	A group from Al-Muthana visited HF plant in Italy.
- Foxboro	Training on control instrument

- Ducker

A group from Al-Muthana visited glass lined plant in Frankfurt in 1986.

- Coulter Counter

Training on the coulter counter machine in U.K.

10.5 Consultation / Technical Assistance

Company

- Kim-Khaleeg/Exomit

Activity

- Personal consultation for determining the specification of supplied PCl_3

- Supplying R&D method for preparation of choline without request from MSE. This happen because the company delivered 13 ton of 2-chloroethanol 48% which was refused by MSE at that time.

- IT

- Supplied specification for machinery which used in the Aerial bomb workshop.

10.6 Technology Transfer

Company

- W. E. T.

Activity

Supplying know-how for production PCl_3 & POCl_3 plant

- Kim-Khaleeg

Suppling know-how for TMP production plant

Chapter-11

MATERIAL BALANCE

Explanation of tables of chapter (XI)

11.1 The quantities of the produced chemical agents have been changed for the following reasons:-

11.1.1 The produced quantity that have been declared in Oct. 1993 depended basically on recollection of memory regarding importation of the raw materials and munitions.

11.1.2 Due to the progress achieved obtaining informations, concerning past importation of raw materials, through the LC document, information stated on barrels and information obtained from some suppliers through direct contact and some document from personnel heading the program, actual imported key precursors quantities enabling closer estimations of the production.

11.1.3 After completion of the destruction of the chemical agents and signing of the protocol regarding handing over AL-Muthanna state establishment, the numbers concerning the remaining quantities became more reasonable and resulted in changing the amount of the produced quantity.

11.1.4 Discussions were also carried out with a group of workers in the field of production in order to become acquainted with the amount of discarded agents through the course of years, which resulted in the correcting of the produced quantity.

11.2 The procedure of obtaining information concerning material balance.

11.2.1 The previous and present declarations depended

may give rise to negative or positive balance for the precursors actually used such as SOCl_2 , POCl_3 , HF, D.M.A.HCl and T.M.P.

- 11.3.2 There were many cases of losses of precursors as a result of the transfer of the materials from barrel using mechanical pumps.

Also this type of pump, as it is well known, fails in sucking of all the quantity in barrels leaving a residue of about 10 l.

As a result considerable quantities of such materials accumulated in the large number of the barrels, materials with positive balance like MPC, MG and T.D.G, show what have been mentioned clearly.

- 11.3.3 Due to the non-suitability of the containers for PCl_3 and to the continuous leak from the barrels, it was urgent need to transfer of this material to larger tanks of capacity of (45 m³, 60 m³ and 90 m³) this measure lead to loss of the remainder quantities which accumulated in the barrels as mentioned in item (b) above.

In addition to that the continuous leak in the larger

tanks for the period from 1989 to mid of 1993 made the difference in the balance was very large, Which was verified by CDG experts and we informed UNSCOM in letters about that.

- 11.3.4 It is likely that there is a cancelled L/Cs related to specific material or an L/C which was not delivered in total quantity of the material in the contract. The increase in the balance of NaCN is a good example for this.

11.4 Explanation concerning the discarded quantity of agents.

Item	Year	Mustard	Reason
		Qty. Discarded (Ton)	
a.	1985	40	Produced at 1982-1983 which stored in 300kg C.S container (blocked filling plugs).
b.	1985	10	Produced at 1984 and stored in 200 liter barrels.
c.	1985	10	Destroyed at filling station due to fire accident.
d.	1986	10	Broken of storage tank (PVDF tank) at filling station
e.	1988	30	Stored in 45 m3 storage tank and Iraq decided to get rid of the quantity after the end of the war.

Item	Year	Tabun	Reason
		Qty. Discarded (Ton)	
a.	1986	10	Using water jet to clean centrifuge
b.	1988	20	Discard after the end of the war 1988

Production & processing of all components of Iraqi's past chemical weapons programmes. Fact used for the material balance calculation which represent figures used in production and weaponization which is collected from senior people worked in production and filling of CW Agents.

1. MUSTARD (M.G) CALCULATION

A. M.G DENSITY 1.27

B. PCL3 DENSITY 1.56

C. SOCL2 DENSITY 1.66

D. TDG DENSITY 1.22

E. 1 TON TDG + OR $\frac{1 \text{ TON PCL3}}{2 \text{ TON SOCL2}}$ ----- 1 TON MG

F. AVERAGE PAYLOAD FOR 130 MM 2.5 KG. (the filling volume 1.9 L)
155 MM 4.5 KG. (the filling volume 3.5 L)
BR-250 76 KG. (the filling volume 60 L)
BR-500 153 KG. (the filling volume 120 L)

2. TABUN (T) CALCULATION

A. T.DENSITY 1.1

B. D4 DENSITY 1.36

C. POCL3 DENSITY 1.67

D. 1.3 TON POCL3 + 0.76 TON DMAHCL ----- 1 TON D4

1.1 TON D4 + 0.45 TON NACN ----- 1 TON TABUN (IT WAS USED
50% EXCESS OF NaCN IN
ORDER TO GET RID
OF ELABORATED HCl)

E. AVERAGE PAYLOAD BR-250 66 KG.

BR-500 132 KG.

3. SARIN (S) CALCULATION

A. S.DENSITY 1.12

B. TMP DENSITY 1.05

C. DMMP DENSITY 1.16

D. MPC DENSITY 1.4

E. MPF DENSITY 1.36

F. 1.1 TON TMP ----- 1 TON DMMP

1.344 TON DMMP+2.9 TON THYONILE ----- 1 TON MPC

1 TON MPC+0.33 TON HF ----- 0.7 TON MPF

0.76 TON MPF+0.5 TON IP ----- 1.25 GB (THE PRODUCT
INCLUDE'S 14.7 %
DICHLOROMETHEN)

0.55 TON MPF+0.15 TON IP+0.225 TON CYCLO -----1.15 TON
GB+GF
(THE PRODUCT
INCLUDE'S 28 %
DICHLOROM ETHE N)

G. AVERAGE PAYLOAD	BR-250	67 KG.
	BR-500	135 KG.
	DB-2	240 KG.
	122MM	7.5 KG.
	HUSSAIN	157 KG.

NOTE:

- ALL CALCULATIONS ARE BASED ON PERCENTAGE BY WEIGHT.
- THE TOTAL QUANTITIES OF PRODUCED AGENTS REPRESENT'S CRUDE QUANTITIES.

Table I

Material Balance

I T E M	YEAR		1981	1982	1983	1984	1985	1986	1987	1988	1990
1.	AGENT Produced (TON)	MG	10	75	150	240	350	350	899	494	280
		TABUN	-	-	-	60	70	80	-	-	-
		SARIN	-	-	-	5	30	40	209	394	117
		VX	-	-	-	-	-	-	-	2.4	1.5

TABLE II

I T E M	YEAR		1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
2.	PRECU RSOR PRODU CED (TON)	T.D.G	-	-	-	-	-	-	-	-	-	-
		SOCL2	-	-	-	-	-	-	-	70	-	-
		PCL3	-	-	-	-	-	-	-	-	-	-
		POCL3	-	-	-	-	-	-	-	-	-	-
		D.M.A	-	-	-	-	-	-	-	-	-	-
		HCL	-	-	-	-	-	-	-	-	-	-
		NaCN	-	-	-	-	-	-	-	-	-	-
		T.M.P	-	-	-	-	-	-	-	-	-	-
		H.F	-	-	-	-	-	-	-	-	-	-
		I.P	-	-	-	-	-	-	-	-	-	-
		CYCHLO- HEXNOL	-	-	-	-	-	-	-	-	-	-
		D4	-	7	10	50	150	180	-	-	-	-
		DMMP	-	-	-	15	60	250	586	114	-	-
		DMPH	-	-	-	-	-	-	-	-	10	28
		Pyro Phosphate	-	-	-	-	-	-	-	-	-	22
		P2S5	-	-	-	-	-	-	-	-	-	-
		Ethylen oxide	-	-	-	-	-	-	-	-	-	-
		Di isopropyl amine -	-	-	-	-	-	-	-	-	-	-

		2-Chloro ethanol										
		MPS	-	-	-	-	-	-	-	6 (85-90%)	-	-
		Monoester	-	-	-	-	-	-	-	0.8(50%)	-	-
		Choline MPC	-	-	-	-	-	-	5	50	3	-
			-	-	-	25	60	90	229	285	-	75 + 19
		MPF	-	-	-	10	30	34	127	229	-	100

TABLE III

I T E M	YEAR		1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
3.	PRECU RSOR PROCE SSED (TON) +++	T.D.G	10	75	150	240	350	350	899	494	-	280
		SOCL2 ++	20 MG	150 MG	300 MG	553 (480 MG + 73 MPC)	874 (700 MG + 174 MPC)	961 (700 MG + 261 MPC)	664 MPC	827 MPC	-	218 MPC +(38)
		PCL3	-	-	-	-	-	-	899	494	25	280+(67)
		POCL3	-	8	12	59	177	213	-	-	-	-
		D.M.A HCL	-	5	7	35	104	124	-	-	-	-
		NaCN	-	-	-	27	32	36	-	-	-	-
		T.M.P	-	-	-	17	66	275	644	125	-	-
		H.F	-	-	-	5	14	16	60	108	-	47
		I.P	-	-	-	2	12	16	40	134	-	31
		CYCHLO- HEXNOL	-	-	-	-	-	-	-	18	-	12
		D4	-	-	-	66	77	88	-	-	-	-
		DMMP	-	-	-	34	81	121	308	383	-	100
		MPC	-	-	-	15	43	49	181	327+ 22	-	143
		MPF	-	-	-	3	18	24	127	227	-	64
		DMPH	-	-	-	-	-	-	-	-	-	35 ++++
												19
		Pyropho sphot	-	-	-	-	-	-	-	-	-	-
		P2S5	-	-	-	-	-	-	-	8	-	-

	Ethylen oxide	-	-	-	-	-	-	2.5	25	1.5	-
	Di isopropyl amine -	-	-	-	-	-	3	35	2	-	
	2-Chloro ethanol	-	-	-	-	-	-	-	-	-	-
	MPS	-	-	-	-	-	-	-	2.5 (85-90%)	-	1.4 (85-90%)
	Monoester	-	-	-	-	-	-	-	0.35	-	-
	Choline	-	-	-	-	-	-	-	2.3	-	0.75

++ SOCI2 WAS USED TO PRODUCE MG & MPC, SO THE QUANTITY CONSUMED FOR EACH PRODUCT IS INDICATED.

+++ THOSE FIGURES REPRESENTS QUANTITY OF PRECURSORS CONSUMED ACCORDING TO THE PRODUCTION PROCEDURE.

++++ 3 TONE OF DMPH DESTROYED THROUGH ARM ACTION AT AHMED SITE.

TABLE IV

I T E M											
	YEAR		1981	1982	1983	1984	1985	1986	1987	1988	1990
4.	AGENT WEAPONIZED (TON) +++	MG	-	5	58	187	251	299	1051	410	182
		TABUN	-	-	-	60	69	10	-	-	-
		SARIN	-	-	-	-	23	15	121	507	66

++++ THESE FIGURES REPRESENT AGENTS WEAPONIZED ACCORDING TO AVERAGE PAYLOAD OF DIFFERENT MUNITION MENTIONED.

TABLE V

I T E M	YEAR		1981	1982	1983	1984	1985	1986	1987	1988	1990
5.	QTY.& TYPE OF EMPTY MUNITION PRODUCED LOCALLY	A.S(130MM)	-	4000	-	-	-	-	-	-	-
		A.S(155MM)	-	-	-	-	-	-	-	-	-
		AB-250	-	-	-	-	-	700	4000	5300	-
		AB-500	-	-	-	-	-	-	-	-	329
		R-400	-	-	-	-	-	-	-	-	1024
		DB-2	-	-	-	-	-	-	-	1360	-
		DB-0	-	-	-	-	-	-	-	-	-

		ROCKET	-	-	-	-	-	-	-	18500	-
		(122MM)									
		AL-HUSSAIN WARHEAD	-	-	-	-	-	-	-	-	75

TABLE VI

Item	Year			1981	1982	1983	1984	1985	1986	1987	1988	1990
6	Qty.& type of munition filed with agent	AS-(130MM)	M T S		2000	2000					-	-
		AS-(155mm)	M T S				6000	13500	3750	28849	3400	12500
		AB-250	M T S			700	1500 100	1600 150 150	1200 50 -	1013	130	950
		AB-500	M T S				300 400 -	450 450 100	1250 55 -	5522 - 65	2518 - 2694	350 - -
		R-400	M T S									- - ++++ 1024
		DB-2	M T S								- - 155	
		DB-0	M T S									
		+++++ ROCKET (122MM)	M T S						- - 2000	- - 15078	- - 12693	- - 8500
		AL-HUSSAIN WARHEAD	M T S									- - 50 ++++ +++

+++++ ALL THIS QUANTITY WERE FILLED WITH ALCOHOL TO BE MIXED WITH MPF WHEN NEEDED

+++++ THE PAYLOAD OF DIFFERENT KIND OF WARHEAD FOR ROCKET 122 mm AS FOLLOWS:

- WARHEAD WITH THREE TEFELZEL CANISTER (SAKAR 18) = 8 kg.
- WARHEAD WITH TWO P.E CANISTER (SAKAR) = 7.8 kg.
- WARHEAD WITH THREE TEFLON CANISTER (SAKAR 30) = 5.4kg.
- WARHEAD WITH TWO P.E CANISTER (VIROSE) = 7.3 kg.

+++++ FROM THIS 50 WARHEAD 16 WERE FILLED WITH SARIN, THE REST 34 WARHEAD WERE FILLED WITH ALCOHOL TO BE MIXED WITH MPF ON REQUEST.

(CONCLUSION)

TABLE VII
MATERIAL BALANCE OF PRECURSOR AND KEY PRECURSOR
CHEMICALS

I T E	CHEMICAL	D4	DMMP	MPC	MPF **	T.D.G	SOCL2	PCL3	POCL3	D.M.A HCL	NaCN ***	TMP	HF ****	IP	CYCLO- HEXANOL
	QTY(TON)														
1	IMPORTED	-	5	-	-	3225	4200	4187	946	570	866	921	431	700	150
2	PRODUCED	397	1025	***** 765 (+19)	530	-	70	-	-	-	-	-	-	-	-
3	USED IN PRODUCTION OF C.W AGENT	23 1	1028	@ 757 (+22)	463	2848	@@ 4567 (+38)	@@@ 1673 (+92)	469	275	95	1130	250	235	30
4	USED TO PRODUCE OTHER CHEMICAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	DESTROYED THROUGH ARM- ACTION	-	-	-	9	120	100	-	-	30	-	-	-	-	105
6	DESTROYED BY IRAQ	-	-	-	30	-	-	-	-	-	-	-	-	-	-
7	DESTROYED UNDER U.N. SUPERVI SION	166	-	-	20	188	282	650	576	272	180	-	7	200	-
8	BALANCE	0	+2	+5	+8	+69	-717	+1772	-99	-7	+191	-209	-27	233	+15

NOTE :

** These quantities of DF (30 + 20 + 9) ton which is destroyed by Iraqi side (30 ton) or under U.N supervision (20 ton) or during army action (9 ton) are reserved from the total quantity. Produced of DF (530 ton) to fill R-400 & Al-Hussain warhead and there quantities does not appear as final product (Sarin) in the declared quantity in table No. 1 (795 ton).

- DF was destroyed during SUMMER 1991 as follows:-

- a. 6.5 ton in Airstrip - 37.
- b. 4.5 ton in Saddam Air base.
- c. 13 ton in AL-Kadissia Air base.
- d. 1.7 ton in AL-Nibbaiee.

- e. 1.5 ton in Saad Air base.
- f. 3.2 ton in Talha Air Strip.
- *** 400 Ton were re exported in 1989 To MELCHEMI.
- **** 200 Ton were sent to ARADET in the beginning of 1991.
- ***** 19 Ton MPC (75% purity) were produced in 1990 Using DMPH.
- @ 22 Ton were used to produced MPS
- @@ 38 Ton of SOCl₂ were used to produced MPC from DMPH, in 1990.
- @@@ 92 Ton of PCl₃ used to produced DMPH.
- (15) Ton of Cyclohexanol sent to modern paint industry in 1991.
- (500) Ton of Isopropyl alcohol sent to modern paint industry in 1991.

TABLE VIII

MATERIAL BALANCE OF C.W AGENT

ITEM	AGENT / (ton)	MG	TABUN	SARIN
1.	QTY PRODUCED	2850	210	795
2.	QTY WEAPONIZED	2443	140	732
3.	QTY STORED	-	-	-
4.	QTY DISCARDED THROUGH ARMACTION	-	-	-
5.	QTY DESTROYED BY IRAQ	100	30	0
6.	QTY DESTROYED UNDER U.N SUPERVISION	295	40	76
7.	BALANCE	+12	0	-13

Material balance of precursors chemicals for VX
(Total Qty. for VX & VX-HCl = 3.9 Tone)

precursor type	P2S5	ethylene oxide	Di iso propyl amine	2-chloro ethanol	MPC	MPS	mono ester	choline
QTY Imported/ ton	250	39	250	202	--	--	--	--
QTY produced/ ton	--	--	--	--	784	6 * (85- 90%)	0.8 *** (50%)	58

QTY processed/ ton	8	29	40	--	22	3.85 (80-85%)	0.35	3.1
QTY destroyed through arm action /ton	85	--	174	200	--	--	0.05	--
QTY destroyed by Iraqi side /ton	157 **	--	--	--	--	1.625 (85-90%)	--	55
QTY used in prod- uction other chemical/ton	--	--	--	--	757	--	--	--
QTY destroyed under UN supervision /ton	--	10 ton remained & returned back to Iraq	22	1.9	--	--	--	--
Balance	0	0	+13	0	+5	0	0	0

* 0.5 (85-90%) ton was polymerized and discarded in 1988.

** At Falluja / Saqlayia.

*** One batch (400 Kg) polymerized and discarded.

- (12) Ton of Di isopropyl amine sent to modern paint industry in 1991.

CHAPTER XII

UNILATERAL DESTRUCTION

12.1. Cease-fire and Iraq's declarations:-

It must be recalled that Iraq was subjected to continuous air bombardments and cruise missile attacks lasting 42 days in which more than 100 000 tons of explosives were dropped all over the country targeting military and non- military industries and infrastructure. After the cease- fire and acceptance of SCR 687 Iraq was troubled by foreign inspired and backed rebellions which lasted for about one month leaving a relatively short time for consideration of the questions related to the declarations required under section C of SRC 687.

It was argued that the most important items of immediate concern to the SC were the hardware items of chemical weapons deployed, bulk chemical agents in stores, as well as the missiles of certain range beyond tactical.

Therefore lists of such items that could generally be located and secured were hastily drawn up and presented by mid April 1991. However, questions pertaining to incomplete projects, inconclusive endeavors, R & D activities etc. were to be subject to future declarations with UNSCOM teams when they visit Iraq. In view of the length of the Iraq-Iran war which lasted eight years and the expansion of the CW activities beyond the scope of the known agents produced and filled into munitions which were identified in the declaration it was decided to avoid possible complications during UNSCOM visits and to trim the size and scope of the programme by unilaterally destroying a number of items given in Chapter -Unilateral destruction.

It must be remembered that the people involved in the implementation of SRC resolution just emerging from a vicious and destructive war, lacking in experience in an entirely new field of work requiring different frame of mind and perceptions, desiring to save as many as possible general purpose equipment, materials and assets from destruction, trying to avoid expanding the area of the work with UNSCOM teams beyond the important items contained in the declarations led to unilateral destruction. There was no intention whatsoever to disregard SCR 687 of rendering harmless all weapons etc. ...

There was no intention to give false or incomplete declarations regarding the above mentioned areas which were considered as the most important. However, activities such as R & D, documentations of whatever kind and other efforts in

non CW production areas were not considered as important information for the declaration purpose.

During that period it was argued that some unimportant items as yet undeclared should be partially or totally concealed and all materials relevant to their existence to be unilaterally obliterated as their revelation would complicate matters and prolong the process with UNSCOM.

The areas covered by that decision concerned the following:

1. Some aspects of the Vx programme concerning the spoiled quantities produced, and the existence of some remaining precursors such as P2S5 and choline.
2. The DF precursor filled in jerrycans at air bases together with the R-400 aviation bombs filled with alcohol as well as 20 Al-Hussain warheads filled with alcohol together with DF additive in jerrycans.
3. Remaining empty munition shells and casings as yet undeclared to UNSCOM teams for being as components for conventional munitions.
4. 125 aerial bombs BR-250 filled with CS stored at airstrip 37 as they were not declared in the first declaration and were not considered an item of importance as they were not intended as chemical weapons but were to be used to mislead the enemy.
5. The documentations especially know-how and production documentations

It is seen from the above instances that there was no criteria for the decisions of unilateral destructions and no obvious logic governing the choice of items concealed.

Rather personal perceptions and some mistaken assessments of the area in question played a major part in those actions. The reasons for the unilateral destruction can be summed up by the wish to avoid complications and to down size the CW programme leaving the essential elements.

It must also be remembered that the minister in charge of MIC was H.K and he was not in favour of cooperation with UNSCOM. In retrospect considering his defection and subsequent revelation of his views it could have been that the decision for unilateral destruction, which was certainly his decision, was made to complicate relation with UNSCOM rather than to simplify the task of the commission as the personnel involved were led to believe.

12.2. UNILATERAL DESTRUCTION OF EMPTY MUNITIONS:

The order for unilateral destruction of all undeclared items, materials and documentations was a blanket order from MIC's highest authority (H.K) communicated orally to all establishments involved directly or indirectly . The destruction was on the responsibility and peril of the establishments themselves except for the important know- how documentations which were to be collected and handed over to H.K personal staff for supervised destruction as the establishments were informed later.

The documentation thus collected appeared in Aug. 1995 in the chicken farm of H.K.

12.2.1. Empty Munitions:

Empty munitions were first considered as unimportant item and due to lack of complete information on the inventory they were not included in the declarations of April and May 1991.

However, at the same time it was argued that any empty munition found later could be useful as components or raw materials for conventional munitions and other valuable materials could be recycled for other industries. So unilateral destruction was carried out in the second half of 1991 (July-Aug. 1991) by teams from Al-Muthana at different sites to implement the oral instruction from D.G of Al-Muthana about the destruction of the items which were regarded as unimportant in order to avoid contradiction with the 1st Iraqi declaration (May 1991) as detailed below:-

12.2.1.1 Mosul Electric Stores:

Different types of empty munition were stored in these warehouses in the second half of 1990 including:

- (2000) 122 mm rocket type Sakar 30
- (4990) 122 mm rocket type firos 25 (carbon steel warhead)
- (4865) 122 mm rocket type firos 25
- (3520) 122 mm aluminium warheads

The destruction was carried out according to the following:

- Sakar warheads were taken to a remote area called Bakhara and destroyed by demolition explosion
- All the Firos 25 warheads were first destroyed by crushing or by cutting by arc welding and then the remains were taken to the foundry of Nassar State Establishment and reformed to ingots.
- The aluminium warheads were first crushed and then taken to Ur foundry and reformed to ingots.

All the above were verified by UNSCOM team (8) lead by Jim Knapp (for the verification See doc. V11 in verification chapter XIV).

12.2.1.2 Haditha Munition Stores:

(4000) empty 122 mm rocket Sakar 30 were stored there. The empty Sakar rockets destroyed in a nearby area by demolition explosion.

(2950) 122 mm rocket type firos 25. The empty 122 mm rocket type firos 25 (warheads) were destroyed at Al-Nassar foundry.

Verification of destruction was carried out by UNSCOM team (8). (for the verification See doc. V11 in verification chapter XIV).

12.2.1.3 Al-Muthana and Al-Tharthar:

(1640) rocket 122 mm type (firos) which had been stored at Al-Muthana were translocated to Al-Tarmiya to open the warheads and transfer them to Nasser foundry to be melted.

(1980) rocket 122 mm type (firos) which had been stored at Al-Tharthar stores (located near Falluja/III site) were translocated to Al-Ramadi in order to open the warheads and then the warhead transferred to Nasser foundry to be melted.

(1000) C.S warhead 122 mm which had been stored at Al-Muthana were translocated to Al-Ramadi then transferred to UR Establishment in Nassariyah in order to molt the aluminium canisters at their foundry and the warhead transferred to Nassir foundry to be melted.

Verification of destruction was carried out by UNSCOM team (8) (for the verification See doc. V11 in verification chapter XIV).

12.2.1.4 Tigris Canal (Kilo 28):

1975 empty aerial bombs gauge 250 (1225 Muthana 1 and Muthana 2 750 aerial bomb type LD 250).

25 empty aerial bomb type Muthana 4 (radiological bomb).

The above were destroyed by cutting the bombs with oxy acetylene, and then transferred to East of Baghdad railway station to be sent afterward to the steel foundry in Basrah.

This was verified by UNSCOM team (8). (See verification chapter Doc. V.11).

12.3. Unilateral Destruction of Filled Munitions:

12.3.1. Aerial bomb R-400 filled with alcohol (Iraqi Binary system)

At the end of the military operations, R-400 stored in different air-bases (which were not declared before) were destroyed in July 1991 by demolition explosion in the same air-base where the bombs were stored as follows:

<u>Location</u>	<u>Quantity</u>
Saddam Air-base	80 (destroyed and buried in a nearby location)
Al-Kadisiyah Air-base	240 (destroyed and buried in a nearby location)
Sa'ad Air-base	28 (destroyed and buried in a nearby location)
Tamoz Air-base	120 (destroyed and buried in a nearby location)
Talha Air-base	60 (destroyed and buried in a nearby location)

These aerial bombs were destroyed according to instruction from DG of MSE to air force in order to destroy the bombs and jerrycans in the air bases. Representatives from Al-Muthana were present at the air bases to supervise the destruction of these bombs which were not declared previously.

(1056) plastic containers (20 liter capacity) containing DF were also destroyed at the above-mentioned sites.

Verification of destruction was carried out later by UNSCOM team (8). (for the verification See doc. V.14, V.15 for the destruction of R-400 at Al-Kadissya and Tamuz air bases and See also the doc. of a letter from MSE to MIC dated 5 Jan. 1991 which was received by UNSCOM in 8 Dec. 1995).

12.3.2 Al-Hussain Warhead filled with Alcohol (Iraqi Binary System):

In July 1991, 15 Al-Hussain Warheads stored in Al-Falluja forest and 5 warheads stored in Al-Tharthar stores were transferred to Alnibae area. There all the warheads (20) were put in a large ditch dug for this purpose and they were destroyed by demolition explosives and some conventional exploded on top.

The other component of the Binary system the DF was destroyed by draining into scattered pits in the area. A letter from MSE to MIC dated 5 Jan. 1991 which was received by UNSCOM in 8 Dec. 1995 confirm the total number of Al-Hussain warheads (50 warhead) and showed that (35) of them had been filled with Iraqi binary and the rest (15 warhead) had been filled with mixture (GB, GF). This doc. confirm that the (20 warhead which unilaterally destroyed had been filled with Iraqi binary and never filled with other agents as suspicion raised by UNSCOM about these warheads.

12.3.3 Aerial bombs type 250 filled with CS:

In Summer of 1991, 125 Aerial bombs filled with CS were destroyed by demolition explosives in the Airfield 37.

Verification was carried out by UNSCOM team (8).

The reason for unilateral destruction of all the items under paragraphs 12.2 and 12.3 mentioned above were in order to avoid intrusions in air-bases in general and not to conceal a particular item. Clearly, type 250 bombs filled with CS cannot be considered an item to be concealed from UNSCOM.

- As for the reasons for failure to declare the unfilled munitions which were stored out side MSE by the end of 1990 it was simply because the stores and depots where the unfilled munitions were stored were reported as total losses

due to their bombardment by allied forces. Later it appeared that some stored material especially unfilled munitions survived the bombardments and when they were found after the declaration they were unilaterally destroyed.

- However, the motors of 122 mm rockets were not destroyed at the time were transferred in 1992 to Al-Qaqa State Establishment as the motors were common to conventional 122 mm rockets. However, Al-Qaqa St. Est. after analysis found that the propellant used was exposed to high temp. and was unstable. The quantity of motors involved about 20000 units were stored at Dijla-2 site. It was moved and destroyed under Al-Qaqa supervision.
- The empty 122 mm warheads were not transferred to any establishment for use in conventional munitions because their design and internal dimensions were unsuitable and no party was interested in the material. Therefore it was destroyed.

12.4. Unilateral Destruction of Raw Materials, Precursors and agents:

In 1991 the Iraqi declaration did not include Vx since all production attempts failed due to instability problems.

However, large amounts of precursors were imported based on the successful research and development results and the presence of such large quantities hastily imported was difficult to explain and it was decided to obliterate the Vx programme and unilaterally destroy all its precursors.

12.4.1 Choline:

In July 1991 a team was assigned to carry out the destruction of about 55 ton of holine filled in 200 liter barrels and stored in 4 shipping containers. These containers were taken to a site North of Sammara city (West of Kassir Al-Ashiq).

The contents of the barrels were drained on the ground from a level area. The destruction site was inspected by the CG group and samples were taken from soil and barrels found at the site in Oct. 1995 for verification purposes.

This precursor was destroyed according to the oral instruction from DG of MSE to the production manager to destroy every thing related to VX (See doc. IV.3 chap. XIV).

12.4.2 Phosphorus Pentasulphide:

P2S5 (157) tons was stored at Dijla warehouse together with isopropanol, cyclohexanol, ethanol, di- isopropylamine, chlorobenzene, and dichloroethane all of which are general purpose chemicals which were used to be transferred for use in chemical and paint industry. However, the Company "Modern Paint Industry" picked up all the solvents and did not have any use for the P2S5. By that time it was too late for including the material in the declaration and consequently was transferred to a dumping site in Al-Saqlawiya area N: 33 23 E: 43 42 and

destroyed by mixing it with sand and burying it in Oct. 1991 according to oral instruction from the DG of Al- Muthana.

Verification of destruction was carried out by UNSCOM team (8). and CG groups from BMVC visited the site several times and samples was taken for the purpose of verification.

12.4.3 MPS:

The remaining quantity of produced MPS about (1625) kg was destroyed by the Iraqi side, by adding water to the barrels of MPS at Diha'a site in Summer 1991. The unilateral destruction of MPS was for the same reasons given for choline above.

12.4.4 (DFP) Di-isopropyl Phosphoro-fluoridate (2) Tons:

This material was produced in (1987) as pesticide against locust which was expected that year to enter Iraq from Saudi Arabia. However, it is classified as a weak CW agent, but was never adopted by Al-Muthana as Cw agent. Not desiring to enlarge the list of agents produced it was decided to destroy it without declaration. It was hydrolized with caustic soda at Al-Muthana in Summer 1991. The material is found in the inventory list of the final agents and precursors in stores of 31.12.1990 (See Verification Ch. doc. II.2.)

12.4.5 Pyrophosphate (adimer of DMPH of unidentified structure):

There was about 3 tons of this material remaining from a quantity of 22 tons, 19 tons of which were processed to MPC. The 3 tons remaining was considered unimportant and was destroyed when cleaning up Dhiaa Plant site. Refer to scrap of paper where orders for destruction are jotted down. (See Verification Ch. doc. IV.4)

12.4.6 Spoilt Vx:

The spoilt Vx which were produced in 1988 and 1990 which had degraded down to zero as the lab. analysis over a period of 3 weeks show together with other materials was destroyed in Summer 1993 under the eyes of UNSCOM CDG 38 without them knowing the exact nature of the materials in the containers being destroyed. Another quantity about 400 kg which were filled inside aviation bombs at the beginning of 1988 which was also completely spoilt had been disposed off in 1988.

The reasons for destructions were to avoid complications that might arise concerning the actual production of such an important CW agent notwithstanding the fact that the effort was not successful.

All the above mentioned unilateral destruction of the raw materials, precursors and agents have been carried out in order to trim down the CW programme, avoid complications that might arise from contradictions with previous

declarations etc. None of those reasons involve the intention to conceal important programmes for future use.

12.5 Unilateral Destruction of Al-Muthana Documentation:

12.5.1 Late 1990 an order was issued by MIC to evacuate all Al-Muthana documents, to implement this order most of the documents were transferred to air raid shelters within Al-Muthana many times until mid of 1991 where they were gathered, and stored in an unfinished house in Samara.

12.5.2 All the documents were transferred to Baghdad, many of these documents were destroyed in the presence of representatives from different directorates in Al-Muthana, which they classified and burned the documents of their directorate according to their personal assessment. After that the remaining classified documents were gathered.

12.5.3 Some documents from Agargoof site were transferred to Al-Falluja.

All the documents were destroyed except some important documents as follows:-

A- Computer Disks	Central library
B- Important Documents	Central library
C- Microfilm	Central library
D- Contracts of purchasing	Trading dept.
E- Documents of planning dept.	
F- Know-how	R & D dept.
G- Personnel files Directorate	Administrative

Some of these documents were returned back to their directorate and an order to destroy all the documents related to the past chemical programme the remaining documents which were classified as very important documents were packed in 12 boxes in addition to a box for the documents of D.G office (i.e total of 13 boxes) were delivered to persons directed by Hussain Kamil.

The contents of these boxes are as follows :-

- 1- Flow charts of production plants + R&D document.
- 2- Operations catalogue + Flow charts of production plant.
- 3- Flow charts of Nasser factory + financial files.
- 4- Flow charts of Nasser factory.
- 5- Scientific literature + special document of MSE.
- 6- Analytical researches + special document of MSE.
- 7- Computer disk, slides, and studies.
- 8- Microfilm + video cassette and slides.
- 9- Researches + studies + flow charts of production plant.

- 10- Microfilm + know-how (7201).
- 11- Flow charts + microfilm + slides.
- 12- Quality control studies.
- 13- Assorted special documents from the office of the General Director.

12.5.4 The above mentioned movements of the documents were written in a report in 1991 see the report handed over to the U.N. Special Commission in Dec. 1, 1995 and the video tape showing their storage at the unfinished house in Samara.

12.6 Location where chemical weapons were stored (Quantities and Types):-

12.6.1 There were no chemical munitions stored outside AL-Muthana Establishment site until the end of 1987.

12.6.2 When the need appeared to find alternative places for storing other than AL-Muthana Establishment, AL-Muhamadyat site was chosen as an additional storing site for the filled chemical munitions.

12.6.3 The chemical munitions normally stored in AL-Muthana Establishment site. (There were (8) underground stores provided with all conditions required for storing chemical munitions.

In addition those stores were protected against aerial raids and all measures required for the protection of the stores area against any external threat).

12.6.4 Some times the filling station in Al-Muthana were used for temporary storing particularly the newly filled munitions.

2.6.5 Location of filled munition:

12.6.5.1 In July-August 1990 Aerial bombs type R-400 were distributed in different air-bases and they were filled with alcohol 40 liters for each, and also each bomb supplied with two plastic containers in each 20 liters of D.F. so as to be mixed in the base when needed.

The distribution was as follows:

<u>Location</u>	<u>Quantity</u>
Al-Waleed Air-base	176
Saddam Air-base	80
Al-Kadisyia Air-base	240
Suad Air-base	28
Tamuz Air-base	120
Talha Air-base	60

Murasana Air-base	160
Al-Tabaat Air-base	160

12.6.5.2. At the beginning of Jan. 1991 and before the war, the chemical munitions were distributed (10-15 Jan. 1991) as shown below :-

(to avoid exposing the cities located near Al-Muthanna site to any risks if the establishment was bombed) and to keep the munition in safe place to avoid direct bombardment.

Aerial bomb filled with mustard were distributed between 10-15 Jan. 1991 as follows:

Storing site	Qty.	Munition
AL-Muhamadiyat	200	aerial bomb 250
Saddam air-base	315	aerial bomb 250
Saddam air-base	90	aerial bomb 500
AL-baker air-base	25	aerial bomb 250
AL-baker air-base	135	aerial bomb 500
AL-kadisiya air-base	135	aerial bomb 250
AL-kadisiya air-base	315	aerial bomb 500
AL-Tuz	225	aerial bomb 250
AL-Tuz	135	aerial bomb 500
Tamoz base	200	aerial bomb 250

12.6.5.3 122 mm rocket type Sakar 18 filled with Sarin were distributed between 10-15 January 1991 as follows:

Al-Mymona Munition Stores	4100
Al-Aukhader Munition Stores	2160
Al-Khamysia Munition Stores	2160

12.6.5.4 155 mm Artillery shell filled with Mustard were distributed in the period 10-15 January 1991 as follows:

Al-Aukhader Munition Stores	6394
Al-Nassiriyah Munition Stores	6240

12.6.5.5 Missile corp received (50) Al-Hussain warheads from MSE, 16 of which filled with Sarin and the rest was filled with Iraqi binary the distribution of these warhead to different site was mentioned in this Chapter.

12.6.5.6 125 Aerial bomb gauge 250 filled with CS were distributed in Airfield 37.

12.6.5.7 12 aerial bombs type DB-2 filled with sarin were stored in Al-Mouhamadiyat.

12.7. Location of empty munition:

Since 1983 the empty munition procured through the army to Al-Muthana, these empty casing were stored in several army stores. Then this empty casing withdrawn by Al-Muthana according to their needs.

12.7.1 Al-Aukhader munition stores:

12.7.1.1 Aerial bomb Br500 (2500), stored between 1983-1986
Aerial bomb Br250 (5000), stored between 1983-1986

12.7.1.2 Artillery shell 155mm (40000)-stored between 1984- 1988.

12.7.1.3 Mortar shell 120 mm.

12.7.2 Al-Taji munition stores:

12.7.2.1 (35000) Artillery shell 155mm - stored between 1985- 1990.

12.7.2.2 (1500) Aerial bomb AALD 500 - through 1987.

12.7.3. Salah Al-Deen munition stores:

12.7.3.1 (5000) rocket 122 mm type Firos 25 (carbon steel) stored between 1985-1990.

12.7.3.2 (5000) rockets 122 mm type Firos 25 - stored between 1988-1990

12.7.3.3 (2000) Aerial bomb AALD 500 - stored through 1987.

12.7.3.4 (2500) rockets 122 mm type Sakar 30 - stored between 1986-1990.

12.7.4 Haditha munition stores:

12.7.4.1 (3000) rocket 122 mm type Firos 25 (carbon steel) stored between 1986-1991.

12.7.4.2 (4000) rockets 122 mm type Sakar 30 - stored between 1986-1991

12.7.4.3 (4000) rockets 122 mm type Sakar 18 - stored between 1989-1991

12.7.4.4 (1000) Aerial bomb AALD 500 - stored between 1987- 1990.

12.7.5. Dijlah munition stores:

(2000) Aerial bomb AALD 500 - stored between 1987-1988.

12.7.6 Al-Hadar munition stores:

(1500) Aerial bomb AALD 500 - stored through 1987.

12.8. Al-Hussain Chemical Warhead:

12.8.1 Filling:

12.8.1.1 In June 1990 the filling of chemical warheads were started when the first batch of them dispatched to Al-Muthana.

The filling was carried out in Al-Muthana filling station.

12.8.1.2 Sixteen warheads were filled with GB or mixture of (GB+GF) and completed in mid or end of July 1990.

12.8.1.3 The filling of Iraqi Binary type was started from mid of August 1990 to end of Oct. 1990. The filling of this type was conducted by splitting the GB precursor in two container one of them was in the warhead which contain the mixture of alcohols (IP + cyclohexanol) and the DF which was placed in plastic container of 20 lit. capacity.

12.8.2 Distribution of Chemical Warheads:

12.8.2.1 The warhead filled with (GB+GF) mixture. The total number of those type were sixteen warheads which were distributed as follows.

12.8.2.1.1 The first batch of four warheads were transferred from Al- Muthana to Al-Mohammadayat in the end of June 1990.

12.8.2.1.2 The second batch of twelve warheads were transferred to Al-Mohammadayat in mid or the end of July 1990.

12.8.2.1.3 After the 2nd of August 1990 events, the distribution of the (16) warheads was carried out and they were transferred as follows, six of them were stored at Kubisa forest, and ten warheads stored in a site called Abu Yazid Al-Bustamy near Al-Mohamady.

12.8.2.1.4 Collection and redistribution of warheads took place again as follows:

(12) warheads at Falluja forest adjacent to Baghdad -Falluja highway and the rest of them (i.e. four warheads) were stored in a location near Taji bridge.

12.8.2.1.5 After cease-fire all the sixteen warheads were transferred to Al-Dujella site and were declared to UNSCOM.

12.8.2.2 The Warhead of Iraqi Binary System.

The total number of those types were thirty four warheads, which were distributed as follows:

12.8.2.2.1 In mid of August 1990 (fifteen) warheads of type (A + B) (i.e. Iraqi Binary) were transferred to Falluja forest.

12.8.2.2.2 Ten warheads were stored in Tel Zagareed near Tigris canal in Sept 1990.

12.8.2.2.3 In the beginning of Oct. 1990, the last batch of nine warheads of the same type were stored in Tharthar stores near Dujla store.

12.8.2.2.4 After cease-fire, (14) warheads of the 34 (A + B) type were transferred to Dujella, and declared to UNSCOM in April 1991.

12.8.2.2.5 In Summer 1991, twenty warheads of the 34 (A + B) type were destroyed by Iraqi side in Al-Nebbae (unilateral destruction)

12.8.3 Transportation of Warheads:

12.8.3.1 Warheads were transferred from Al-Muthana to the indicated stores or sites, according to security regulations of MSE. a convoy consist two security cars, water tanks, pick-up loaded with decontamination materials and protection equipments.

12.8.3.2 Transportation of warheads by the missile corps was carried out in the same procedure as mentioned above with available facilities, such as security car and number of water containers instead of water tanks if not available as well as protection equipments and decontamination materials to be used in case of emergency.

12.8.4 Unilateral Destruction of Warheads:

12.8.4.1 In Summer 1991, an instruction was issued by MIC to destroy the warheads as well as the other prohibited items. The missile corps was informed to select a site for destruction and to prepare a number of pits to occupy the warheads to be

destroyed and other facilities (i.e. explosives, wires, engineering office's ... etc.). However, the site chosen was Al-Nebaa.

12.8.4.2 Fifteen warheads of type (A+B) were transferred from Falluja forest and (5) warheads of the same type were transferred from Tharthar store (near Dujla stores). The total quantity (twenty warheads) were placed in large pit in their containers.

The containers were arranged one besides one, then 20-40 kg of explosives were placed on each container, wired together and detonated to be destroyed.

12.8.4.3 Most of the scattered fragments were collected by shovel and placed in same pits and buried, then number of expired conventional aerial bombs were exploded

12.8.4.4 Prior the destruction of warheads, a disposing of (DF) was carried out, where all containers of DF were transferred to Al-Nibbae too, and were drained in small muddy area.

12.8.5 Coordination with Missile Command:

12.8.5.1 Coordination between Al-Muthana and Missile Command prior the transferring of first batch of warheads of type A. A small group headed by Mr. R. Manhal was formed to conduct a training to small group from Missile Command to dealing with chemical warheads as well as taking the proper measures in case of emergency using protection equipments and decontaminates.

12.8.5.2 When the warheads were transferred from Al-Muthana, a group from Al-Muthana accompanied the convoy, while the group of Missile Corps accompanied the convoy which transferred the warheads between their units from time to time. However, the Missile would call Al-Muthana group in case of emergency to deal with the situation.

12.8.5.3 After the successful of Iraqi Binary, Al-Muthana group was trained missile group for mixing the GB precursors.

12.8.5.4 Three metal stands for filling warheads were prepared and transferred to Missile Corp and they were distributed in their units to be used in case of mixing the precursors.

12.8.5.5 The personnel were familiarized with the requirement for mixing the precursors known as the Iraqi binary. However, liaison officers were nominated to help the missile command in this task if needed in order to supervise the mixing and to make sure of safe handling absence of leakages.

CHAPTER XIII

Miscellaneous

13.1 Relations with Individuals, Agents, and Companies:

13.1.1 The following explanations are given in answer to questions raised during meetings with UNSCOM on different occasions. Relationship between Mr. Frans, Mr. Tanaka and Oriac Company:-

Mr. Tanaka purchased all the chemicals from Japan in accordance with orders from Mr. Frans. Oriac purchased from United States Companies recommended by Mr. Tanaka. The name of the U.S. Company is called Galvanized Steel and the owner called Harold Greenberg.

Mr. Greenberg made the purchase from Alcolac through a company called UN-Kraf.

13.1.2 Mr. Frans one of the main suppliers to the programme; a meeting with UNSCOM team gave the following answers upon questioning regarding documentations:-

Am not possession of any documents at all with regard to shipping or business documents related to the subject in question.

Firstly; shipping documents have never been in my possession and if anything at all would still exist than it should be with the shipping company in Italy, named Italtenco-Milan and the person in charge was Mr. Massimo Dallago.

Secondly; any business documents whatsoever were seized by Swiss authority in my absence from my residence as well as my office, therefore any records if any are not in my possession nor do I know where they might be, if any.

Concerning the possible existence of shipping documents in Amman or Aqaba, once again this would have to be asked to the shipping co., Italtenco in Milan. I had no correspondence with any of the shipping companies or its agents.

The procurement process was as follows :

Through verbal or written request from Seorgi for some so called precursor materials, an offer was made. Sometimes the prices were discussed in Baghdad and an order was given. Payment was usually through a Letter of Credit with Companies as beneficiary or with Oriac as beneficiary.

Both Companies and Oriac were responsible to procure the goods up to European ports, where its responsibilities terminated.

A shipping company took over the responsibility, as far as I know this company was Italtenco in Milan Italy.

FCA has not procured any of these so called precursor materials. FCA has supplied 6 electric steam boilers, some Hastelloy plate (small quantity) and some valves and fittings. This order was for Seorgi and carried out in 1988/89.

FCA was founded in Switzerland in 1985? and registered in Bissone, Canton Ticino. by F. van Anraat and fully owned, there is no relation between FCA and any other company.

Oriac was based in Luxembourg, however a Panamanian registered company. Foundation date not known to me nor the owners. Oriac was run by a certain Mr. Benoit of a financial management company which was called Figeo (abbreviation).

Companies was based in Switzerland, but also Panamanian registered. Foundation date known. As executive of companies was Mr. Enderlin in Lugano. There is no organizational linkage between FCA and Oriac and Companies, nor was there any business relation. In order to proceed with orders for Companies and Oriac, I have signed on behalf of Companies and Oriac the offers and correspondence orders were the sole responsibility of Companies and Oriac.

13.1.3 Universal Trading Company :-

It was a Canadian company, the contact person was Mr. Abdul Kadir Thakib claim at that time that the origin of TMP which he intend to supply from China, this L/C was cancelled in 1988 because he could not supply the chemical.

13.1.4 In 1989 (400) ton of NaCN was re-exported from Iraq to Melchemie company (Holland) as it was not needed by Al- Muthana.

13.1.5 In 1990 a contact was carried out with several foreign companies (Astra/Sweden, Duphar/Belgium and another German Company) to transfer the technology for local manufacturing of Atropine auto-injector, the German Company submitted an offer for transfer of technology under the condition that the Iraqi side imported from the same company two million ready made Atropine auto- injector after several technical negotiations nothing materialized and no agreement achieved.

13.1.6 In April 1987 an attempt was carried with Sinia PBD representative to procure liquids filling line, but this was abandoned.

13.1.7 An offer was submitted by Exomit Company in 1988 for thionyl chloride plant but this was not materialized.

13.1.8 Negotiation with Cojarate Company (India) to procure glass line reactors. The Indian Company refused the negotiation or to permit the Iraqi side to visit the coating site.

13.1.9 An attempt was carried with Deditrich Company to obtain the know-how for manufacturing glass lined tanks, but this was not materialized.

13.2 Codes Used:

During the chemical programme, each civil construction work executed had a code No. related to 922 for example:

The chemical stores (Bankers) and the four production building (H1,H2,H3 and H4), the residential village, the Cafeteria were given the code No. 9221, 9222, 9223, 9224 and so on because of lack of documentation it was difficult to remember which code No. related exactly to the specific civil work mentioned.

During 1985 - 1987 the directorates in Al-Muthana given a code number and as follows:-

- Director general office (70)
- Legal department (71)
- Planning and follow up (72)
- Tactical group (74)
- Technical directorate (80)
- Administrative directorate and personal (81-82)
- Production directorate (77)
- R & D directorate (76)
- Handling directorate (79)
- Trading and financial directorate (73)

Color codes and sample designation for produced and synthesized agent and precursors Color codes were used to identify the produced agents and filled munition although there is a sample designation for each agent and precursor in general, as usual codes. Also many codes rather than the specific codes were used by researchers in R & D or workers in production plants when they were sent a sample for analysis to follow the reaction whether synthesized or produced, or to follow the agents stored in different containers. In these cases the sample sent for analysis may take another code in addition to the main code to identify the requested analysis. The following shows the main color code and the main sample designation for produced and synthesized agents and precursors.

- | | |
|--------------------|---------------|
| - Cs | White |
| - Mustard (MG)* | Yellow |
| - Tabun (GA)** | Red |
| - Sarin (GB) | Black |
| - Cyclo sarin (GF) | Green |
| - mixture (GB+GF) | Black + Green |
| - VX *** | Blue |

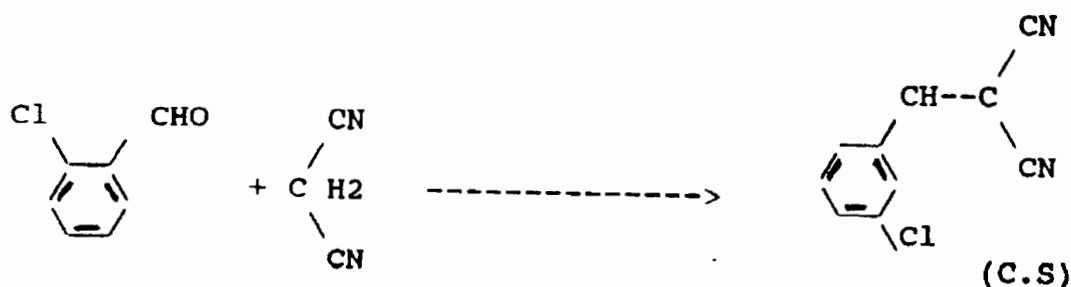
- (*) Artillery shell 155 mm filled with mustard sometimes marked CA.
 (**) Tabun designated GF in Mass production and R & D during the period from 1983 till beginning of 1987.
 (***) Vx sometime designated as (SO, SM, SN and SG)

- Soman (Z)	No colour code
- Lewsite (LW & AW)	No colour code
- BZ	No colour code
- BZ (JB 339)	No colour code
- Sec. Butanol Sarin (GS)	No colour code
- Cyclopentanol Sarin (CG)	No colour code
- Cyclohexanol Sarin (S) or thiosarin (GBX)	
- Cyclopentanol Sarin (S)	
- DFP	No colour code
- Nitrogen Mustard (NMG)	Yellow
- Isobutanol Sarin (NB-GB)	No colour code
- Isopentanol Sarin (NP-GB)	No colour code
- Dx mean either D4 or Vx	No colour code
- Thiodiglycol TDG	No colour code
- DMMP	No colour code
- TMP or MPT (Trimethyl phosphite)	
- Mix. (MPC+MPE) called RTF	
- Choline two type	
- Choline - SM	
- Choline - OH	No colour code
- Monoester(O) called monoester(O)	No colour code
- Monoester(S) called monoester	No colour code
- MPS	No colour code
- Hydrazin either (H) or UDMH	
- Admsite (DM)	No colour code
- Vx. Hcl (D) or syrup	
- MPF (PF)	
- MPC (PC)	

13.3 The Chemical Activity at Al-Salman Site:-

- Preparation of CS agent at AL-SALMAN Site was carried out in 1981, and during two months at a production rate of 30 kg / day, One ton of this agent was produced. This agent was produced through the reaction of the following materials :-O-chlorobenzaldehyde and Malononitrile.

The produced quantity had been filled in Plastic hand grenade to be used for anti-riot control.



The agent was produced by mixing the materials in metal container, then to filtered and packed in Plastic container.

- In 1988 a research group at TRC (T3 Dept.) conducted some experiment on the synthesis of GB & derivative of V-agent in Lab. Scale in order to be used for a binary system. Artillery shell (152 mm) was chosen as the proper munition to be used for the binary system by using two canisters (plastic or aluminum) several static tests were conducted using simulant to examine the mechanism of mixing by destroying the rupture disc.

These researches were stopped according to order from MIC because MSE conducting the same research in advance.

- In 1988 a research group from TRC were synthesized one liter of fluouromethyl acetate (S2) as an incapacitating agent. 9

13.4 Second Hand Equipment Obtained from (SDI):

The used equipment obtained from SDI which remained at Al- Muthana and are all now out of commission are listed below:

- Two Porcelain lined reactors (1 m3) were used in Al- Muthana (in 1983).
- One S.S reactor (100 l.) was used in Al-Muthana (in 1983).
- One vessel (1 m3) in the hydrolysis plant was used in Al-Muthana (in 1983).
Destroyed under U.N supervision.
- Two tanks porcelain lined (1m3) were used in Al-Muthana in (1984).

13.5 Local Production:

Attempts of precursors

- 13.5.1 In 1985 an attempt was made to initiate the local production of the main precursors used by Al-Muthana such as: SOCl₂, PCl₃, POCl₃, choline and TEM

which were subject to export restrictions according to the Australian Group list. Other chemicals like phosphorus and HF were to be produced by the Ministry of Industry.

- The organizational body which undertook the planning was Al-Muthana.
- The establishments involved were :

Al-Muthana

Al-QAQAA (to supply AL-Muthana with SO₃ to produce SOCl₂ in late 1987)

AL-Kaim (to supply H₂SiF₆ to HF plant which was supposed to be established in 1988)

Ministry of Industry / project No. 7 to supply Phosphorous to Al-Muthana to produce PCl₃ and POCl₃.

- The following were achieved:-

SOC₂: The project was erected in 1988 and produced 70 tons of SOCl₂ only. Then stopped due to technical difficulties.

PCl₃ + POCl₃ (Project A+B): erected in 1988 but not commissioned due to incompleteness and contractual problems.

TMP: Contract was signed with Kim-Khaleeg the Know-how was received for the (LC/No. 88/10/24) project, and some equipments (decanter, dissolver, and nitrogen plant). The plant was incomplete and was not erected.

Choline : Produced in Al-Muthanna in 1988.

- The HF and P plants were not implemented.

13.5.2 Al-Tahady project:-

In the end of 1990 a plant for production of DMPH was erected next to Mohammed plant, where two reactors, tanks, pumps & pipes used in the erection (about 70% of the equipment of plant were erected). The erected equipment was destroyed in Jan. 1991 during the bombardment of the site.

13.6 Project Site Allocation:

Ownership and protective measures for important structures.

13.6.1 Al-Muthana inherited project 922 through SOTI from the liquidated Al-Hassan Ibn Al-Haitham. The buildings were completed by SAAD State Establishment which belonged to SOTI. Legally the site plot was therefore owned by SOTI which later became MIC.

13.6.2 Protection measures and as well site allocations for projects in general are overseen by a Special Department for strategic projects affiliated to MOD

Planning Directorate which gave consultations and recommendations for suitable site locations for important projects and the protective measures to be incorporated in the design of buildings as well as measures implemented for camouflage to safeguard important installation and vital locations.

13.7 Relations with other Iraqi Establishments:

13.7.1 Where the special steel production equipment were manufactured or repaired?
- The Heavy Engineering Equipment State Establishment at Al-Daura.

13.7.2 Where the cladding of production equipment were made?
- Al Sadda Rayon Factory and Al Kaim Phosphate Establishment for rubber lining.
In 1986 the scrubber and storage tank were lined with rubber at Al-Sadda Rayon Factory.

13.7.3 The facilities which can perform high alloy steel welding are:
- The Heavy Engineering Equipment Establishment at Al- Daura.
- Al Nida'a State Establishment
- Al Karama Centre
- Ibn Al-Haitham Centre

13.7.4 The names used for correspondence for on behalf of Al- Muthana?
- SEPP, SORGI, SOTI, and SOCI

13.7.5 Al-Muthana acted on behalf of PC3 project to procure in 1988 chemicals:
- Activated Alumina
- Molecular sieves
- HF
- KOH

13.7.6 Al-Muthana performed the job of coating several steel vessels with Haller for PC3 project.

13.7.7 In 1990 an attempt to transport Ethylene liquid from PC1 in Basrah to Al-Muthana by using a modified liquid nitrogen truck. The modification was to be carried out at Al-Tarmia site (Nuclear site) but the suggestion was not implemented.

13.7.8 In mid-1990 the Institute for vaccine and serum was affiliated to Al-Muthana which previously belonged to the Ministry of Health and was experiencing administrative difficulties. Al-Muthana could run at as a production facility and

offer the same incentives given to Al-Muthana employees for the purpose of improving the performance.

13.7.9 At the end of 1991 some chemicals were transferred to the (Modern Paint Industry) these chemicals were stored at Dujla Store near Falluja city which belong to Al- Muthana.

The chemicals were as follow:

- Isopropyl alcoholabout 500 Ton.
- Cyclohexanolabout 15 Ton.
- Butanolabout 3.4 Ton.
- Methanolabout 76 Ton.
- Ethanolabout 1.8 Ton.
- Isopropyl amineabout 1.2 Ton.
- Triethyl amineabout 2.4 Ton.
- Di-isopropyl amineabout 12 Ton.
- Dichloro methaneabout 196 Ton.
- Chlorobenzeneabout 3.5 Ton.
- Dichloro ethaneabout 6.8 Ton.

13.7.10 Several unused warehouse at Sugar Factory in Mosul were used in 1990 to store the machines of the aerial bomb workshop which were evacuated from Al-Muthana before the bombardment.

In 1991, these machines were returned back to Al- Muthana and then destroyed in 1992 under UNSCOM supervision.

13.7.11 The Radiation Bomb

13.7.11.1 In 1987, and idea was suggested for an "area denial weapon" to be used in connection with the campaign for liberating Al-Fao from the Iranian occupation forces, to construct a radioactive bomb. The weapon was based on the dissemination of an isotope of temporary radioactivity over a wide area to be denied to enemy forces.

13.7.11.2 The idea involved the use of the vertical channels of 14 July reactor through the introduction of a selected material capable of acquiring radioactivity after exposing it to an affluence of neutrons for a certain period of time . Then this material is to be transferred to special containers surrounding an explosive charge and shielded with lead and inside an aerial bomb body.

13.7.11.3 Zirconium dioxide was chosen to be radiated for the following reasons:-

- a- It was available in sufficient quantity at Al- Qaqa establishment.
- b- The half life is short (65 days).

- c- It contains some impurities like Hafnium characterized by its suitable cross section.

13.7.11.4 During the study of using this weapon the following points were taken into consideration:-

- a- Possible exposure of the workers to the danger of radiation during irradiation, charging, handling and even during the field using.
- b- The revelation of using such a weapon will be exploited by the hostile mass media against Iraq.
- c- The radiating capacity of the reactor was limited.
- d- The atmospheric factors like wind speed and direction, rain and humidity affect to a large extent the dissemination of the material on the ground.
- e- The limitations on aircraft loading of the large number of bombs needed per sq.km.

13.7.11.5 In laboratory, several grams of zirconia was radiated inside an aluminum container, after making sure of the efficiency of welding and the safety of the reactor from radiation heat increasing. The radioactivity was measured after the process of radiation and compared to the theoretical radioactivity . And in order to prepare a suitable sample for the weapon an aluminum container 87 Cm long was filled with 2.4 Kg. of Zirconia. Then, the container was radiated in the vertical channel (16) at the reactor core for 14 hours under neutron affluence of about 1012 N/Cm2/Sec. The experiment was conducted on 22 Aug. 1987. The level of the sample radiation ranged between 1 and 25 Roentgen/hr without the lead plate, but it declined to (0.1 - 0.25) Roentgen /hr with the existence of the lead plate.

13.7.11.6 At the beginning it was found that the suitable bomb for containing the radio active charge was Al-Qaqa 28 (see the enclosed figure).

Two static and dynamic experiments were conducted as follows:-

- a- One experiment on 18 Aug. 1987 at Al-Haswa field for making sure of the rupture of the lead cover and metal case to ensure the dissemination of the radioactive material.
- b- An experiment was conducted on 27 Aug. 1987 at the Western Desert to determine the nature of the radioactive intensity near the explosion center (which was more than 2.5 ml Roentgen/ hr). While part of the material thrown in the air as a cloud driven by wind was impossible to determine as the radioactive material in it was very small.
- c- The experiment conducted on 14/12/87 using aircraft in the test range near (160)Km point.

This experiment was to ensure the suitability of this weapon for flying. The experiment was conducted in two stages the first was a dummy and the

second was an active bomb with a time fuse. The bomb was heavy (1400 kg) and one bomb only could be carried by the aircraft. Radioactivity measurement results were approx 2 mrad/h, (which was unsatisfactory), 10m from the explosion center and that is close to the permitted level allowed to personnel operating in radiation fields. However the remainder of radioactivity was spread out by the wind.

13.7.11.7 The theoretical calculations show and that the required number of aerial bombs to cause lethal effect on the enemy were too high, in case of internal exposure and higher still in case of external exposure in addition to the reactors limited capacity and the need for a large number of planes to cause the required effect on an area of 12 km².

13.7.11.8 For technical reasons it was impossible to measure the radioactivity level in the air, so mathematical models were adopted to calculate the dissemination of suspended materials in the air, for various atmospheric factors. For ground measurements portable detection equipment were used, TLD, and soil samples were taken from polluted areas and measured in the IAEA labs.

13.7.11.9 The possible use of natural uranium instead of zirconia was considered and rejected for various reasons.

13.7.11.10 Al-Muthana bomb(LD-250) : The Air force during the flight test objected to the heavy weight of the Al-Qaqa (2) bombs (weight 1400 kg), Al- Muthana bomb with a weight of 400 Kg was chosen On 27/Jan/1988 flight tests were conducted by mirage, Su-22 and Mig-23. The tests results were acceptable.

13.7.11.11 Conclusion :

The use of radio active bomb was excluded due to the a.m limitation and the difficulty to achieve the required effects.

13.8 Alternative Production Sites:

During 1988 Al-Muthana production sites became well known internationally especially after several articles appeared in the Western press. An idea was therefore evolved to use Al- Muthana for chemical and pharmaceutical production and to move the CW core-production units elsewhere. The project named 4x2 where four sites with two production units each were to be established. However, the project was not implemented beyond the inquiry stage for production equipment from suppliers.

13.9 Answers to Questions raised by letter of UNSCOM dated 27 July 1995 concerning the following:

13.9.1 Project MC-3:

In 1988 procurement effort for technical equipment was given code name Project MC3 in order to differentiate it from other orders.

- The first supplier was FCA Contractor SA Via delle Ale 1/A 6900 Lugano through Mr. Frans Van Anraat as mediator. The letter of credit was 88/3/1873 and the value 393,455.50 \$ from FCA Contractor.
- The item procured through the above L/C as follows:
 - Flow meter for HF gas.
 - Conveyor belt.
 - Steam generator.
 - Hastalloy sheets.
 - Spare parts for pumps.
 - Spare parts for air compressor.

All the above technical equipment which was procured through SORG were used in Al-Muthana State Establishment.

- The second supplier of the MC-3 was KIM-Khaleej. The Letter of Credit was 88/3/899 of value 539,160.00 DM.

The items procured through the above L/C was as mentioned in the attached documents (10 pages) provided by Mr. Kamal Saudi.

These technical equipment were used also in Al-Muthana.

13.9.2 Project M3-A:

- The project M3-A was an attempt to procure material and equipment for a plant to be used in manufacturing aerosol cans and a filling line for domestic insecticide.
- The L/C No. 87/3/2790 opened in favour of ORIAC International S.A. 30, Boulevard DE La Foier, Luxembourg, through Mr. F. Van Anraat as mediator.
- The correct value of the above L/C was 2,574.530.00 \$ as mentioned in Arabic original copy of the L/C's list handed in April, 1994 to UNSCOM. There is typing error in English Version for the list of L/C's in the FFCD (missing Zero the last figure of the value of this L/C).
- The material procured through this L/C 88/3/2790 was only TDG as mentioned in the FFCD and after the cease-fire between Iraq-Iran in 1988, the rest of the value remaining in this L/C was changed to procure material, equipment and machines for plant for manufacturing cans and filling for pesticide (M3-A). Later this L/C was cancelled and did not supply any equipment or machinery by the remaining value of this L/C.
- No Contract was signed between ORIAC and SORG for the procurement of a plant for the manufacture of cans and their fillings.

Through FCA, SORG received an offer for filling lines from Coster Company, Italy this offer never materialized into a Contract or an order for the supply of such:

- Another offer for can making and filling line was obtained from a Company called FMI, Naples, Italy. Once again this offer never materialized into a Contract or order.
- Concerning L/C No. 10/65736, it was opened in favour of FCA Contractor S.A./Switzerland to procure machines and equipment for cans and filling (M3-A).

This L/C was cancelled as the supplier did not fulfill his obligations.

13.9.3 FCA Involvement in Delivery to the Daura Refinery:

FCA had acted without success as mediator for delivery from paramins to Al-Daura Refinery.

The intended supply concerned additives for the production of lubricant oil.

Enclosed a complete information provided by Al-Daura refinery about suppliers, description of items and quantities, dates and financing covered by the L/C's (Attached herewith full information (40 pages) regarding the following L/C's).

L/C 88/2/248

L/C 88/2/248

L/C 87/2/437 and not 88/2/437

L/C 87/2/716 and not 88/2/716

as mentioned in your letter dated 28 July, 1995.

There is no relation to Mr. Frans Anraat concerning the above L/C's.

All the above information obtained from:

- KIM-Khaleej - Mr. Kamal Saudi
- Mr. Frans Van Anraat
- Al-Daura Refinery.

13.9.4 Imported Precursors:

Thorough reassessments of the contracts and procurements for precursors in general was carried out and all the quantities have been declared. Some contracts and L/Cs which UNSCOM team have enquired about as possibly covering precursors import have been fully explained as mentioned above.

13.10 Additional sites involved in CW program :

13.10.1 Administration offices for Al-Muthana

- One floor occupied by SEPP from state org. for chemical industries during 1981-1982.

Address : Al-Jamhoria street, AL-Sinak P.O. Box : 5367

- Building in AL-Sinak (previously occupied by SOTI), during 1983-1985.
- Building in AL-Mansour sector during 1985-1987.
- AL-Shuala site during 1987-1990.
- Drug Information Bureau / Al-Alwiyah sector /
Baghdad P.O.Box 13033 -Aqrguf site end 1990-1992.

The above offices for Al-Muthana consist of:

- The general director office.
- The financing department.
- Procurement department.
- Telex office.

13.10.2 Storage site for AL-Muthana

- Dijla storage site near Falluja city was used to store chemicals, (P2S5, Di isopropyl amine, Isopropanol and other general chemical) -Other sites belonging to MOD were used for distribution and storing of munitions, both filled and empty. (See chapter Unilateral Destruction)

13.10.3 Attempt to establish a filling line in Hutteen State Establishment in 1983 to fill artillery shell 130 mm with Mustard, this was not implemented.

13.11 Ricin Production:

UNSCOM team enquired whether ricin was produced at Al- Muthana. Ricin was never produced at Al-Muthana in any quantity. However, Al-Muthana specialists participated in ricing field tests carried out for a small quantity produced by TRC laboratory for details see FFCD/BW programme. In addition Al-Muthana provided TRC with some chemicals like CS, CN, and mustard and evaluation of toxic effects.

Caster oil:

Caster oil production was suggested at the St. Est. for Chemical Industries in the beginning of 1992 needed for the production of brake fluid since caster oil was the main component of brake fluid also there was a demand on caster oil from other establishment such as State Establishment for Rubber Industries.

The caster oil unit was erected after the completion of erection of brake fluid unit.

Brake fluid unit :

The brake fluid project started in 1991 due to the embargo on imports and the unit was completed and production started in 1992, at that time the unit used the imported castor oil.

Caster oil unit :

The date of erection the project was in Aug. 1992 and the unit was completed in Aug. 1993 but the production did not start because the unavailability of the seed of castor oil needed for the production of castor oil at that time. In June 1994 the production of castor oil started.

Due to high demand on castor oil from other establishments (i.e. Rubber industry, Al-Qaqa ...) therefore it was suggested to increase the production capacity by erecting a new unit with larger capacity.

Therefore, as explained above, the need to formulate brake fluid and to provide castor oil for the Rubber and Chemical Ind. and the embargo imposed on Iraq to import essential materials for legitimate civilian needs was the driving force for the local production of castor oil.

The attached documents explain the procedure of destruction of documents of MSE in addition to the video tape received by UNSCOM in Dec. 1995.

These documents showed that all the documents were destroyed except some important documents which kept in boxes and send to the chicken farm.

VI- No. of L/C s

List of L/Cs Nos. (38 copies) which explain the importation of chemicals, equipment spare parts and different materials by MSE during (1981-1989). Each list include the LC value, currency, Companies Names and the imported materials. These L/C's Nos. support the material balance for the imported equipment and the financial budget for the past CW programme.

ADDENDUM

TO IRAQ'S CHEMICAL FFCD

In order to clarify certain aspects of Iraq's chemical programme particularly relations with the Ministry of Defence and other areas where UNSCOM felt that documentary supporting evidence was lacking a seminar was organized on 20th and 21st May 1996 and attended from UNSCOM by a joint team . From the Iraqi side, in addition to the personnel involved in the two programmes were present high ranking officers from the Ministry of Defence who held positions of responsibility in the Chemical Corps, Missile Force, and Air Force in addition to five of the original six members (one member deceased) of the planning committee for the special munitions.

The account given in this addendum is considered by Iraq as further clarifications in support of the May 1996 final draft FFCD addressing many of the issues raised during the seminar.

1. The Role Of The Chemical Corps In The Chemical Programme During 1988 - 1991

In order to answer the questions asked in the seminar about the Chemical Corps role in the CW programme, a historical brief is quite in order so that the apparent lack of involvement during the period from 1988-1991 may be put in its proper perspective:

- 1.1 The Chemical Corps was established in the Iraqi army in the sixties to provide the necessary information and training in defensive measures against chemical warfare as in all modern armies around the world. Training courses in this field were attended by officers of the newly formed Chemical Corps in the USSR and USA. The chemical Corps became the main source for expertise in chemical protection and decontamination measures as well as for the equipment and materials necessary for those measures.
- 1.2 In 1981 the Iraq-Iran war became a war of attrition in which Iran began successive campaigns launched to wear down Iraq's defences and to occupy Iraqi territories using their superiority in numbers. The Chemical Corps Director in 1981 submitted a study to MOD suggesting the reactivation of the cancelled chemical project of Al-Hussian Ibn Al Haithem in Sammara. The proposal was accepted and project 922 was created to complete the unfinished structures of the old project and to install the equipment procured which were kept in boxes. The Director of the Chemical Corps Gen. Nizzer Al Attar became at the same time the Director of project 922 until 1983. For that period project 922 was an MOD project overseen directly by the Chemical Corps Director together with a large number of Officers and men drawn from the Chemical Corps. However, the project remained a separate

entity and was not merged in any way with the Chemical Corps. In the second half of 1983 the project Director Gen. Al Attar became a full time Director of project 922 and a new Director for the Chemical Corps was appointed. The affiliation to MOD continued until 1986. However, overlapping with this period another affiliation was made with SOTI to provide administrative and technical management expertise to MSE leaving the planning and financial decisions to MOD (the Minister himself). In 1987 MSE severed its affiliation to MOD and became a fully fledged MIC establishment.

1.3 Early in 1983 when the production began to appear necessitating the creation of an organ to coordinate between MOD requirements and production activity. Thus in that year a group of two staff officers from the Chemical Corps was formed which was called the tactical group. The group moved from the Chemical Corps to project 922 when a new director was appointed to the Chemical Corps. This group by the end of 1983 was enlarged and became the planning committee as will be explained later in this addendum.

1.4. The Chemical Corps participated through one representative in the planning committee. However late in 1987 with the appointment of a new chief of staff Gen. Nizzar Al Khazraji, he conducted some reorganization of MODs tasks and procedures and ordered that a more active role is to be played by the Chemical Corps than was practiced. However, the Chemical Corps depleted from most of its best and most active officers and men by the creation of project 922 and later by MSE when the production was expanded was not in a position to assume the complicated responsibilities that MSE was shouldering throughout the past 6 years.

Essentially the chief of staff order meant that the Chemical Corps was to assume the leading role in the planning committee and to play a more active role in the implementation of the tasks after the chemical munition is supplied by MSE. In response to that MIC proposed to the chief of staff that MSE henceforth would be only a supplier of munitions in the same way other munitions and weapons manufacturers within MIC supply MOD with their requirements and would consequently hand over responsibilities for all stocks and stores of munitions and the responsibility for checking and maintenance of the stocks. And would no longer, carry out any duties and services that MSE had been rendering to MOD. MIC was quite clear in drawing the lines of responsibility and was not prepared to compromise on that unless the order of the chief of staff is changed and the procedure reverts back to what it had been for the past 6 years. Thus the order of the chief of staff was changed and the role of the Chemical Corps remained limited as described above until 1991.

In 1989 a new Director was appointed for the Chemical Corps who attempted to overhaul the Chemical Corps and to define a new relationship with MSE,

but as MOD was not prepared to place orders for Chemical munitions for 1989 and 1990, any new ideas about the role of Chemical Corps had no opportunity to express itself vis a vis MSE.

1.5. On 9 January 1991 a general order was issued to all MIC's establishments to evacuate all stored munitions and weapons and products in general and to disperse them in various available storage sites. As that order required considerable logistical support many storage sites were needed it was decided that the MOD Corps would take the responsibility of storing and guarding all stocks of munitions of weapons in accordance to specialization. That is for example, all aerial bombs would be stored at Air Force sites chemical munitions would be stored with the Chemical Corps, and Missile warheads would be stored with the Missile Force and so forth. That order was to be carried out regardless of whether the items concerned have been contracted for or not. As MSE and the stores within its boundaries were considered certain targets for bombardments the chemical munitions stored there under contract or outside the contract which had not been already dispersed became a subject of cooperation between MSE and the Chemical Corps. The munitions (included 122 mm rockets filled with sarin, 155 mm art. shells filled with mustard, and 120 mm motor shells filled with CS) were transported on MSE trailers to various army depots and sites under the supervision of the Chemical Corps which also assumed responsibility for guarding the stores and protecting them in general. The Chemical Corps also assumed responsibility for measures taken when some of the stored munition was damaged during the war. This period lasted about 3 months when stocks were returned to MSE for declaration and destruction.

To sum up the Chemical Corps (in the personal capacity of its director and a considerable number of its best officers and men) may be said to have had a pivotal role in the establishment of project 922 in 1981 and the success in realizing the status Al-Muthana State Establishment achieved in 1986/1987. After that and due to the continuous depletion of the Chemical Corps personnel its task remained restricted to protection and training activities in the armed forces and the supplier of protective gear and materials to all who required them in the armed forces. On a few occasions there were some attempts to give the Chemical Corps a bigger role than it had in the Chemical weapons area particularly in 1987 but that attempt failed due to lack of expertise and resources to assume the responsibilities MSE had assumed for several years in the past. In 1991 a minor role was thrust upon the Chemical Corps to store and protect Chemical munitions stocks for a period of a little more than 3 months. However, the Chemical Corps was represented by one officer in the planning committee as a permanent member throughout its working life. The Chemical Corps did not initiate any activities such as production of new agents or proposing an R & D project.

2. Planning Committee:

The Planning Committee's role was confined to the study of a particular threat pointed out by other analysts to recommend ways and means of dealing with that threat. The Committee was affiliated to the Directorate of Planning at MOD.

2.1 The committee was first formed according to a proposal submitted by the D.G of the project 922 General Nazar Al-Attar in the second half of 1983. However, MSE's two representatives in the Planning Committee were also called the tactical group within MSE organization, who had the additional task of verifying and giving consultations on MSE's field tests.

2.2. The Committee carried out its task through the following procedure:

- a. The committee convened its meeting upon notification from the directorate of planning through its representative who was also the secretary for the committee.
- b. The committee had no designated chairman and usually such committees are chaired by the highest ranking officer present in the meeting.
- c. The committee studied the hostile threat and recommended ways and means to deal with it and its recommendation were recorded by its secretary who at the end of the meeting read out the conclusion.
- d. The secretary takes the necessary measure through his Directorate for obtaining the necessary approvals and notifying MSE for implementation.
- e. MSE carried out the necessary measures and informed the Planning Directorate and MIC about the measures taken in writing.

Remarks:

- The committee convened its meetings only upon notification through its secretary, and it did not hold regular meetings.
- The committee had no role in the planning for production or R & D activities at MSE.
- Its last meeting was held at the end on 1988 upon instruction to study and elaborate what was called "Strategic Reserves " for chemical munition. Although the committee was not formally terminated no activities were performed after that meeting.
- The committee had no role in activities and the events of 1990 and 1991 referred to in this addendum.
- The committee had no role whatsoever in the BW programme at any time.

3. The Role of MOD in the planning of the CW programme:

3.1. Period 1981-1986

The initiative to reactivate the CW programme came from the Director of the Chemical Corps Gen. Nizzar Al-Attar in 1981 and the project 922 was

Namely that Hussain Kamal after rewarding the leading personnel at MSE so generously wanted to increase the pressure on them to work harder and faster in the production effort by causing the demand to come from MOD procurement channel (the Directorate of Armament and Supply) as an added motivation to fulfil the task he gave to them.

Opinions still differ regarding which explanation is the more likely, but they all agree that Vx was not produced let alone weaponized and that the order send from the Directorate of Armament and Supply was not in accordance with the established procedure.

As for the actual fulfillment of that order it is clear from the letter of the DG of MSE which navigates around the question of suppling Vx munition by offering alternative agents like mustard or GB derivatives instead until the production of Vx is achieved providing the raw materials arrive to MSE etc.. This explanation supported by the letter of MSE dated 2 Dec. 1987 (see the document received by UNSCOM-138 in 21 May 1996). referred to above practically show beyond any doubt that Vx was not in production prior to the date of the attempts given in detail in Chapter-VI.

- 4.2. At the end of Iraq- Iran war in 1988, MOD prompted by MSE to state its requirement of stocks of chemical munitions for the year 1989, so as to enable MSE to plan its activities for peacetime. MOD instructed the planning committee to study and elaborate what was called "strategic reserves" of chemical munitions. The planning committee worked out types and quantities of chemical munitions which correspond to seven days requirements or 21 days requirements based on MSE present and projected possibilities and the document was sent to MSE for comments.

However, MSE worked out the cost of production for the two options and awaited MOD decision for the preferred option. MOD dropped the matter having noted that the cost (85 M ID and 307 MID respectively) was too high even for the smaller option as MOD was actively undertaking large cuts in its budget for 1989. Furthermore, MSE warned that the types of munitions it produced deteriorate with storage and some types deteriorate more rapidly like sarin and in any case the stock must be renewed every year. Quite obviously MSE had over played its hand and consequently received no orders from MOD for 1989 and 1990.

- 4.3. Late in 1990, MOD urged by MIC to state its requirements for chemical munitions since MSE was actively producing munitions since May. 1990, without specific orders from MOD which would put MSE in financial difficulties if no order from MOD was forth- coming. MOD in Dec. 1990 resorted to the last study preformed by the planning committee at the end of 1988 and sent it for MIC as its requirement choosing the smaller option. However, as can be seen from MSE's comments on MOD's requirement

contained in the letter of D.G of MSE dated 5 Jan. 1991 addressed to MIC some changes have taken place on the types that MSE had actually produced in 1990 prior to receiving the order. The table below illustrate the changes:

4.3.1 Table

<u>Item</u>	<u>Type</u>	<u>Agent</u>	<u>Qty.</u>	<u>Comments of MSE</u>
(a)	AALD-500	GB Derv.	1232	About 90% of the order was delivered and distributed to airbases namely 1024 R-400 bombs Iraqi binary. Of the remaining quantity about 200 only 35 are available filled according to the old system (sarin)
(b)	AALD-500	Mustard	1232	Fulfilled
(c)	122 mm rocket	Sarin	33264	Largely fulfilled and the remainder will be ready by 9 Jan. 1991.
(d)	155 mm artillery	Mustard	12474	Fulfilled

It is thus quite clear that MSE had produced more munitions than was specifically asked for by MOD. As the letter of 5 Jan. 1991 goes on to state that the following items were produced outside the order namely:

4.3.2 50 Al-Hussain warheads 35 of which Iraqi binary and 15 filled with sarin (N.B the figure 35 is first written as 34 and then corrected to 35 !).

4.3.3 500 LD 250 bombs filled with mustard.

4.3.4 1006 art. shell 155 mm filled with mustard in addition to 100% of the order.

4.3.5 18000 mortar shell 120 mm filled with CS outside the order.

4.3.6 Also there are several thousands of empty munitions of rocket warheads (122 mm), aviation bombs and artillery shells which can be filled on demand. In addition we have bulk agents of 220 tons mustard and 380 tons under production at the rate of 10 tons per day. Regarding the GB agents the stock is exhausted and fresh stock is being built at the rate 1 ton per day. It is worth mentioning that as late as Jan. 1991 there is no mention of Vx as being one of the current production which puts an end to UNSCOM speculation about the Vx account given by Iraq.

Chapter-XII paragraph 12.8.2.2) under the responsibility of the Missile Corps with the presence of MSE members at the storage sites at all times in accordance with the previously agreed procedure. Moreover the Missile Corps, with cooperation of Project 144, had conducted the integration of the warheads and airframes for test purposes before the filling. In addition to that members from Al-Muthana State Establishment had conducted trainings for a group from the Missile Corps on the way of adding (B) material to the warheads when necessary.

6.4 When the date for the start of the military operations against Iraq was approaching, orders were received by the Missile Corps in coordination with MIC concerning the Chemical warheads. These warheads were to be ready for use in case of orders to do so, but no order was issued concerning the use of these warheads.

6.5. After the end of military operation against Iraq, (16) warheads, filled with sarin and its mixtures, were transferred to Al-Dijela site and were declared to UNSCOM. In addition to that (14) warheads from the Iraqi binary were declared to UNSCOM in April 1991 after transferring them to Al-Dijela site. The remaining (20) warheads from the binary were destroyed by the Iraqi side at Al-Niba'e area. The Missile Corps had prepared the destruction area after receiving the orders of destruction through MSE (see unilateral destruction, chapter-XII from the FFCD). In conclusion it is worth mentioning that the Missile Force enjoyed a special relationship with MIC due to the on going development throughout the period from 1987 onwards in the missile area. Several versions of Al-Hussain missile were developed in close cooperation with the Missile Force which established continuous contacts which facilitated the joint tasks.

7. How the Quantities were specified for producing R-400, DB-2 and Al-Hussain Warheads for the Chemical programme:

7.1 R-400 Bomb: In April 1990 discussions took place between MIC and Air Force on the type and quantity of aerial bombs which would be the most suitable for the new threat. (1000) R-400 bombs were chosen based on the consideration of the available tail units that the Air Force can supply from its stock, the raw materials available at Nasser State Establishment for the production of bomb bodies, and the quantity of precursor (DF) material necessary for production the binary type of munition.

7.2 DB-2 Bomb: In 1985, the original need for those bombs, manufactured from aluminium, was specified by the Air Force for Napalm purposes. However the Air Force after production of limited quantity lost interest in the product

and the production was stopped. MSE was looking for containers with large capacity made from Aluminum in order to overcome the corrosion effect of acids in the sarin it produced. MSE studied some of the DB-2 containers produced by the State Establishment For Mechanical Industries and found them acceptable. MSE ordered about (1300) pieces of DB-2 based on the raw material available with the manufacturer. Of those only (155) DB-2 were filled and the remainder were stored empty at Al-Muhamadiyat sits. It is obvious that the choice of DB-2 was not considered a success.

7.3 Al-Hussain Warheads: (50) Al-Hussain chemical warheads, were specified by MIC after coordinating with Missile Force Command, which project 144 had manufactured for the benefit of Al-Muthana State Establishment in 1990 according to the order of MIC. Those Warheads were filled with chemical agents (sarin and its mixtures 16 warheads), and the Iraqi binary (alcohol mixture 34 warhead). The Ministry of Defence had no role in specifying the quantity for this weapon (A letter from MSE to MIC dated 5 Jan.1991 which was received by UNSCOM in 8th Dec. 1995 which shows that MSE has produced (50) Al-Hussain chemical warheads (16+34) and were submitted to the Missile Force without any order.

8. The Distribution, Storing and Responsibilities for these munitions were as follows:

8.1 R-400 bomb: R-400 bombs, filled with the Iraqi binary (Alcohol Mixture only), were distributed to the air- bases in 1990 according to the number of the air squadrons working in each air-base in the western area, and the type of the aircraft and its capacity. The transferred R-400 bombs remained under the supervision of MSE personnel assigned to each storage site throughout the period of their storage (see chap XII). Whereas the responsibility of the air-base towards these bombs was only to protect and store them in safe places.

8.2 Al Hussian Wearhead : Al-Hussain Warheads were distributed as mentioned in chapter (XII), and transferred by Al muthana State Establishment to Missile Forces. After receiving these warheads, their distribution and storing became under the responsibility of Missile units, supervised by specialists from Al Muthana State Establishment for protection measures in emergency cases.

9. Role of the Air Force in the Chemical Program:

9.1 For the period from the beginning of the chemical programme until the end of Iraq-Iran war, the Air Force had no role in the planning of production of chemical munition, neither in the types of munitions nor the agents filled. The

representative of the Air Force in the planning committee coordinates with the other members about the Air Force tasks after the evaluation of the required chemical munition by the planning committee depending on the hostile threats.

- 9.2 In 1990, when Israel threatened preemptive strikes against Iraq, Iraq declared that if Israel strikes, Iraq will not hesitate to use the binary chemical in retaliation. Therefore a group from MIC and the Air Force was formed to study the requirements of the Air Force for the aviation bomb which can be used from low levels. R-400 was chosen as the aviation bomb to be used for the binary chemical. A thousand (1000) R-400 bombs were proposed depending on the capabilities of Nasser State Establishment in production of these bombs, MSE in production of the agents and the available tail fins and parachute of the bomb BRIP-400, which were to be used with R-400 bomb.
- 9.3 In Aug. 1990 the aerial bomb R-400 which were filled with Iraqi binary (mixture of alcohol) distributed in different air-bases and airfields as mentioned in chap. (XII). The distribution of R-400 (1024 bomb) were carried out according to the availability of aircraft and the storage sites at the air-bases and the type of the aircraft and its capacity.

9.4 In 1991, the aviation bombs type LD-250 filled with mustard and AALD-500 filled with mustard (which were evacuated from MSE) were distributed near air-bases and airstrips in isolated pits until the end of the war actions when some of these bombs were unilaterally destroyed and the rest were transferred to MSE and then destroyed under UNSCOM supervision. To sum up the Air Force had no role in the planning or production of the chemical programme and was not properly consulted on weapon selections for the chemical munitions. Only in one case which relates to the selection of the R-400 bomb there was any meaningful consultation regarding the type and quantity of the aerial bomb to be produced. Apart from that the Air Force carried out tasks assigned to it through the established procedures including storing and protection of dispersed munitions to various and air-bases and sites.