Comprehensive Report

of the Special Advisor to the DCI on
Iraq's WMD

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volume III of III

Iraq's Chemical Warfare Program

By God, spare us your evil. Pick up your goods and leave. We do not need an atomic bomb. We have the dual chemical. Let them take note of this. We have the dual chemical. It exists in Iraq.[1]

[1] Saddam speaking about the Israeli, US, and UK intelligence services and Iraq's development of binary CW munitions in a speech on 2 April 1990. (Foreign Broadcast Information Service 021329 April 1990).

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Contents

Annexes

Key Findings

Saddam never abandoned his intentions to resume a CW effort when sanctions were lifted and conditions were judged favorable:

- Saddam and many Iraqis regarded CW as a proven weapon against an enemy's superior numerical strength, a weapon that had saved the nation at least once already—during the Iran-Iraq war—and contributed to deterring the Coalition in 1991 from advancing to Baghdad.

While a small number of old, abandoned chemical munitions have been discovered, ISG judges that Iraq unilaterally destroyed its undeclared chemical weapons stockpile in 1991. There are no credible indications that Baghdad resumed production of chemical munitions thereafter, a policy ISG attributes to Baghdad's desire to see sanctions lifted, or rendered ineffectual, or its fear of force against it should WMD be discovered.

- The scale of the Iraqi conventional munitions stockpile, among other factors, precluded an examination of the entire stockpile; however, ISG inspected sites judged most likely associated with possible storage or deployment of chemical weapons.

Iraq's CW program was crippled by the Gulf war and the legitimate chemical industry, which suffered under sanctions, only began to recover in the mid-1990s. Subsequent changes in the management of key military and civilian organizations, followed by an influx of funding and resources, provided Iraq with the ability to reinvigorate its industrial base.

- Poor policies and management in the early 1990s left the Military Industrial Commission (MIC) financially unsound and in a state of almost complete disarray.

- Saddam implemented a number of changes to the Regime's organizational and programmatic structures after the departure of Husayn Kamil.

- Iraq's acceptance of the Oil-for-Food (OFF) program was the foundation of Iraq's economic recovery and sparked a flow of illicitly diverted funds that could be applied to projects for Iraq's chemical industry.

The way Iraq organized its chemical industry after the mid-1990s allowed it to conserve the knowledge-base needed to restart a CW program, conduct a modest amount of dual-use research, and partially recover from the decline of its production capability caused by the effects of the Gulf war and UN-sponsored destruction and sanctions. Iraq implemented a rigorous and formalized system of nationwide research and production of chemicals, but ISG will not be able to resolve whether Iraq intended the system to underpin any CW-related efforts.

- The Regime employed a cadre of trained and experienced researchers, production managers, and weaponization experts from the former CW program.

- Iraq began implementing a range of indigenous chemical production projects in 1995 and 1996. Many of these projects, while not weapons-related, were designed to improve Iraq's infrastructure, which would have enhanced Iraq's ability to produce CW agents if the scaled-up production processes were implemented.

- Iraq had an effective system for the procurement of items that Iraq was not allowed to acquire due to sanctions. ISG found no evidence that this system was used to acquire precursor chemicals in bulk; however documents indicate that dual-use laboratory equipment and chemicals were acquired through this system.

Iraq constructed a number of new plants starting in the mid-1990s that enhanced its chemical infrastructure, although its overall industry had not fully recovered from the effects of sanctions, and had not regained pre-1991 technical sophistication or production capabilities prior to Operation Iraqi Freedom (OIF).

- ISG did not discover chemical process or production units configured to produce key precursors or CW agents. However, site visits and debriefs revealed that Iraq maintained its ability for reconfiguring and 'making-do' with available equipment as substitutes for sanctioned items.

- ISG judges, based on available chemicals, infrastructure, and scientist debriefings, that Iraq at OIF probably had a capability to produce large quantities of sulfur mustard within three to six months.

- A former nerve agent expert indicated that Iraq retained the capability to produce nerve agent in significant quantities within two years, given the import of required phosphorous precursors. However, we have no credible indications that Iraq acquired or attempted to acquire large quantities of these chemicals through its existing procurement networks for sanctioned items.

In addition to new investment in its industry, Iraq was able to monitor the location and use of all existing dual-use process equipment. This provided Iraq the ability to rapidly reallocate key equipment for proscribed activities, if required by the Regime.

- One effect of UN monitoring was to implement a national level control system for important dual-use process plants.

Iraq's historical ability to implement simple solutions to weaponization challenges allowed Iraq to retain the capability to weaponize CW agent when the need arose. Because of the risk of discovery and consequences for ending UN sanctions, Iraq would have significantly jeopardized its chances of having sanctions lifted or no longer enforced if the UN or foreign entity had discovered that Iraq had undertaken any weaponization activities.

- ISG has uncovered hardware at a few military depots, which suggests that Iraq may have prototyped experimental CW rounds. The available evidence is insufficient to determine the nature of the effort or the timeframe of activities.

- Iraq could indigenously produce a range of conventional munitions, throughout the 1990s, many of which had previously been adapted for filling with CW agent. However, ISG has found ambiguous evidence of weaponization activities.

Saddam's Leadership Defense Plan consisted of a tactical doctrine taught to all Iraqi officers and included the concept of a "red-line" or last line of defense. However, ISG has no information that the plan ever included a trigger for CW use.

- Despite reported high-level discussions about the use of chemical weapons in the defense of Iraq, information acquired after OIF does not confirm the inclusion of CW in Iraq's tactical planning for OIF. We believe these were mostly theoretical discussions and do not imply the existence of undiscovered CW munitions.

Discussions concerning WMD, particularly leading up to OIF, would have been highly compartmentalized within the Regime. ISG found no credible evidence that any field elements knew about plans for CW use during Operation Iraqi Freedom.

- Uday—head of the Fedayeen Saddam—attempted to obtain chemical weapons for use during OIF, according to reporting, but ISG found no evidence that Iraq ever came into possession of any CW weapons.

ISG uncovered information that the Iraqi Intelligence Service (IIS) maintained throughout 1991 to 2003 a set of undeclared covert laboratories to research and test various chemicals and poisons, primarily for intelligence operations. The network of laboratories could have provided an ideal, compartmented platform from which to continue CW agent R&D or small-scale production efforts, but we have no indications this was planned. (See Annex A.)

- ISG has no evidence that IIS Directorate of Criminology (M16) scientists were producing CW or BW agents in these laboratories. However, sources indicate that M16 was planning to produce several CW agents including sulfur mustard, nitrogen mustard, and Sarin.

- Exploitations of IIS laboratories, safe houses, and disposal sites revealed no evidence of CW-related research or production, however many of these sites were either sanitized by the Regime or looted prior to OIF. Interviews with key IIS officials within and outside of M16 yielded very little information about the IIS' activities in this area.

- The existence, function, and purpose of the laboratories were never declared to the UN.

- The IIS program included the use of human subjects for testing purposes.

ISG investigated a series of key pre-OIF indicators involving the possible movement and storage of chemical weapons, focusing on 11 major depots assessed to have possible links to CW. A review of documents, interviews, available reporting, and site exploitations revealed alternate, plausible explanations for activities noted prior to OIF which, at the time, were believed to be CW-related.

- ISG investigated pre-OIF activities at Musayyib Ammunition Storage Depot—the storage site that was judged to have the strongest link to CW. An extensive investigation of the facility revealed that there was no CW activity, unlike previously assessed.

Evolution of the Chemical Warfare Program

Over a period of twenty years, beginning with a laboratory operated by the intelligence services, Iraq was able to begin and successfully undertake an offensive CW program which helped ensure the Regime's internal and external security. By 1984, Iraq was operating a number of CW agent production plants, producing hundreds of tons of a range of weaponized agents annually, for use against external and internal enemies of the Regime. The program was supported by a complex web of international procurement, R&D, weaponization and indigenous precursor production efforts. Iraq fired or dropped over 100,000 chemical munitions against Iranian forces and its own Kurdish population during the Iran-Iraq war and then later to help put down the Shi'a rebellion in March 1991.

- Iraq became the first nation to use a nerve agent on the battlefield when it used Tabun munitions against Iran in 1984.

- During the Iran-Iraq war, CW use helped the Iraqis turn back Iranian human-wave attacks when all other methods failed, buying time for Iraqi forces to regroup and replenish. Iraq again used CW successfully to help crush the popular revolt in 1991.

- By 1991, Iraq had amassed a sizable CW arsenal, comprising thousands of short range rockets, artillery shells, and bombs, and hundreds of tons of bulk agent. It also had produced 50 nerve agent warheads for the 650 km-range al Husayn missile.

- Despite the provisions of UN Security Council Resolution (UNSCR) 687 in April 1991, which called for Iraq to disarm, Iraq initially chose to retain CW weapons, precursors and associated equipment, making false declarations to the UN. Even when Iraq claimed to have complied with UNSCR 687 and its successors, Saddam retained components vital to restarting a CW program.

Regime Strategy and WMD Timeline

For an overview of Iraqi WMD programs and policy choices, readers should consult the Regime Strategy and WMD Timeline chart, enclosed as a separate foldout and in tabular form at the back of Volume I. Covering the period from 1980-2003, the timeline shows specific events bearing on the Regime's efforts in the BW, CW, delivery systems and nuclear realms and their chronological relationship with political and military developments that had direct bearing on the Regime's policy choices.

Readers should also be aware that, at the conclusion of each volume of text, we have also included foldout summary charts that relate inflection points—critical turning points in the Regime's WMD policymaking—to particular events/initiatives/decisions the Regime took with respect to specific WMD programs. Inflection points are marked in the margins of the body of the text with a gray triangle.

The Early Years, 1960-1980: A Slow Start

The Chemical Corps and Al-Hasan Ibn-al-Haytham Research Foundation

Iraq's interest in CW began in the early 1960s and escalated in response to a perceived threat from Iran and Israel to comprehensive CW research program by the mid-1970s. The Regime initially sent a number of Iraqi officers abroad for training in nuclear, biological and chemical defense. These officers later formed the nucleus of the Iraqi Chemical Corps, established in 1964.

- In 1971, a cadre of Chemical Corps officers sought authorization to synthesize small quantities of CW agents (mustard, Tabun, and CS) for familiarization and the experience, according to Iraq's Currently Accurate Full and Complete Declaration (CAFCD) submitted to the UN in December 2002. The Iraqi General Staff approved the request, and laboratories were built for the Chemical Corps at al-Rashad near Baghdad.

- By 1974, this initial effort had failed, and the IIS stepped in and founded the Al Hasan Ibn al-Haithem Research Foundation. The IIS funded Al Hasan, whose cover was as part of the Ministry of Higher Education and Scientific Research. Iraq's various intelligence services remained involved, directly and indirectly, in CW and related activities for many years.

- Al Hasan personnel were drawn from academia and the Chemical Corps. Al Hasan expanded with the construction of new laboratories in Baghdad and the selection of a new production site 60 kilometers northwest of Baghdad, later to be known as Al Muthanna. Al Hasan's mission was to research the synthesis and production of CW agents. It had limited success producing gram quantities of mustard, Tabun, CS and organophosphate pesticides like Malathion and parathion.

Iraq later declared that the work at Al Hasan was suspended in 1978 and the organization liquidated for failure to achieve its objectives, as well as for mismanagement and fraud.

- General Amer al-Sa'adi found that Al Hasan had made insufficient progress toward the goal of production. Having failed, a Presidential Decree dissolved Al Hasan.

That same year, the former head of the Chemical Corps, BG Nizar al-Atar, claims he submitted a five-year plan to the Ministry of Industry and Minerals for a CW program that included the production of weapons, and some work continued.

By the end of 1979, a reorganized Chemical Corps used the expanded al-Rashad site to produce CW agents, ostensibly for the testing of CW defensive gear and detection equipment. The Chemical Corps, reinforced by many of the former Al Hasan staff, was also surveying the technical literature for information on the production of the nerve agents, Sarin and Tabun, research, which laid the groundwork for their nerve agent production processes.

Full Capability, 1981-1991: Ambition

Foundation of the Al Muthanna State Establishment

Once committed, Iraq spent large amounts of money and resources on its CW program (see Figure 1). The outbreak of war with Iran in 1980 and Iraq's failure to attain a speedy victory appear to have been the impetus for the Ministry of Defense's launch of its industrial-scale, comprehensive, strategic CW program—code-named Research Center 922 or Project 922—on June 8, 1981. The objective was to produce CW agents—mustard, Tabun, Sarin, and VX, chemical munitions, and white phosphorus (WP) munitions. (See Annex B.)

- Project 922 covered research and development for all aspects of CW, production of CW agents and precursors, filling of CW munitions, storing of chemical munitions and agents, and acquiring sufficient technical expertise to construct and maintain production lines.

- The project also included BW R&D after 1985 and pesticide R&D from 1984 to 1987.

Agent Production Begins and Al Muthanna State Establishment Takes Shape

Project 922 subsumed the Chemical Corps al-Rashad CW efforts and their site 60 km northwest of Baghdad. Within months of its inception, Project 922 began construction at the site on what was to become Iraq's main CW production and research center. West German businesses, using East German designs, supervised the creation of what was at the time the world's most modern and best-planned CW facility under the cover of pesticide production.

- Construction activity between 1982 and 1983 was intense. Iraq's foreign contractors, including Karl Kolb with Massar for reinforcement, built five large research laboratories, an administrative building, eight large underground bunkers for the storage of chemical munitions, and the first production buildings.

Figure 1. *Pre-1991 CW facilities.*

Iraq had acquired sufficient expertise during the 1970s, despite fraud and failure by Al Hasan, to begin agent production immediately on completion of the first pilot-scale production line in the early 1980s. For example, 85 tons of mustard agent were produced at al-Rashad from 1981 to 1982. After Project 922 came on line, both facilities produced agent.

- 150 tons of mustard were produced in 1983.
- About 60 tons of Tabun were produced in 1984.
- Pilot-scale production of Sarin began in 1984.

Work at the Project 922 site did not pass unnoticed:

- During the summer of 1985, Iranian F-4 aircraft attacked the Samarra' site;
- This was followed in October 1986 with a SCUD attack.

As a result, Iraq moved a significant portion of its Roland Air Defense System to the Samarra' area to protect the project.

As production increased, Baghdad recognized that its dependence on foreign suppliers for precursors was a program weakness and took immediate steps towards self-reliance for precursor production. Iraq made plans to build three precursor production plants, starting in 1985, near the town of Fallujah, 50 kilometers west of Baghdad.

- Iraq began constructing Fallujah I, II and III between 1986 and 1988 to produce precursors.

The decision to construct the precursor production plants was the beginning of a significant commitment of resources to a long-term CW program. In 1987, Husayn Kamil, assisted by Amer al-Sa'adi, created the MIC and renamed the CW complex *the Al Muthanna State Establishment* (MSE).

MSE Redefines "Dual-Use"

The term "dual-use" refers to resources that have both WMD and legitimate civilian or conventional military applications. MSE pursued legitimate industrial projects in addition to CW agent production, particularly after the end of the Iran-Iraq war. Pesticide and pharmaceutical research took place at Al Muthanna alongside CW development, often involving the same people.

- *The German firm Karl Kolb described the production plants it built as "general multi-purpose pilot plants," providing Iraq with plausible deniability regarding the plants and distancing Karl Kolb from being implicated in contributing to WMD programs.*
- *Pesticide research and development was a secondary responsibility for MSE. Post-1988, MSE unsuccessfully attempted to purchase a pesticide production plant from a number of leading companies worldwide, in order to expand its background knowledge in organophosphorous production.*
- *Between 1989 and 1990, during which time Iraq interrupted CW production because there was no longer an immediate need for agent, the MSE CW infrastructure produced civilian goods, including shampoos, disinfectants, and simple pesticides.*

Early Weaponization: Simple Solutions

Against the background of the Iran-Iraq war and the pressure to halt the Iranians, Al Muthanna took every available shortcut in developing chemical weapons. To avoid the delays of developing indigenous delivery systems, Iraq purchased conventional bombs from Spain that easily could be modified for CW fill. Later, using reverse-engineering, Al Muthanna built the infrastructure to manufacture its own weapons.

- According to Iraq's declaration to the UN in 1996, from 1981 to 1984 Iraq purchased 40,000 artillery shells, and 7,500 bomb casings from various countries that were to be modified for delivery of CW.

- Iraq also declared that by 1989, it had manufactured 10,000 CW bomb casings and 18,500 rocket warheads, all reverse engineered from imported munitions.

CW—A Permanent and Pivotal Strategic Weapon

The work underway at Al Muthanna State Enterprise by the late 1980s was an indication Saddam intended Iraq's CW effort to be a significant, large-scale program. From its inception, MSE's Research and Development (R&D) Directorate investigated a broad assortment of agents. Iraqi CW scientists understood that they would gain the greatest battlefield impact by developing a range of CW agents with different characteristics for different situations.

- MSE's R&D Directorate had individual departments dedicated to the development of mustard agents, nerve agents, and psychomimetic compounds according to Iraq's declaration to the UN in 1996. Reporting from various sources indicates Iraq investigated more than 40 potential CW compounds.

Saddam believed Iraqi WMD capabilities had played a central role in the winning of the Iran-Iraq war and were vital to Iraq's national security strategy.

- ***Iraq became the first nation to use nerve agent on the battlefield when it used Tabun against Iran in 1984. By the end of the Iran-Iraq war, Iraq had used over 100,000 chemical munitions against Iranian human wave attacks and its own Kurdish population.***

- ***By 1991, Iraq had amassed a sizeable CW arsenal and hundreds of tons of bulk agent. Iraq had also produced nerve agent warheads for the 650 km al-Husayn missile.***

Reflecting those perceptions, and in a bid to create a strategic deterrent, MSE turned immediately after the Iran-Iraq war to a strategy for maintaining an offensive CW capability in peacetime. With the end of the war in August 1988, MSE stopped CW agent production, and focused on production of marketable products while continuing research to improve production techniques, agent purity, and shelf life, although it restarted production in 1990.

- Al Muthanna's CW nerve agents contained impurities that affected agent stability and thus limited the shelf life of stored filled munitions and bulk agent. This had not mattered during the Iran-Iraq War, when Iraq was using agent as fast as it could produce it, but given Iraq's intent to use chemical weapons as a strategic deterrent, some stockpiling was essential.

A speech by Saddam on 2 April 1990 publicly identified Iraq's CW research and production efforts in anticipation of the next war. Saddam claimed Iraq had a binary agent capability, an assertion that caught MSE scientists off guard, according to Iraqi declaration corroborated by documents the UN discovered at Al Muthanna.

- In less than a month after Saddam's speech, Iraq restarted its CW production lines, tested CW warheads for al Husayn missiles, and reverse-engineered special parachute-retarded bombs. [According to the FFCD, Iraq did not import any aerial bombs in 1990.]

Al Muthanna filled the al-Husayn warheads and aerial bombs with a binary nerve agent component. These weapons were accompanied by Jerry cans containing the second component, a chemical that, when mixed with the weapons' contents, produced nerve agent. This was the mix-before-flight Iraqi 'binary' system. Iraq deployed 1,000 binary bombs and 50 al-Husayn warheads—binary and unitary—by August 1990.

- In the subsequent first Gulf war, it is assessed that Saddam believed that the deployment of CW, and the delegated authority to use them, contributed to the US not driving on to Baghdad.

The Decline, 1991-1996

Destroying Iraqi Weapons

During the Gulf war in early 1991, Coalition Forces destroyed or extensively damaged most of Iraq's CW infrastructure, including many of the agent and precursor production facilities at Al Muthanna. Then, in April 1991, the UN adopted Security Council

Examples of Known Iraqi Use of CW

The war with Iran ended in August 1988. By this time, seven UN specialist missions had documented repeated use of chemicals in the war. According to Iraq, it consumed almost 19,500 chemical bombs, over 54,000 chemical artillery shells and 27,000 short-range chemical rockets between 1983 and 1988. Iraq declared it consumed about 1,800 tons of mustard gas, 140 tons of Tabun, and over 600 tons of Sarin. Almost two-thirds of the CW weapons were used in the last 18 months of the war. Examples of CW use by Iraq:

Use in Iran-Iraq war, 1983-1988

• ***August 1983 Haij Umran***	Mustard , fewer than 100 Iranian/Kurdish casualties
• ***October-November 1983 Panjwin***	Mustard, 3,000 Iranian/Kurdish casualties
• ***February-March 1984 Majnoon Island***	Mustard, 2,500 Iranian casualties
• ***March 1984 al-Basrah***	Tabun, 50-100 Iranian casualties
• ***March 1985 Hawizah Marsh***	Mustard & Tabun, 3,000 Iranian casualties
• ***February 1986 al-Faw***	Mustard & Tabun, 8,000 to 10,000 Iranian casualties
• ***December 1986 Um ar-Rasas***	Mustard, 1,000s Iranian casualties
• ***April 1987 al-Basrah***	Mustard & Tabun, 5,000 Iranian casualties
• ***October 1987 Sumar/Mehran***	Mustard & nerve agent, 3,000 Iranian casualties
• ***March 1988 Halabjah& Kurdish area***	Mustard & nerve agent, 1,000s Kurdish/Iranian casualties
• ***April 1988 al-Faw***	Mustard & nerve agent, 1,000s Iranian casualties
• ***May 1988 Fish Lake***	Mustard & nerve agent, 100s or 1,000s Iranian casualties
• ***June 1988 Majnoon Islands***	Mustard & nerve agent, 100s or 1,000s Iranian casualties
• ***July 1988 South-central border***	Mustard & nerve agent, 100s or 1,000s Iranian casualties

Use in Southern Iraq against the Popular Uprising, 1991

• ***March 1991, an-Najaf - Karbala area***	Nerve agent & CS, Shi'a casualties not known.

These are selected uses only. Numerous other smaller scale CW attacks occurred.

Resolution 687, which established a ceasefire in the Gulf war. Iraq was required to verifiably disarm as a prerequisite to lifting of the oil embargo imposed by UNSCR 660 of August 1990.

Iraq initially chose not to fully declare its CW weapons and infrastructure, a decision usually attributed to Husayn Kamil and implemented by senior personnel including his senior deputy, Amer al-Sa'adi.

- Anticipating that inspections would be an ineffective and short-lived inconvenience, Iraqi leaders decided in early April 1991 to hide significant components of the CW program, including weapons, precursors, and equipment.

- Following a particularly invasive IAEA inspection in late-June 1991, Saddam ordered Dr. Mahmud Faraj Bilal, former deputy of the CW program, to destroy all hidden CW and BW materials, according to an interview with Bilal after OIF.

- ***Available evidence indicates Iraq destroyed its hidden CW weapons and precursors,*** but key documentation and dual-use equipment were retained and were later discovered by inspectors.

For the next five years, Iraq maintained the hidden items useful for a CW program restart but did not renew its major CW efforts out of fear the UN sanctions would not be removed. UN sanctions severely limited Iraq's financial resources. Raw materials, precursors, equipment, and expertise became increasingly scarce. The crippling of Iraq's CW infrastructure by the war, and the subsequent destruction and UN monitoring of much of the remaining materials and equipment limited Iraq's ability to rebuild or restart a CW program.

- The effects of sanctions reverberated throughout the scientific community and affected all aspects of industry within Iraq. Many scientists were underemployed or had access to neither research and production materials nor professional development.

In August 1995, shortly after Iraq revealed its production of bulk BW agent, Saddam's son-in-law and head of Iraq's WMD programs, Husayn Kamil, fled the country. Saddam made a decision at that time to declare virtually all hidden information and material they felt was significant on Iraq's programs, turning over WMD documentation, including 12 trunks of CW documents.

- The documentation turned over by Iraq, allegedly hidden by Husayn Kamil, included results of Iraqi research material up to 1988 that indicated more extensive research on VX than previously admitted.

- The documents also included papers related to new agent research, mix-in-flight binary munitions development, and previously undisclosed involvement of other organizations in CW research.

ISG believes that none of these events weakened Saddam's resolve to possess a robust CW capability. Baghdad believed its need for chemical weapons was justified, based on its fear of hostilities with Iran and Israel. The Regime, we judge, was also motivated by an unstated desire to elevate its status among Arab nations. ISG believes that Saddam deferred but did not abandon his CW ambitions.

- ***Saddam implied, according to the former Presidential Secretary, that Iraq would resume WMD programs after sanctions in order to restore the "strategic balance" within the region and, particularly, against Israel.***

- Saddam was fascinated by science and by the possibilities it offered for enhancing his military power base. He felt that possessing the technological capability to develop WMD conferred the intrinsic right on the country to do so, according to a former senior Iraqi official.

- In the 1990s, the Regime actively sought to achieve scientific excellence in Iraq through a series of administrative measures, but years of isolation from the international academic community and a lack of successful domestic research left Iraq's scientific infrastructure in decay.

- According to an Iraqi academic scientist, Saddam issued an edict in 1993-1994 that all Iraqi universities address problems encountered in the military and industrial sectors. This marked a departure from past practice where the government denied such work to universities.

- Following this order, Iraqi research universities were required to become self-funding. MIC projects accounted for much of the research funding during this time, according to a leading university scientist.

- Saddam encouraged open forums for competition among scientists through committees and other programs, and he personally awarded top scientists for exceptional work in technical fields. Saddam became personally involved in the direction of some of these programs, but many lacked unified planning or direction for research, and few were successful, according to Sa'adi.

Following Husayn Kamil's defection, Saddam took steps to better manage Iraqi industry, and with the creation of the Iraqi Industrial Committee (IIC) in September 1995, the stage was set for a renewal of Iraq's chemical industry. The IIC coordinated a range of projects aimed at developing an indigenous chemical production capability for strategically important chemicals that were difficult to import under UN sanctions, according to reporting. (See Annex C.)

Recovery and Transition, 1996-2003

Iraq's CW program was crippled by the Gulf war and the legitimate chemical industry, which suffered under sanctions, and only began to recover in the mid-1990s. Subsequent changes in the management of key military and civilian organizations, followed by an influx of funding and resources, provided Iraq with the ability to reinvigorate its industrial base. Iraq's acceptance of the UN OFF program in 1996 was the foundation of Iraq's economic recovery and sparked a flow of illicitly diverted funds.

Iraq's chemical industry surged in the late 1990s, when more financial resources became available to the Regime. Although Iraq still lagged behind its pre–Gulf war capabilities, it was able to divert a portion of its revenue to purchase new plants and renovate existing ones to renew its basic chemical industry.

- Iraq was successful in procuring, constructing, and commissioning a complete state-of-the-art chemical facility for ammonium perchlorate through the Indian company NEC. Ammonium perchlorate is a key chemical for missile propellants.

- Iraq began refurbishing, and in some cases expanding, existing chemical facilities with foreign assistance. For example, the Al Tariq complex renovated its chlorine and phenol lines and restarted them in March 2000, according to reporting.

Between 1996 and 2003, the IIC coordinated large and important projects for the indigenous production of chemicals.

- A written order from Saddam established the National Project for Pharmaceuticals and Pesticides (NPPP). NPPP focused on the synthesis of drugs and pesticides, for which Iraq in the past relied heavily on foreign suppliers.

- The IIC examined over ***1,000 chemicals for initial R&D*** to determine the feasibility of scaled-up production. ISG notes that two chemicals on this list were compounds that are consistent with an experimental VX pathway.

- The process for vetting the 1,000 chemicals for economic feasibility and large-scale production was intensive and formalized. The IIC leadership built in several layers of review, research, and justification before compounds were selected for scale-up, ***raising further suspicion about the three compounds, particularly dicyclocarbodiimide (DCC)—a dehydrating agent that can be used as a VX stabilizer***

- Dr. Ja'far Dhia Ja'far, and IIC member, could not recall which projects were accepted for scale-up but he knew that some compounds were dual-use and declarable to the UN, and that the National Monitoring Directorate (NMD) did not declare all of the chemicals.

Reports of an unexplained discovery of VX traces on missile warhead fragments in April 1997 led to further tension between UNSCOM and Iraq. The uneasy relationship escalated with the discovery of the 'Air Force Document' (see RSI chapter) in July 1998, which indicated further Iraqi deception and obfuscation over its CW disclosures. Iraq's anger about these two major issues was a contributing factor to Saddam's decisions to suspend cooperation with UNSCOM and IAEA.

- ***The lack of inspectors allowed further dual-use infrastructure to be developed. The lack of effective monitoring emboldened Saddam and his illicit procurement activities.***

Concurrently, Iraq continued to upgrade its indigenous manufacturing capability, pursuing glass-lining technology and manufacturing its own multipurpose controllers.

- Reporting indicates that research being conducted by State Establishment for Heavy Engineering Equipment (SEHEE)—Iraq's primary fabrication plant—beginning in 1999 was geared towards developing a process for glass lining steel reactors, making them corrosion resistant. SEHEE was focused on making cheaper, longer-lasting vessels, and reducing reliance on stainless steel.

- Documents recovered by ISG indicate that two teams, including one from the Al Majid Company had developed multipurpose controllers for typical chemical production by January 2003.

As the chemical industry began to recover, former CW scientists remained employed, primarily at Al Tariq Company (see Annex F), on a range of issues of interest to the UN and which Iraq claimed were part of its industrial chemical or defensive NBC interests. We have not been able to confirm that any of these efforts were connected to chemical agent production capability.

- Scientists from the former CW program formulated agent simulants such as concentrated Malathion, a pesticide, and locally manufactured a copy of a system to disperse the simulant in 2001 and 2002.

There is an extensive, yet fragmentary and circumstantial body of evidence suggesting that Saddam pursued a strategy to maintain a capability to return to WMD production after sanctions were lifted by preserving assets and expertise. In addition to preserved capability, we have clear evidence of his intent to resume WMD production as soon as sanctions were lifted. All sources suggest that Saddam encouraged compartmentalization and would have discussed something as sensitive as WMD with as few people as possible.

- Huwaysh claimed that in 1999 Saddam asked how long it would take to build a production line for CW agents. Huwaysh tasked four officials to investigate, and they responded that experts could readily prepare a production line for mustard within six months. VX and Sarin production were more complicated and would take longer. Huwaysh relayed this answer to Saddam, who never requested follow-up information. An Iraqi CW expert separately estimated Iraq would require only a few days to start producing mustard—if it were prepared to sacrifice the production equipment.

Miscalculation, 2002-2003

As the reality of the UN's impending return sank in, Iraq rapidly initiated steps to prepare for inspectors. Committees and groups were formed to ensure sites and key scientists were ready to receive the inspectors.

- As had often occurred in the past, individual scientists, heads of departments and security officials examined their plans of work for items or documents that would be subject to inspections. In every relevant location in Iraq, to some extent, normal work was disrupted in the effort to ensure Iraq was not suspected of undertaking proscribed activities.

- According to a senior chemist at the MIC, Huwaysh in October 2002, issued an order—the same order issued several times in the past—which held scientists personally responsible for any materials, equipment, or other prohibited items found by the UN.

- Vice President Taha Ramadan chaired a meeting of over 400 scientists before the inspectors returned, threatening scientists with dire consequences if the inspectors found anything that interfered with Iraq's progress towards the lifting of sanctions.

- When inspections resumed, foreign experts were hidden from the inspection teams.

In the final days of his Regime, Saddam continued to pursue efforts to enhance Iraq's industrial base, with plans underway for the construction of a multipurpose chemical plant, and nine oil refineries in Southern and Northern Iraq. The plans for this chemical plant were the result of years of the IIC's efforts to coordinate research into the indigenous production of chemicals.

- The Ministry of Industry and Minerals (MIM) owned a plot of land west of Baghdad that it set aside for construction of this multipurpose production facility, which was designed to produce a year's supply of 100 chemicals using only 10 independent pilot-scale production lines. (For more information, see Iraq's Infrastructure: Production Capability).

- Construction was scheduled to begin in March 2003, but was halted just prior to OIF. The plant would have provided Iraq with an indigenous multipurpose production facility capable of producing large quantities of chemicals, in a relatively short time.

Command and Control

Preamble: Muddling Through After the Gulf War

ISG believes that two of Saddam's primary goals after the war were to recover economically from war damage and to retain Iraq's capability to reconstitute its WMD program after sanctions were lifted or became ineffectual, inspections were removed, and the threat of force abated. During the Gulf war in early 1991, Coalition Forces destroyed or extensively damaged most of Iraq's CW infrastructure, including the agent and precursor production facilities at Al Muthanna. Given the Iraqi government's possession of CW data and production experience, the preservation of intellectual capital would be key to the eventual restoration of a post-sanctions CW program, and the Regime took explicit steps to ensure the preservation of its body of CW scientists.

- Many former employees of Al Muthanna were deployed to Al Tariq and worked there until OIF.

- In some cases, CW experts were diverted to companies within the IIC or the MIM, according to interviews with multiple sources after OIF. Others were assigned to be instructors at chemical schools for defensive NBC work.

Of the approximately 200 former CW scientists—about 60 of whom are considered key CW experts from the Al Muthanna years—ISG attempted to contact close to 150 to determine their activities since 1991 and any efforts by the Regime to utilize their skills for CW-related efforts. ISG was able to identify initial location information for approximately 130 individuals, many of whom were not able to contacted.

- Based on locations, employment, and availability, ISG experts were able to speak to nearly 30 former key-CW scientists, none of whom claimed to have been involved in CW-related activities after 1991 or to know any individuals suspected of involvement in such work.

- With the exception of one instance, when former VX expert Imad Husayn Al-Ani was apporached by 'Uday's officer in 2003 with a request to make chemical agent, no other scientists claimed they had been contacted by Regime officials requesting assistance in CW work.

Iraq Could Maintain CW Competence With Relative Ease

The issue of retaining scientists in Iraq was a Regime policy. However, given the command economy in Iraq, which offered limited possibilities for work at private chemical companies, it is not surprising that most key personnel from the former CW program remained employed in the government chemical sector. Former CW scientists became heavily involved in rebuilding Iraq's industrial infrastructure, and some experts were directed to work projects within various military organizations.

- Saddam instructed Directors General of Iraqi companies and other state entities to prevent key scientists from the pre-1991 WMD program from leaving the country, according to Dr. Ja'far Dhia Ja'far.

Iraqi scientists and engineers could maintain a minimal CW production proficiency without engaging in CW-related R&D and production because they were already experienced in key CW agent production processes. Largely based on data available in previously published technical literature, Iraq had sufficiently developed processes to produce nerve, blister, and psychological agents.

- For instance, Iraqi research on VX started in 1985 with a literature survey on the preparation and production methods of VX. Based on their literature review, the best and easiest method was chosen for the preparation of VX agent, according to Iraq's CW Full, Final, and Complete Disclosure (FFCD) to the UN.

- Iraq's CW agent purity, formulation, and production standards in the 1980s program—although inferior to Western standards with the exception of its high-grade mustard—were "good enough" to produce harmful agent proven successful during previous use.

ISG Strategy To Evaluate Whether Iraq's Chemical Industry Infrastructure Was CW-Ready

ISG's strategy for assessing the capabilities of Iraq's chemical infrastructure to support a CW program was based on a systematic evaluation of four components necessary to maintain such a program: raw material, equipment, expertise and Regime intent. During its investigations, ISG seized documents, conducted several site visits and interviewed high-ranking technocrats, former CW scientists, and prominent Iraqi academics to determine the extent, breadth, and coordination of Regime directed dual-use infrastructure development and chemical research and production.

- *To determine the availability of expertise required to contribute to a large-scale CW effort, ISG exploited sites, interviewed former CW scientists and analyzed documents on government-sponsored research.*

- *ISG searched for chemistry technology necessary for production of key CW precursors, such as processes involving phosphorous and chlorine.*

- *ISG used various historical intelligence reporting, open-source materials, and interviews with Iraqi scientists, and site visits to investigate Iraq's chemical laboratories and industries, and information about Iraq's CW agent production experts from 1991 to OIF.*

- *Chemical plants that used or produced phosphorus compounds were a priority because Iraq's ability to quickly recover a nerve agent production capability was dependent on its access to phosphorus-based compounds.*

Overall, ISG's efforts to uncover information on CW-germane research, development and infrastructure were complicated by uncooperative detainees, threats to some sources and extensive looting and burning of documents and facilities.

Inadequacies in Iraq's pre-1991 CW program were probably caused by limited equipment and inferior precursor chemicals. Iraq could procure the materials to address these problems if sanctions were lifted, intrusive inspections removed, and threat of force abated.

- In the case of VX, which Iraq claimed it abandoned because of lack of success at large-scale production according to Iraq's FCCD, the scientists eventually became well aware of the factors resulting in unstable, poor quality (low purity) VX. *(see discussion on VX in production section).*

- These factors included low purity and instability of precursors, reaction temperature control, inadequate vacuum systems, and inadequate size of separation vessels.

Infrastructure—Research and Development

Reflecting the importance the Regime attached to industrial and scientific progress and aiming to recover from the war with Iran, Baghdad undertook in the mid 1990s a centralized, national effort to coordinate Iraqi industrial activities. By the late 1990s, fueled by resources available through the Oil-for-Food program, that effort underlay a specific initiative aimed at boosting the capabilities of Iraqi pesticide and pharmaceutical industries, including the capability to manufacture dual-use chemicals. Although ISG found no direct evidence linking dual-use chemical production to an active or latent CW program, research and development on types of specific chemicals linked to Iraq's CW program raises concerns about the legitimacy of Iraq's chemical plans.

Prior to 1991, Iraq's national research and development (R&D) capability was limited in scope, and efforts were largely concentrated in state establishments such as the Al Muthanna State Establishment (MSE) and at the university level.

- Iraq's industrial sector had limited capabilities for research, primarily because it had typically purchased turnkey facilities for industrial production from abroad.

After the Gulf war, Iraq's ability to conduct R&D stagnated, and the majority of MSE scientists were deployed to operate factories or manage critical infrastructure problems caused by the war. The universities had no formal national R&D role and continued to operate their departments in a self-directed, isolated style.

- The effects of sanctions and the prevailing international situation devastated the research community, preventing the intellectual capital of Iraq from participating in normal academic interaction.

In the 1994 timeframe, Saddam issued an edict that all Iraqi universities address problems experienced in the military and industrial sectors, according to an Iraqi academic scientist. Prior to this, universities were not obligated to conduct applied research for either sector.

In subsequent years, and in part triggered by the surge of state funding from the OFF program, Iraq was able to begin implementing Saddam's edict and utilizing the intellectual capital of Iraq to help solve some of the shortages which had plagued Iraq's industrial and military sectors.

- An upturn in the economy after years of sanctions allowed Iraq to reevaluate its research efforts and initiate a series of projects to enhance its industrial base.

Creation of the Iraqi Industrial Committee

Saddam ordered the creation of the Iraqi Industrial Committee (IIC) in September 1995 to coordinate Iraqi industrial activities after Husayn Kamil fled the country according to documents. After the defection, Saddam assumed the role of Prime Minister as well as president of Iraq, and began attending the weekly ministers meetings. He ordered the establishment of the IIC and a similar Economic Committee to prevent the weekly meetings from becoming too detailed, according to interviews with Huwasyh.

- The RCC issued a decree formally setting up the Industrial Committee and charged it to deal with all scientific, technical, and industrial matters affecting the entire Iraqi industrial sector, according to interviews with Huwaysh and Ja'far.

- Ja'far indicated that the IIC commissioned a program aimed at developing an indigenous production capability for strategically important chemicals for domestic consumption that were difficult to import under UN sanctions

The IIC's membership included the heads of Iraq's military and civilian industrial ministries and sectors:

- Members included the Head of MIC, the Minister of Industry and Minerals (MIM), the Minister of Higher Education and Scientific Research (MHESR), the Minister of Oil, and the Iraqi Atomic Energy Commission (IAEC), according to multiple reports.

- Saddam appointed Minister of Oil Amer Rashid as the first IIC chairman, and he was followed by the Minister of Higher Education and Scientific Research Abd Al-Khaliq al-Ghafur in 1996 or early 1997. Abd al-Tuwab Huwaysh later assumed the role of chairman of the IIC—as well as being a Deputy Prime Minister of Iraq, according to documents signed by Huwaysh and other reporting.

- Dr. Ja'far, as the Senior Advisor to the President, was appointed as an independent member of the IIC. He was neither subordinate to a ministry nor to the IIC chairman—instead he reported directly to Saddam's personal Secretary, Abd Hamid Mahmud, according to interviews with Dr. Ja'far. Ja'far also was made chairman of the Research and Development Committee and the Technology Transfer Committee, which was later subordinated to the IIC.

The Power of the IIC

ISG judges that the IIC had significant influence over Iraq's chemical infrastructure, industry, and research, even though it had not been constituted with that aim in mind. In effect, the IIC was the driving force behind an extensive, centralized national infrastructure improvement effort apparently focused on developing the pesticide and pharmaceutical industries and improving self-sufficiency, based on interviews with IIC officials and documentation.

- The IIC actively allocated research in Iraq, including work at universities, state companies and government research centers. Government ministry research resources, including the MIC's, were distributed by the IIC according to official reporting.

- The MHESR was the primary channel for recommending industrial research to universities and educational research centers in Iraq, according to the same reporting. However, the Ministry could not dictate to universities what type of research to conduct—instead, universities chose their own research based on their capabilities, according to different official reporting.

Source Note: Principal source for IIC activity—Dr. Ja'far Dhia Ja'far

Interviews with Dr. Ja'far Dhia Ja'far provide the basis of the majority of information ISG has obtained on key IIC projects such as the National Project for Pharmaceuticals and Pesticides (NPPP) and the National Project for Active Chemical Materials, and their execution. Dr. Ja'far was founder of the Iraqi nuclear program, Director of the Office of the Presidential Advisor, and Chairman of the IIC's Research and Development and Technology Transfer Committees. A very capable technocrat, Dr. Ja'far had unparalleled access as Director and supervisor of the NPPP and Chair of IIC's Research & Development Committee, which had oversight responsibilities for chemical research. Dr. Ja'far indicated he had near total control over the implementation of the NPPP. Much of Dr. Ja'far's information has been corroborated by documents and other officials including high-ranking employees from MIC and MHESR.

The IIC's Master Plan for Self-Reliance: The List of 1,000 Chemicals

IIC placed greater emphasis on the synthesis of active chemical compounds than on novel R&D, because Iraq was highly dependent on foreign supplies of these materials for production of pharmaceuticals and pesticides. Several ad hoc panels drawn from the IIC's Research and Development Committee selected the final "List" of approximately 1,000 chemicals for initial R&D to assess the feasibility of scaled up production. The feasibility research was referred to as "phase 1". According to an Iraqi academic scientist, around 15 items on the List of 1,000 chemicals were so-called "first order emergency" or top priority compounds. There were also second-order emergency compounds and a third-order tier.

The IIC distributed the final list of chemicals to Iraq's industrial Ministries, State companies, research centers, and universities, and instructed these organizations to bid on research contracts for the chemical research and development projects for which they were best equipped to complete. IIC's Research and Development Committee identified the entities best suited for each project and awarded the contracts.

The IIC's Program for the Indigenous Production of Chemicals appears to have evolved into a nation-wide, pan-industry, pan-academia merit-based competition for project ideas and project implementation. According to official reporting, the work stimulated by the IIC's Technology Transfer Committee, a committee involved in promoting private-sector and university research, was scientifically credible and was selected on merit. Progress on the Program for the Indigenous Production of Chemicals was largely limited to economic feasibility studies and small scale laboratory research, until approximately early 1999, according to Ja'far.

- The Presidential Diwan reviewed and approved the final list and allocated approximately one million dinars (approximately $US 500) per project (note—in 1998, $1 is 2000 dinars). The IIC only planned to select a fraction of the 1,000 chemicals for scale-up after the review and recommendation process was complete.

- Studies included requirements for infrastructure, equipment, manpower, and chemical precursors, according to different reporting.

Dual-Use Chemicals on the List of 1,000 Chemicals

Past Iraqi use of three of these chemicals—thionyl chloride, thiourea, and DCC—in its former VX program raises questions about their legitimacy. Thionyl chloride and thiourea were used in a VX production route that resulted in a product with higher purity for the Iraqis which we assess could have been successfully stabilized with DCC. However, we found no information linking this research to a CW program.

- Imad Husayn al Ani, Iraq's former program director for VX, stated in an interview in 2003 that plans to produce thiourea and DCC, both of which he was unaware, indicated unequivocally that the Regime intended to reconstitute the V-series nerve agent program.

- ISG has been unable to establish why thiourea and DCC were considered strategic chemicals. There were no constraints on Iraq's importation of thiourea and no identified industrial products or processes in Iraq that require DCC for their manufacture. In addition, Mosul University had not determined the economic benefit of producing DCC.

- All three compounds were, however, part of Iraq's former VX program. Two of the compounds are directly applicable to an experimental VX synthesis route which yielded higher purities for Iraq than the two main VX production routes which it declared

- Thionyl chloride is a chlorinating agent used by Iraq in its former CW program. Iraq could have selected alternative chlorinating agents for production that are not controlled for importation or production for legitimate manufacturing purposes.

Thionyl Chloride

ISG does not believe that the scale-up project extended beyond feasibility studies prior to OIF, and we are unsure of Iraq's intended use thionyl chloride ($SOCl_2$) given its many industrial uses and potential industrial value. A letter from the Office of the Presidential Advisor indicated that as of September 2002, the office had not yet received a report on pilot-scale research projects for 14 chemicals, including thionyl chloride. Thionyl chloride, a controlled CW precursor that Iraq had used as a chlorinating agent in its sulfur mustard and nerve agent production processes up until 1990, was part of the program for the indigenous production of chemicals. The IIC tasked the Jaber Bin Hayan State Company between 1996 and 1998 to research the small-scale production of thionyl chloride, according to reporting. According to official reporting, thionyl chloride production was reported to Iraq's National Monitoring Directorate.

- After Jaber Bin Hayan in 1998 achieved its objective of reaching 99.99 percent purity on the 50 milliliter scale, the company was charged in 2001 with outlining the feasibility of pilot-scale production—approximately 1,000 kilograms—according to official reporting and documents recovered from a MIC hard drive.

- The same former CW official believed that Jaber Bin Hayan otherwise would have been an odd choice, mainly because its facilities and equipment are ill-suited to produce thionyl chloride compared to other MIC and MIM companies. The official opined that Jaber Bin Hayen was tasked because it employed two chemists who had worked on thionyl chloride at Al Muthanna in the pre-1991 CW program.

- Reportedly, the thionyl chloride project was meant to support pharmaceutical production.

DCC

DCC was on the UN Good's Review List, but is not restricted under the Chemical Weapons Convention Schedules of Chemicals or the Australia Group international export control Regimes, and is available on the international commercial market. ISG assessed the Iraqi domestic market for DCC was small at the time of OIF.

- Mosul University accepted the DCC tasking from the IIC in July 1998, according to a Mosul University report to the IIC sent in 2001. Other reporting discussed their research results in synthesis and purification of DCC.

- ISG discovered documents at the offices of the IIC in September 2003—which had been subjected to military action, looting, burning and deliberate destruction—outlining Iraq's intent to investigate production of DCC.

- According to a former high-ranking employee of the MHESR, the inclusion of DCC among the List of 1,000 chemicals for the IIC was common knowledge. He claimed that DCC is used in the synthesis of various compounds, and the scientists working on it would not be aware of its utility as a VX stabilizer even thought it was described as a potential VX stabilizer in the Iraqi Chemical Warfare FFCD.

Iraqis themselves differ over the economic rationale for DCC. DCC has several industrial uses as a dehydrating agent and acid scavenger and is used in the industrial production of peptides. A former Iraqi CW scientist familiar with legitimate lab-scale uses of DCC in the production of pharmaceuticals was not aware of a commercial reason for the use of large amounts in Iraq. However, Dr. Bilal, the former head of R&D for the CW program, stated that DCC was a dehydrating agent and thus would have applications in the pharmaceutical industry.

DCC did not move beyond laboratory research because Iraq did not have the raw materials to produce it, according to former high ranking employees of the MIC and MHESR. However, ISG recovered documents from the Technology Transfer Office that suggest DCC was planned by Al Majid State Company for later production.

- In late 2002, the IIC asked the MIC if they had any companies capable of producing DCC. Al Basel, Ibn Sina, al-Qa Qa'a, Al Tariq, Jaber Bin Hayan, and Al Kindi all claimed they could not produce DCC with the materials they had on hand, according to a senior chemist from the MIC.

- The Al Majid State Company was ready to transfer University of Mosul, Chemistry Department's "cyclohexanol carbon 2 Aymayid" precursor project to formal production even though no economic benefit had been determined, according to final research evaluation documents from Dr. Ja'far's office. ISG believes the "cyclohexanol carbon 2 Aymayid" is an odd notation or translation of N,N-dicylohexylcarbodiimide (DCC).

- These documents also indicate that a precursor chemical in the DCC production process investigated by Mosul University and Baghdad University—cyclohexylamine —was researched for production.

- Of the three suspect compounds mentioned here, DCC was the only one included in the set of Process Flow Diagrams (PFDs) provided by the Al Majid State Company for potential scale-up in the multi-purpose plant. This could be an indication of Iraq's intent to produce DCC at a large scale, although we have no detailed information revealing the actual intended scale.

Iraq's Declared Work With VX Nerve Agent

Iraq began research on VX in the 1980s but failed to declare any production or attempts to produce VX until August 1995. *In its 1996 declaration, Iraq claimed to have unsuccessfully attempted large-scale VX production by two routes, and admitted researching two additional, experimental routes between 1984 and 1990.*

- *Iraq initially declared production of 0.26 tons of VX, then modified its declaration several times to reach a total of 3.9 tons produced at Al Muthanna with available pilot-scale equipment. Iraq denied large-scale VX production or weaponization.*
- *The two routes it claimed only to have researched, also known as Routes C and D, provided higher purity and yield than the two main routes, A and B. We judge that Iraq would have been more likely to continue work on one of these two routes.*
- *DCC and other dehydrating agents cannot stabilize low purity (<90%) VX for long term storage.*

Iraq claims not to have pursued routes C and D, primarily because it did not have access to key precursors and did not retain any prior stocks that would have been necessary to produce VX.

- *Iraq claimed to the UN that thiourea was unavailable or too expensive, but thiourea is not controlled and is available on the open market for relatively low prices.*
- *Iraq claimed to have conducted minimal research into route C, but according to UNSCOM reporting, Iraq conducted over 100 experiments on route C.*
- *Iraq had plans to procure a thiourea and nitrogen plant, both which are necessary for VX production via route C, according to UNSCOM reporting.*

ISG during its investigation of the IIC program for strategic large-scale production noted three compounds—thionyl chloride, thiourea, and DCC—with direct applications to the Route C VX production process. *The table below shows that this route, which utilizes two of the three chemicals for production, can address prior Iraqi deficiencies in VX purity and stability if yield and purity can be maintained in production scale synthesis.*

Comparing routes investigated by Iraq

	Route A	Route B	Route C	Route D
Purity	60-65%	50%	80-90%	90%
Yield	50-55%	30-35%	80%	90%
Starting reactant	MPC	MPC	MPC	MPC
Couple with	choline	choline	thiocholine	chlorocholine
Source of sulfur	P2S5	P2S5	thiourea	P2S5
Binary possible?	yes	yes	yes	No
Scale of declared production	Large-scale	Large-scale	Research only	Research only

* DCC and other dehydrating agents cannot stabilize low purity (<90%) VX for long term storage.

Thiourea

Thiourea is a readily available commodity chemical not normally associated with CW agent production. It is used in the synthesis of dyes, flame retardants, pesticides and pharmaceuticals. However, thiourea was used by Iraq in successful synthesis of VX prior to the Gulf war.

- Methyl thiouracil, a thyroid medicine which requires thiourea for its synthesis, was a project under the NPPP according to documentary reporting.

Considering that thionyl chloride and thiourea are two of the precursors needed to synthesize VX using Iraq's investigative pathway and that DCC could potentially stabilize the product of this synthetic route, ISG believes Iraq's interest in these chemicals is suspicious. However, we note that these three compounds are a small part of the larger, more difficult organophosphorous synthesis component of VX production.

Chemicals From the List Move Toward Production

Although ISG has multiple HUMINT and documentary reports on the Program for the Indigenous Production of Chemicals and the NPPP, we have found no evidence that any of the programs reached a commercial production phase prior to OIF. Dr. Ja'far Dhia Ja'far could not recall which projects were accepted for scale-up or the intended end-users, but he also knew some of the compounds were dual-use and declarable to the UN and that the NMD did not declare all of the chemicals.

- The Technology Transfer Committee awarded two contracts for the preparation of Process Flow Diagrams (PFDs) for the production plant required to produce the 100 strategically important chemicals to the IAEC and to the Al Majid Chemical Engineering Center in 2002.

Al Maijd and IAEC engineers designed a plant that could produce a year's supply of each of the 100 chemicals using only 10 independent pilot-scale production lines. The engineers supplied Ja'far with process flow diagrams (PFDs) and piping and instrumentation diagrams (P&IDs) for a plant.

- Reportedly, the conceptual designs were given to Ja'far in late 2002.

- Each production line was to be designed so that it was capable of producing multiple chemicals with only minor reconfiguration.

The multipurpose design is particularly interesting in the context of a statement made by General Faiz Abdullah Shahine—the last known director of the CW program—at a conference in 1989 or 1990 examining the future direction of Al Muthanna that "we cannot have a reactor for each unit. Even in the drug industry, they tend towards the multipurpose reactors. God willing, we will have 6 to 10 units… we must work in a manner compatible with our potentials."

Infrastructure—Production Capability

Improving economic conditions and better management led to a revival in the industry's fortunes by the latter half of the 1990s. Although they still lagged behind pre-war capacity, the Regime envisioned further expansion in the new century and on the eve of OIF, Iraq had some capability to restore chemical weapons production.

Iraq's CW infrastructure suffered a severe blow during Desert Storm, and under subsequent UN sanctions and UN inspections. The entire industrial sector for years endured shortages of raw materials, infrastructure decay and declining production. Iraq's residual CW infrastructure was under intense scrutiny by the UN, which set up additional controls to monitor or destroy remaining materials and equipment.

- In 1991, the majority of CW production sites suffered extensive bomb damage, but many filled munitions, bulk agent and precursors remained on site under the control of the Regime.

- Vital materials were unavailable or unaffordable, and neglected plants deteriorated while productivity declined. Electricity and water remained unreliable, which impacted on the ability to run chemical production processes.

- The UN set up the Chemical Destruction Group, which operated in Iraq from 1992-1994, tasked with the job of destroying the bulk agent, filled munitions, and precursors left over from the former program. Remaining process equipment was tagged and monitored, as was all dual-use process equipment throughout Iraq.

- By 1994, Iraq's capability to produce CW at Al Muthanna was completely destroyed, along with Iraq's supply of chemical precursors.

An improving economy in 1997—due in part to the OFF Program—and better management at MIC led to improvement in the chemical industry, especially in production output. MIC and companies within other Ministries continued to develop, expand, and renovate the chemical infrastructure, and by 2001, Iraq believed it had proven its ability to defy sanctions and revive itself, according to an Iraqi economics media report.

- In 1998, the MIM began rehabilitating Al-Furat State Company for Chemical Industries' chlorine plant, employing technical teams and engineers from its own companies. According to the Iraqi economic media report, key parts for the plant that were previously imported now could be produced indigenously.

- Also in 1998, the State Enterprise for Petrochemical Industries set up a chlorine plant for water purification, according to Iraqi press reports.

Iraq continued to upgrade its indigenous manufacturing capability, pursuing glass-lining technology and manufacturing its own multipurpose controllers. Beginning in 1999, the Baghdad State Enterprise Heavy Engineering Equipment (SEHEE) fabrication plant initiated a research effort to develop a process for glass lining carbon steel reactors, making them corrosion resistant.

- SEHEE's research was designed to boost company profits, make cheaper, longer-lasting vessels, and reduce reliance on stainless steel. Al-Qa Qa'a State Company, at that time, requested SEHEE fabricate a 2.5 meter diameter, 2 meter tall glass-lined reactor (large-scale) for use in nitric acid production, according to reporting.

- SEHEE was successful at lining small-scale vessels, but failed in its efforts to glass-line vessels at a larger scale. An inadequate furnace probably contributed to the failure at the larger scale, according to reports from two different sources.

- Two teams from IAEC and Al Majid Company by January 2003 had developed multipurpose controllers for typical chemical production, according to documents obtained by ISG.

Starting in 2000, production of nitric acid, plastics, chlorine, and phenol was increased.

- Iraq's capacity to produce nitric acid tripled between 1998 and 2003.

- Plastics production increased by 125 percent in 2000, meeting production goals that were set for 2002. The Al Majid Company was also planning a new production line for PVC, according to Iraqi press reports.

- In March 2000, Iraq restarted chlorine and phenol production at the Al Tariq's Fallujah plants—also known as the Habbaniyah facilities, Iraq's key pre-1991 precursor production sites –based on reporting. *(See Annex F—Al Tariq Company's Activities.)*

A steady increase in spending and improvements to the industrial sector continued throughout 2001. Additional inorganic chemical facilities were constructed and other plants were renovated.

- Iraq built a sulfuric acid plant equipped with corrosion resistant equipment in a separate and isolated building at al-Qa Qa'a.

- MIM planned to initiate rehabilitation of Al-Furat State Company for Chemical Industries' sulfuric acid plant expecting to double its production, according to an Iraqi economics media report.

- Iraq constructed a separate nitric acid production facility at Karbala, which was completed shortly before OIF.

Iraq's revitalization of its chemical industry continued up until OIF, and Saddam had ambitious plans for improvements well beyond 2003. With foreign assistance, Iraq renovated its nitric acid plant at al-Qa Qa'a, which was plagued by corrosion problems, creating a bottleneck for Iraq's munitions production.

- In 2002, Iraq made a number of improvements to the nitric acid plant at al-Qa Qa'a with equipment, materials and expertise obtained from Russia, Yugoslavia, Belarus, and Ukraine, according to Dr. Ja'far. For example, corroded compressors were replaced with new compressors, which had better, corrosion-resistant rotors.

- According to the same reporting, MIM also supervised the construction of a pilot plant for acetaminophen at the Baghdad Plant for Medical Gases. The plant was designed to produce paracetamol from nitrobenzene, but it only produced a small quantity of low quality material pre-OIF.

- According to 2003 reporting, there were plans for the construction of nine oil refineries to be built by either MIC or MIM in Southern and Northern Iraq under the control of MIC.

State of Chemical Industry at OIF—Limited Break-Out Capability

> ***Definition***. *"Breakout Capability": ISG considers a CW breakout capability to be the capacity of Iraq to de novo produce and field militarily significant CW rapidly. ISG considered a range of break-out scenarios applicable to Iraq and its capabilities existing in 2002. An example of a breakout scenario would be wartime or imminent threat-precipitated production of dubious quality, low-stability agents for immediate use. A breakout capability could be deliberately developed during peacetime or improvised in response to a threat.*

Though on an upward trend since the late 1990s, Iraq's chemical industry was still not up to pre–Gulf war capacity as of OIF. Technical problems and poor maintenance of aging equipment throughout the 1990s resulted in many chemical plants, including ethylene and chlorine production plants, operating at less than half capacity despite the improvements to the chemical industry.

- A country-wide chlorine shortage, for instance, caused a lack of PVC production at the Az Zubayr plant, which was detrimental to Iraq's economy and downstream chemical processing.

- Plants within Iraq that still produced chlorine suffered from corroded condensers, and were only able to produce aqueous chlorine. Iraq, prior to OIF,

imported anhydrous chlorine gas from China, with the permission of the UN, for use within its chemical and sewage treatment industries.

- Formalene and phenol, both ostensibly produced indigenously, were imported by the resin facility north of Baghdad because of a lack of consistent, quality supply from local producers.

ISG judges that the longstanding intent of the Regime was to restart WMD production once UN sanctions were lifted. Based on an investigation of facilities, materials, and production outputs, ISG also judges that Iraq had a break-out capability to produce large quantities of sulfur mustard CW agent, but not nerve agents.

- Iraq declared to the UN an experimental sulfur mustard production route from locally available chemicals—sulfur, chlorine, and ethylene, all of which Iraq had access to at the time of OIF (see Figure 2).

- Iraq retained the necessary basic chemicals to produce sulfur mustard on a large-scale, but probably did not have key precursors for nerve agent production. With the importation of key phosphorus-based precursors, Iraq could have produced limited quantities of nerve agent as well.

- Mustard production could have started within days if the necessary precursor chemicals were co-located in a suitable production facility; otherwise production could have started within weeks. Nerve agent production would have taken much longer, because of the complexity of the process, according to Dr. Mahmud Faraj Bilal, a senior Iraqi scientist and CBW expert, and the lack of advanced phosphorus precursors in country. Bilal believed a covert offensive CW program was unlikely because the program would require 400-500 witting personnel.

Iraq at OIF possessed a large range of corrosion-resistant production equipment, tagged and monitored by UNMOVIC, and procured for civilian purposes by non-CW associated facilities. However, ISG did not encounter any production units specifically configured to produce key precursors or CW agents.

Sulfur Mustard process and key chemicals/ associated Iraqi facilities.

Ethylene + Chlorine (aq)	=	Chloroethanol
Chloroethanol + Na2S	=	thiodiglycol
Thiodiglycol + HCl	=	Sulfur Mustard

Figure 2.

Phosphorus Chemistry in Iraq

Because ISG did not find any phosphorus chemistry applicable to nerve agents at an industrial scale in Iraq, we judge that Iraq could not have produced nerve agents without imports of key phosphorus compounds.

Why does the indigenous production of nerve agent depend on phosphorus precursors?

The backbone and toxicity of both G and V-series nerve agents is based on the phosphorus-carbon bond. Creating this bond utilizes trimethyl phosphite $(CH_3O)_3P$—used in most phosphorus-based agents. Other phosphorus containing compounds, such as phosphoric acid and phosphates used in fertilizer production, are not suitable for forming the necessary P-C bond.

What evidence of phosphorus did ISG find in Iraq?

ISG investigated four production areas suspected of conducting phosphorus chemistry:

- ***The al-Qaim Superphosphate Plant was** suspected by ISG of possible production of highly reactive phosphorus compounds. An ISG site visit revealed that by design, the plant could not be used for this purpose. At al-Qaim SPP, phosphate rock was crushed and converted into phosphoric acid. Superphosphate was then produced from the acid and sold on the local market.*
- ***The Al Tariq Company was** suspected of producing pesticides, a process that usually consumes similar precursors and employs similar chemical reactions as nerve agents. However, an ISG site visit and a series of interviews with Al Tariq employees revealed that the company imports concentrated pesticides (expensive and unsuitable for nerve agent production) for dilution, formulation, and resale in Iraq.*
- ***The Qubaysah White Phosphorus Production Facility** would have provided Iraq with the capability to convert phosphate rock into a potential nerve agent precursor. However, according to reporting the facility was never fully completed, and no equipment was installed, according to ISG analysis and a military reconnaissance mission.*
- ***Hutin Munitions Production and Storage Facility:** ISG discovered numerous barrels (over 3,000 gallons) of white phosphorus and munitions assembly lines, which we judge were intended for the production of white phosphorus illumination rounds. This white phosphorus, probably imported and declared by Iraq in 2002, could have been used to produce some nerve agent precursors on a laboratory scale.*

- Iraq also possessed declarable equipment for chemical production, which it had not declared to the UN. During ISG operation, a complete process hall containing stainless steel reaction vessels of up to $3m^3$ for the extraction of purity of essence of plant material was discovered at Samarra' Drug Industries.

By cannibalizing production equipment from various civilian chemical facilities, it would have been possible for Iraq to assemble a CW production plant. Alternatively, equipment that was less suitable could have been reconfigured at an existing site and used for short-term limited production. Iraq had improvised and jury-rigged equipment in the past.

- According to Dr. Bilal, Iraq's hypothetical breakout mustard production could be achieved by using equipment that could be sacrificed, instead of relying on specially lined vessels.
- In an interview, MIC director Huwaysh said that Iraq would have been willing to use systems that would be disposed of after a few production runs.

- Less corrosion resistant equipment could be used for most, if not all, CW agent chemical processes. However such equipment would wear out fairly quickly when used for some of the chemical processes involved in the agent production, according to UNMOVIC.

Figure 3 shows a two-ton bulk storage cylinder found in the underground pilot plant at Al Muthanna. The storage container had been modified in the 1980s into a reactor vessel probably for mustard production. This item escaped UNSCOM-directed destruction.

What is "corrosion resistant" equipment? "Corrosion resistant" is a term usually applied to equipment where all the surfaces that come into direct contact with the reagents are made of high nickel alloys, titanium alloys, tantalum alloys, ferrosilicons, ceramic or glass—all highly corrosion resistant to specific materials. Corrosion resistant equipment is commonly used in fluorinating reactions, such as Sarin and soman production, within a CW program, and for chemical processes requiring heat and chlorinating agents such as the manufacture of mustard and nerve agents. Most commercially available materials used in the manufacture of chemical production equipment have some degree of corrosion resistance.

Chemical Process Development and Engineering in Iraq

ISG examined a range of documents obtained for Iraq's key engineering design center which show that Iraqi chemical manufacturers followed process development engineering practices that are very similar to international convention. *This is not surprising given the legacy of British oil production and refining in Iraq.*

The plant designs and process plans of MIC and MIC subcontractors essentially conformed to the international norm, based on analysis of seized documents. *MIC projects for "Triethylamine Process Scale-up", "Xylidene Production Plans" and a fuming sulfuric acid (oleum) plant all demonstrated Iraqi engineering capability.*

- *MIC used AutoCAD software for many of its designs. Process modeling and some PFD's appear to have been produced using ChemCAD software.*

- *A chart taken from the Sa'ad Center (see Figure 4) outlines the planning and building of a proposed oleum plant. Although it handwritten, it is the same engineering strategy used by most global corporations.*

- *The IIC and the MIC often tasked universities to prepare these initial technical reports, feasibility studies and drawings, steps A-C, as seen with the List of 1,000 Chemicals. The work Mosul University did in its report "Preparation of N,N-Dicyclohexyl Carbodiimide" is an example of a typical early-end feasibility study.*

Figure 4 illustrates a portion of the total design package (Items A-S) for the oleum plant. These drawings and plans are not merely academic steps to optimize a given process. In many multi-step chemical manufacturing processes, minimal and safe operational performance would require most of these development steps, even for small scale facilities that have the capability to switch between products rapidly.

Figure 3. *A two ton bulk storage cylinder found in the underground pilot plant at Al Muthanna. The storage container had been modified in the 1980s into a reactor vessel probably for mustard production. This item escaped UNSCOM-directed destruction.*

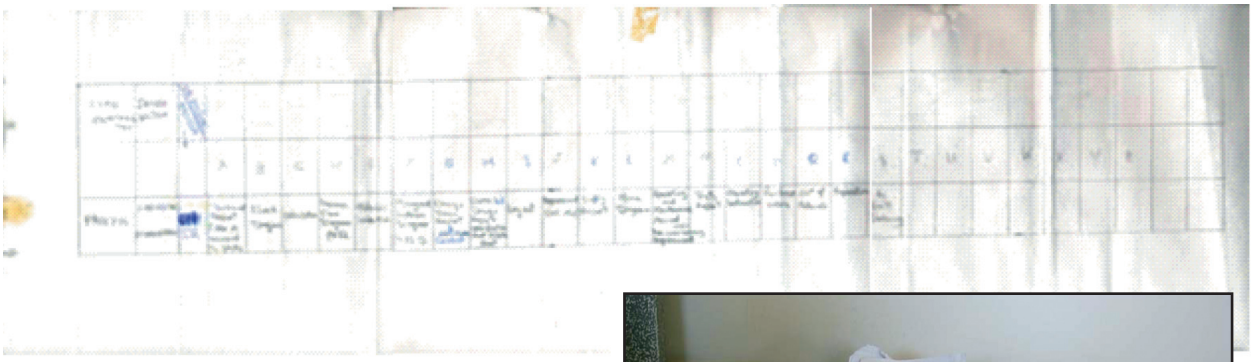

Figure 4. *This chart illustrates a portion of the total design package (Items A-S) for the oleum plant. These drawings and plans are not merely academic steps to optimized a given process. In many multi-step chemical manufacturing processes, minimal and safe operational performance would require most of these development steps, even for small scale facilities that have the capability to switch between products rapidly.*

Weaponization

Iraq's capability to produce CW munitions on a large scale ended with Desert Storm. However, Iraq retained the ability to retool existing factories to produce new munitions, and would have relied on basic fabrication techniques to weaponize agent if it had chosen to do so.

- Most of the Iraqi modifications for chemical delivery consisted of simple machining and/or welding of aluminum or steel.

- Although much of the Iraqi infrastructure to fill CW munitions was destroyed, the technology was basic and we judged it could be quickly recreated.

- The performance of the modified weapons was usually sub-optimal by Western standards, reflecting the simplicity—or crudeness—of Iraqi design approaches. However, the performance was usually good enough to meet minimum requirements.

- A former Iraqi CW munitions researcher offered a dissenting opinion by claiming the thread type on the base plates would not be sufficient to keep the munitions from leaking. Furthermore he claimed that the 183mm base plate found could not have been for a chemical munitions because Iraq did not work on munitions this large.

- No other significant munitions components of these sizes have been found to date. ISG therefore is unable to satisfactorily to conclude the munitions type and caliber.

In September 2003, a senior official at the Al Nu'man cluster bomb production facility gave ISG a 3.5-liter CW submunitions he claimed had been held by a factory worker in his private residence to keep it from being looted. The Al Nu'man facility historically had been involved in attempts to develop chemical capable submunitions, which had been a focus of Iraqi pre–Desert Storm munitions development work.

Suspect Munitions Activities

A number of unusual and unexplained items found at Taji ammo depot could have been used for either conventional or CW weaponization. All Iraqi CW weaponization experts who were asked by ISG were unfamiliar with these items, and although they could have been intended for CW delivery, the items represented crude prototypes and concept components that were found at a non–Al Muthanna bunker.

- In January 2003, UNMOVIC found several suspect items at the Taji ammunition depot, including six unfilled CW 122mm rocket warheads and munitions base plates of varying sizes.

- A number of scientists who were involved with Iraq's CW weaponization projects did not recognize the 76mm, 115mm and 183mm base plates, shown to them in photographs. They speculated that these base plates could have been used for CW munitions.

Disposition of CW Munitions Post-1991

ISG expended considerable time and effort investigating longstanding Iraqi assertions about the fate of CW munitions known to have been in Baghdad's possession during the Gulf war. We believe the vast majority of these munitions were destroyed, but questions remain concerning hundreds of CW munitions.

Since May 2004, ISG has recovered dozens of additional chemical munitions, including artillery rounds, rockets and a binary Sarin artillery projectile (see Figure 5). In each case, the recovered munitions appear to have been part of the pre-1991 Gulf war stocks, but we can neither determine if the munitions were declared to the UN or if, as required by the UN SCR 687, Iraq attempted to destroy them. (See Annex F.)

- The most significant recovered munitions was a 152mm binary Sarin artillery projectile which insurgents had attempted to use as an improvised explosive device.

Figure 5. *Chemical weapons findings in Iraq.*

Post-OIF Insurgent Attempts to Tap Chemical Resources

A group of insurgents began a nascent CW effort without CW scientists or industrial-scale chemical supplies. After OIF, a group of insurgents—referred to as the al-Abud network—assembled key supplies and relevant expertise from community resources to develop a program for weaponizing CW agents for use against Coalition Forces. The al-Abud network in late 2003 recruited a Baghdad chemist—who lacked the relevant CW expertise—to develop chemical agents. The group sought and easily acquired from farmers and local shops chemicals and equipment to conduct CW experiments. An investigation of these CW attempts suggests that the al-Abud network failed to produce desired CW agents, however it remains unclear whether these failures derive from a lack of available precursors or insufficient CW expertise.

- ISG has also recovered 155mm chemical rounds and 122mm artillery rockets which we judge came from abandoned Regime stocks.

The 1991 Decision To Destroy Undeclared Weapons

An IAEA inspection led by Dr. David Kay in late June 1991 triggered Iraq's decision to unilaterally destroy the undeclared weapons that had been concealed from the UN, according to multiple senior Iraqi officials. Dr. Kay's inspection team was blocked from sites in Abu Ghurayb and Fallujah. The Iraqis fired warning shots over the inspectors' heads, but Dr. Kay and his group brought back video tapes and photos that indicated Iraq was hiding undeclared uranium enrichment equipment from the inspectors.

- Dr. Kay's inspection and the international uproar surrounding it caused consternation and a measure of panic in the Regime's leadership, particularly Husayn Kamil, and Saddam appointed a high-level committee headed by Deputy Prime Minister Tariq 'Aziz to deal with inspection matters, according to multiple sources.

- A senior Iraqi scientist who directed the destruction of chemical and biological munitions contends that the decision to destroy the hidden materials was made at the end of June 1991. David Kay's inspection and the ensuing controversy prompted Iraqi concerns about renewed war with the United States, according to Dr. Mahmud Firaj Bilal. Amir Rashid contacted Dr. Bilal and ordered that all hidden chemical and biological munitions be destroyed within 48 hours. When Bilal responded that this was impossible, Rashid directed that Bilal use the resources of the Iraqi Air Force and the surface-to-surface missile force to accomplish the task. Dr. Bilal gathered his colleagues from Al Muthanna State Establishment, went to the locations of the stored munitions, and began the destruction.

- Iraq declared some of the unilateral destruction–missiles and chemical munitions–to UNSCOM in March 1992 but continued to conceal the destruction of the biological weapons program.

Iraq Unilateral Weapons Destruction in 1991

Iraq completed the destruction of its pre-1991 stockpile of CW by the end of 1991, with most items destroyed in July of that year. ISG judges that Iraq destroyed almost all prohibited weapons at that time.

- ISG has obtained no evidence that contradicts our assessment that the Iraqis destroyed most of their hidden stockpile, although we recovered a small number of pre-1991 chemical munitions in early to mid 2004.

- These remaining pre-1991 weapons either escaped destruction in 1991 or suffered only partial damage. More may be found in the months and years ahead.

Destruction of Chemical Munitions, Bulk Agent, and Precursors

ISG interviewed Dr. Mahmud Firaj Bilal, the Iraqi scientist who supervised the destruction of Iraq's undeclared chemical munitions, along with a number of Iraqi higher officials who were knowledgeable of the weapons destruction. Although other sources have corroborated parts of Dr. Bilal's account, ISG's understanding of Iraq's chemical and biological warfare agent unilateral destruction is heavily dependent

on Dr. Bilal's information, which is a weakness in our analysis. Nevertheless, as with Iraq's long range missiles, we obtained a reasonably coherent account of the disposition of the CW munitions, though we were not able physically to verify the story. The UN has, however, verified some of it.

- Iraq likely destroyed all 20 concealed CW Al Husayn missile warheads in the summer of 1991, according to Dr. Bilal based on UN-sponsored excavations. All were "binary" GB/GF nerve agent warheads filled with a mixture of isopropanol and cyclohexanol and MPF.

- Al Muthanna had dispersed approximately 1024 CW R-400 bombs along various Iraqi airbases. Iraq did not declare some of these to the UN and unilaterally destroyed them in situ. The UN holds these as accounted for, although they were unaware that a small percentage of them were used on the Shia in March 1991 according to multiple sources.

- Iraq disposed of 1.5 tons of spoiled bulk VX nerve agent at the Al Muthanna State Establishment dumpsite.

- Dr. Bilal also stated that Iraq destroyed the following chemical agent precursors:

  —157 tons of the VX precursor phosphorus pentasulfide (P2S5) destroyed by mixing it with soil at Saqlawiyah, northwest of Fallujah. UNSCOM-sponsored excavations accounted for about this amount.

  —55 tons of the VX precursor choline destroyed at Qasr al-'ashiq near Samarra'.

  —10 tons of the mustard precursor thiodiglycol destroyed by burning at Saqlawiyah. This precursor was never declared to the UN and had been stored in the city of Samarra'. When the rest of the unilateral destruction took place, no one remembered this stock until a month after the rest of the chemical destruction. This realization triggered its destruction.

  —Al Muthanna State Establishment gave cyclohexanol, isopropanol, and isopropylamine to various industries for use as solvents.

- Iraq also destroyed a quantity of empty aerial bombs intended for CW use and empty 122-mm CW rockets.

- Bilal insisted that Iraq's CW "Full, Final, and Complete Declaration" is completely accurate regarding the unilateral destruction of CW munitions.

UNSCOM had verified or accepted some of what Bilal said about munitions destruction, but other parts of the story remain unverified.

- Iraq presented supporting documents on the unilateral destruction of 527 R-400 CW bombs and UNSCOM observed remnants of bombs consistent with the declared quantity.

- When considered with the number of declared BW Al Husayn warheads (25), the total number of undeclared "special warheads" was 45. In the period from 1992 to 1998, UNSCOM recovered and accounted for remnants of 43-45 special warheads. In 1997-1998, UNSCOM recovered the remnants of three additional training warheads. Iraq provided supporting documents on the overall accounting for special warheads and on the unilateral destruction of 45 warheads. We cannot be sure, however, that there were only 45 "special" warheads in Iraq's inventory.

- UNSCOM was not able to verify the quantity of VX destroyed, nor were they able to verify the destruction of all VX precursor chemicals.

- UNSCOM was not able to verify the destruction of unfilled 250 gauge aerial bombs, unfilled R-400 aerial bombs, and unfilled 122-mm rockets.

The destruction years ago of the bulk of Iraq's CW munitions not withstanding, ISG remains concerned about the status and whereabouts of hundreds of CW artillery rounds. Previous assertions that the munitions were all destroyed have been undermined by reporting that the munitions remain intact in an unknown location.

In the 5 January 1999 Compendium, UNSCOM assessed that Iraq had not adequately accounted for 550 mustard-filled artillery rounds it claimed to have lost. This issue first surfaced in 1996 because of discrepancies in Iraq's accounting of weapons holdings,

VX Weaponization

Iraq had not adequately addressed VX production and weaponization activities—a point on which Iraq's denials were contradicted by UNSCOM findings. ISG investigations into Iraq's work with VX reveals that Iraq did weaponize VX in 1988, and dropped 3 aerial bombs filled with VX on Iran. The bombs, originally declared to be part of a storage stability trial, were in fact dropped on an undisclosed Iranian location in 1988.

and was investigated but not resolved by UNSCOM (see the January 1999 UN compendium for details). ISG conducted extensive interviews with high- and mid-level Iraqi officials to determine the final disposition of the 550 mustard-filled rounds—which would be highly toxic, even now—cited by the UN as an unresolved disarmament issue, and found inconsistencies in the story among witting high-level officials. Most officials recounted the story of accidental destruction in a fire in Karbala, reporting provided to the UN after Iraq's investigation of this issue prior to 1998, while the former MIC director, Huwaysh, claims the rounds were retained for future use.

- In a 7 August 2003 debriefing, Huwaysh said that as of early 2003, all 550 mustard rounds were kept by the SRG at Suwayrah, probably the former location of the II RG Corps Headquarters, just north of the Shaykh-Mazar ammunition depot.

- According to Huwaysh, the matter was discussed by the Higher Committee on Monitoring Inspections and a decision was made to declare the shells, which was done just prior to OIF.

- Amir Rashid admitted that the Higher Committee discussed the shells in February or March 2003. Rashid said the discussion focused on the connection between the burned mustard shells at the Fallujah proving ground and other shells that reportedly burned on a trailer near Karbala after the 1991 Gulf War.

- General Hussam Amin did not remember any discussions of Suwayrah and mustard shells. According to Amin, in early 2003, General 'Amir Al Sa'adi explained to him that the mustard shells were destroyed on the trailer near Karbala.

Chemical Munitions—Searching Military Depots and Caches

Reflecting pre-OIF intelligence assessments that Iraq had stockpiled hundreds of tons of chemical weapons, ISG expended considerable time and expertise searching for extant CW munitions. ISG inspected ammunition supply points identified from preliminary analysis of the 'red-line' theory–including sites in proximity to units possibly equipped with chemical-capable weapons and in proximity to suspected decontamination activity.

- ISG exploited munitions at captured enemy ammunition (CEA) depots established by Coalition Forces after OIF to serve as repositories for ammunition captured throughout the country.

- Teams also investigated other suspect locations identified prior to OIF as suspect CW locations, in particular 11 depots at which possible CW movement and storage activity was assessed to have taken place in the late 2002-2003 timeframe.

- Overall, only a modest fraction of rounds were identified for exploitation. The sites had been subject to looting during and after OIF, bombing of military installations during the war, and detonation of large numbers of rounds by Coalition Forces.

- Although only a fraction of Iraq's total munitions inventory was identified and exploited for CW rounds, a review of high-priority facilities, munitions caches, and locations identified prior to OIF as suspect CW storage or transfer sites, did not reveal caches of CW weapons.

Investigating Ammunition Supply Points

ISG's investigation of Iraq's ammunition supply points—ammunition depots, field ammunition supply points (FASPs), tactical FASPs, and other dispersed weapons caches—has not uncovered any

Types of ASPs

ASPs can be divided into three different classes: (1) Ammunition Depot, (2) Field Ammunition Supply Point (FASP), and (3) Tactical FASP (TFASP). Sites vary depending on permanence of structures and proximity to forward deployed units.

- *Ammunition Depots are permanent structures located far from the forward lines. They are fenced and guarded with hardened bunkers as well as revetments for open storage. Depots are designed to supply munitions to a large number of different units and as a result contain a wide variety of ammunition types.*

- *FASPs are usually permanent structures as well. As with depots, they are usually fenced and guarded and may contain bunkers or revetments. FASPs are meant to serve a smaller number of units and will maintain a limited mixture of munitions. In US Army terminology, they would be equivalent to Ammunition Transfer Points, or ATPs.*

- *TFASPs are semi-permanent structures in close proximity to the units that require the munitions. They may be fenced or bermed and contain mostly open storage in revetments. TFASPs function as the immediate supply point for a limited number of units and retain only the munitions required for those units. In US Army terminology, a TFASP would be equivalent to a cache.*

CW munitions. ISG investigation, however, was hampered by several factors beyond our control. The scale and complexity of Iraqi munitions handling, storage, and weapons markings, and extensive looting and destruction at military facilities during OIF significantly limited the number of munitions that ISG was able to thoroughly inspect.

- ISG technical experts fully evaluated less than one quarter of one percent of the over 10,000 weapons caches throughout Iraq, and visited fewer than ten ammunition depots identified prior to OIF as suspect CW sites.

- The enormous number of munitions dispersed throughout the country may include some older, CW-filled munitions, and ISG cannot discount the possibility that a few large caches of munitions remain to be discovered within Iraq.

Investigation

ISG began its search for Iraqi chemical weapons by identifying a set of facilities from the nearly 1,000 sites at which Iraq stockpiled or deployed munitions. ISG obtained from CENTCOM a database of 104 ASPs identified within the assessed "Red Line" surrounding Baghdad (*see Annex G, for details on the 'Red Line Theory')*. This list was narrowed down to 26 sites using two main criteria (see Figure 6).

- Reporting of a suspect CW decontamination vehicle, a "Samarra' " type water truck in proximity to the ASP—at the time the targets were selected, the presence of these vehicles was regarded as indicators of CW-related activity.

- An artillery unit capable of firing 122mm multiple-rocket launcher (MRL) or 155mm CW rounds, also in proximity of the site.

The ASPs of the Republican Guard Al Madinah, Al Manawrah, Baghdad, and Hammurabi Divisions were of highest priority because of the units' trusted status and location during the combat phase of OIF. Exploitation of the 26 ASPs began with a thorough review of all reporting the facilities to discern the status and change in the site during and after OIF , in order to narrow the list of sites to be visited.

- Reporting revealed 16 of the 26 sites were either empty, destroyed, or contained unidentified material with an imagery signature inconsistent with CW. One site was found to be a duplicate location under a different name and another was removed for lack of evidence. Teams from ISG visited the remaining eight sites.

- ISG investigation of eight ASPs turned up a wealth of different Iraqi munitions including artillery shells, and rockets. However, we did not locate any CW filled artillery.

Investigating Captured Enemy Ammunition Points (CEA Consolidation Points)

ISG capitalized on efforts by Coalition Forces in December 2003 to begin a program to consolidate captured Iraqi weapons into seven pre-identified Captured Enemy Ammunition (CEA) Depots (see Figure 7). As of mid-September 2004, Coalition Forces have reviewed and cleared a total of 10,033 weapons caches dispersed throughout the country, destroying a total of 243,045 tons of munitions. This represents only part of Iraq's pre-OIF munitions inventory, and only a fraction of these were checked by ISG technical experts for signs of chemical agent fill. (See Annex H.)

Many of the rounds were destroyed at their original cache locations or at a CEA depot; however, ISG technical experts have been working with CEA officials to evaluate munitions that were returned to consolidation points for storage or later destruction.

- ISG reviewed CEA inventory lists for chemical-capable projectiles, rockets, missiles, or bombs, and conducted missions to the consolidation points to X-ray, catalogue, and analyze specific rounds for CW signatures. No CW munitions were found at these sites as of September 2004.

- ISG teams also sought unique munitions identified by CEA as new shipments arrived onsite. No significant findings were reported.

ISG estimates that CEA visits allowed us to review at most about 10 percent of Iraqi munitions. As of 15 September 2004, ***CEA has identified a total of 10,049 caches*** (a cache is considered a collection of munitions in any quantity) throughout Iraq. The breakdown of their activities follows:

- To date, 10,033 caches have been cleared with a total of 405,944 tons of munitions delivered to the CEA points, an average of about 40 tons of munitions per cleared cache. Of that total, ***243,045 tons of munitions have been destroyed***, and 162,899 tons remain at the CEA points for future destruction.

- 16 caches remain outstanding, containing an estimated total of 6,068 tons, an average of 380 tons per cache.

- ISG conducted CEA visits at about a two-per-month rate in early 2004 and it is estimated that ISG experts reviewed about 50,000-75,000 tons of munitions—about 12 to 18 percent of the grand total of 412,012 existing tons.

- In addition to the CEA process, a large number of munitions were destroyed between OIF and late 2003, when CEA instituted its process. Officials at CEA have been highly efficient in destroying as much as 25,000 tons of munitions per month.

- Recent data indicate that the grand total will continue to grow. Over the six-week period from the end of July to mid-September, CEA discovered an additional 291 caches with a total of 105,028 tons of munitions—cache discoveries continued to the time of writing. CEA estimates a total of 600,000 tons of munitions is the total tonnage, including munitions destroyed during OIF and scattered about the countryside. ISG believes this number is fairly uncertain, and could go considerably higher in the future as new caches are discovered. We regard 600,000 as a lower limit on total munitions. Using this number, we estimate we visited about 8-12 percent (in round numbers, 10 percent), or less of the total Iraqi munitions stocks.

Although ISG only inspected a small fraction of the Iraqi munitions, we remain confident that we have not destroyed chemical munitions in the process of destroying Iraqi weapons.

- The US military has high confidence that the destruction process has thus far proceeded safely, with no release of chemicals connected with it.

Figure 6. *Location of 26 RG ASPs. The "Red Line" is shown for reference purposes.*

- The amount of inspections ISG was able to carry out was consistent with the resources available, and the safety factors involved in carrying out the inspections of munitions facilities.

In addition to the ASPs and CEA sites, ISG undertook a systematic effort to review and investigate a series of depots that factored prominently in pre-OIF assessments of possible CW transshipment activity in the 2002-2003 timeframe. Several studies, based primarily on imagery Analysis at that time concluded that Iraq probably deployed CW munitions from depots to ammunition supply points throughout Iraq as part of ongoing preparations for war. The original list of 11 sites at which activity had been noted was narrowed to two main depots for intensive ISG investigation, including site visits, technical assessments, and personal interviews.

- Imagery analysis observed indication of ammunition movement Iraq in 2002. Analysis of specific activity—at the 11 depots—raised increased analytic scrutiny and prompted a review of munitions transshipment signatures throughout Iraq.

- The key indicators to identify suspect CW munitions movement and storage included the presence of special guards, vehicles assessed to be decontamination trucks, cargo vehicles, and the grading of top soil near suspect bunkers.

ISG began an investigation of the 11 major depots by reviewing imagery reporting of the sites to determine feasibility for site exploitations and by subsequent site visits and identification of individuals and military officials who had previously worked there. ISG analysis revealed that most of the sites were destroyed or looted during or shortly after OIF, and the military officers who worked there proved difficult to locate.

- ISG conducted an in-depth investigation of the **Al-Musayyib Storage Depot**—assessed prior to OIF to have the strongest indicators of CW movement—in an attempt to understand the nature of suspect CW transshipment activity there between 1998 and 2002. (See Annex H for a detailed account).

- Reporting indicated the presence of a suspect CW decontamination vehicle at the **Miqdadiyah Depot** north of Baghdad and prompted an ISG operation to recover two vehicles for exploitation.

- The remaining sites were not visited because indicated looting and destruction that prevented the discovery of any munitions remaining from pre-OIF.

Figure 7. *Captured enemy ammunition supply points.*

An Najaf Depot			
Az Zubayr Depot			
Taji Depot			
Buckmaster			
Jaguar Depot			
Arlington Depot			
Paladin Depot			

Figure 7. *Captured enemy ammunition supply points (continued).*

	Depot Name	Pre-OIF "Indicators"	ISG Investigations
1	Al Miqdadiyah Ammunition Storage Facility	–Presence of Samarra'-type vehicle –Separately secured area under MEK control –Transshipment with stakebed trucks and Samarra'-type vehicle 1994 –Transshipment with stakebed trucks and Samarra'-type vehicle in Jan 2003 –Visited by UNMOVIC after 2003 transshipment activity terminated	–Identification and acquisition of two 'Samarra'-type' vehicles from the Miqdadiyah area; detailed analysis of vehicles included in section (3); no signs of decontamination activity.
2	Al Hadithah Site Command/ Ammunition Depot West	–Covered stakebed trucks 2002 –Former CW storage [(a)] –clean-up efforts 2002	–Imagery indicated site was entirely looted and destroyed. No ISG exploitation.
3,4	Al Musayyib Barracks Brigade Headquarters and Ammunition Ordnance Depot[b]	–Presence of Samarra'-type vehicle late 2001-Aug 2002 –Transshipment with stakebed trucks and Samarra'-type vehicle mid-2002 –Separately secured area –Grading of the area July 2002 –Decon/washdown trenches near entrance	–Thorough investigation of site, to include multiple site visits, debriefing of former military employees, and extensive document review. –Detailed findings included in section below.
5	Baghdad Ammunition Depot Taji[b]	–Transshipment with stakebed trucks and tanker truck 2002 –Internal security tents with tanker truck Nov 2002 –Presence of tanker truck	–Multiple site visits, bunkers searched. –Found 81mm rockets, aluminum tubes referred to in Powell's speech –Air delivery bombs, rockets exploited.
6	An Najaf Storage and Ammo Depot Area[b]	–Increased security after Husayn Kamel defection in August 1995 –Presence of Samarra'-type vehicle 1996 –Munitions transshipment June 1998 –Dispersal activity within secured area 1999	–Multiple visits by ISG. –Unusual fuel air bomb discovered by onsite contractors.
7	Ar Rutbah Storage Facility	–Transshipment with covered stakebed trucks in 2002 –Dispersion of munitions within depot Jan 2003 involving Samarra'-type vehicle, stakebed truck, and probable security vehicle –Presence of Samarra'-type vehicle	–Imagery indicated site was looted –Remaining munitions cleared by 82nd ABD and EODT a US EOD contractor –No ISG exploitation.

82nd ABD = 82nd Airborne Division
120th EN = 120th Engineers
EODT = Proper name of a US contractor
EOD = Explosives Ordnance Demolition
UXO = Unexploded Ordnance

Figure 7. *Ammunition depots of interest (continued).*

	Depot Name	Pre-OIF "Indicators"	ISG Investigations
8	H-3 Ammo Storage Depot West	–CW storage at H-3 NW in 1991 –Stakebed truck transshipment in 2002	–Remaining munitions cleared by 82nd ABD and EODT a US EOD contractor –No ISG exploitation.
9	Habbaniyah Ammo Depot	–Transshipment with stakebed trucks and tanker truck 2002	–Few structures remain. 100 tons of UXO with sub munitions in the mix. –Being cleared by 120th EN and Naval EOD, no WMD reported by EOD experts. –No ISG exploitation.
10	Qabatiyah Ammo Storage Depot	–Samarra'-type tanker truck attached to engineer platoon 2002 –Transshipment with stakebed trucks 2003	–Imagery indicated site was entirely looted and destroyed. –Remaining munitions cleared by US forces. –No ISG exploitation.
11	Qubaysah (Muhammidiyat) Storage and Ammo and Scud Depot	–Transshipment with covered stakebed trucks in 2002 –Transshipment with stakebed trucks and tank truck 2003	–Bunkers destroyed –Site reduced by US forces –No ISG Exploitation

[a]Stored empty 122 mm chemical rockets in 1991, AALD-500 bombs late-1980s.
[b]Highlighted in Secretary of State Powell's speech to the UNSC.

Figure 7. *Ammunition depots of interest (continued).*

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