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Iraq's Biological Weapons (BW) Program was among the most secretive of its weapons−of−mass−destruction (WMD) programs. Its existence was not acknowledged until July 1995. From 1991 to 1995 Iraq categorically denied it had a BW program and it took active steps to conceal the program from the UN Special Commission. This pattern of denial and concealment continued through the termination of inspections by Iraq. These steps included fraudulent statements, false and forged documents, misrepresentation of the roles of people and facilities, and other specific acts of deception. The pattern of deception appears to continue even unto the present. The full extent and the objective of Iraq's BW program has never been disclosed by Iraq.

Iraq's Biological Weapons Program, Then and Now: Iraq asserts that its BW program began in 1985 and dismisses the earlier BW investigations that began in late 1972/early 1973 as being insignificant. From its inception in the 1970s, Iraq's BW program included both military and terrorist applications. The program included bacteria, viruses, toxins, and agents causing plant diseases. The agents included lethal and incapacitating agents for humans and economic damaging agents. The program sought enhanced virulence, environmental and antibiotic resistance, and aerosol dispersion. In other words, this was a well planned, broadly encompassing program. The covert (terrorist and assassination) feature of Iraq's program was not actively pursued by UNSCOM.

BW Program under Intelligence Service/Special Security Organization: The evidence suggests that Iraq's BW program was under the Intelligence Service/SSO. Much of this information came from senior Iraqi personnel, during the course of interviews. Hard evidence as might be expected is lacking.

Iraq's BW program (and, initially, it appears its chemical weapons (CW) program as well) was founded and funded by Iraq's Intelligence Service with some limited technical input from Iraq's Ministry of Defense. A variety of cover organizations were used to conceal the program including the Ministries of Interior, Health, and Higher Education and Scientific Research. From its inception, there were two distinct interests for the program. One dealt with the pursuit of agents that had small scale, covert application and the other would have application to larger scale strategic/military purpose.

Except for the period from 1979 to 1987 when the military portion of the BW program paralleled and was a part of the CW program under direct Ministry of Defense influence, the BW program remained (and probably remains) under the SSO (Amn al Khass). In 1987, the military relevant piece of the BW program was rejoined with the covert BW program. Iraq has repeatedly stated that the BW program was different than the other WMD programs in that it did not report to the staff of Military Industrial Commission (MIC), but rather reported directly to Hussein Kamal Hassan or his senior deputy, Dr. Amer Al Sa'adi (a similar reporting system existed for the SSO). Interview information clearly indicates that the BW-filled weapons remained under the control of the SSO up to and including whatever destruction of such weapons as might have occurred. It is likely that the BW program still remains under the SSO.

How has the Iraqi biological weapons program changed from the Persian Gulf War and UNSCOM inspections to today? On three separate occasions in 1997 and 1998 panels of international experts reviewed all the information available to UNSCOM. These panels were able to get an extensive albeit undoubtedly incomplete picture of Iraq's BW program. The program was far more complex and extensive than that which Iraq had acknowledged. Iraq asserts that the program was obliterated in 1991 but this is patently not true. UNSCOM monitoring while useful in hindering Iraq's program, was not successful in preventing some degree of continuation of Iraq's BW investigations.

Iraq's BW program in 1990: By any definition, in 1990/1991, Iraq's BW program was in an accelerating expansion phase. An international panel of experts convened at the UN headquarters in New York in 1997 had concluded that the program had not yet reached maturity (this phrase has been advertised by Iraq, including a 2002 submission to the United Nations Security Council (UNSC) as meaning that the program was inadequate and not capable of producing BW weapons). Actually, the panel was stating Iraq had not yet attained its desired level of expansion. Iraq's bacterial BW capabilities was reasonably well established including its ability for production, concentration, spray drying, and delivery to produce a readily dispersable small particle aerosol. Iraq was well underway in establishing a virus research, development, and production capability, but had not reached weaponization potential. Iraq had demonstrated an anticrop capability. It had demonstrated a mycotoxin capability. There was no information on an anti-animal program. Along with its agent production, Iraq was developing a weapons delivery capability, apparently for both short range and intermediate

range delivery. The agents included lethal, incapacitating, and agricultural biological warfare agents. There is a major disparity between the amount of agent declared as produced by Iraq and that estimated by UNSCOM experts.

A serious issue concerns Iraq's interest in and weaponization of aflatoxin. It is apparent that Iraq's interest was in its long-term carcinogenic and liver toxicity effect rather than any short term effects. One can only wonder what was the intended target population.

Field tests encompassed point source releases, small area contamination, and large-scale line source release and were evaluated both for tactical and strategic use. The weapons and range of agents considered provided Iraq with a variety of options for their use.

Iraq had deployed R400 aerial bombs to at least three locations in western and southern Iraq, and had also deployed Al Hussein (SCUD) missiles BW-filled warheads and at least one "droptank." Additionally Iraq had field tested BW agents in 122mm rocket warheads and 155mm artillery shells.

Iraq also had an interest in landmines, flechettes, fragmentation weapons, drones, missiles, thin-skinned aluminum weapons, fibre glass-coated weapons, and Supergun projectiles. No investigation of field testing is acknowledged for these weapon types although there are indications that interest had developed in such weapons for biological warfare purposes.

Iraq's BW program in 1998: Although Iraq claims that it "obliterated" the program in 1991 (without the supervision by the UN as was set out in the ceasefire resolution 687 (April 1991), and in so doing it destroyed all weapons and bulk agents unilaterally without any further documentation. The evidence indicates rather that Iraq continued to expand its BW capabilities.

Expert panels concluded that it was not certain that Iraq had indeed "obliterated" its BW program. Documentation recovered by UNSCOM indicated a continued build up of Iraq's BW program capability. The organizations associated with its BW program continued to acquire and attempted to acquire equipment that would enhance its BW capability and that seemingly would have relatively little utility for Single Cell Protein (SCP) production as alleged by Iraq. From 1991 to 1995, Iraq was actively expanding Al Hakam, its major BW agent production facility, with additional infrastructure and facilities. Iraq tried to explain these as being for SCP production for animal feed supplement. Particularly notable were clear expansion plans that were more reminiscent of an expanded BW facility than a development of an SCP factory.

Among the expansion plans were design and construction of 5,000 and 50,000 liter fermentation units for Al Hakam and Tuwaitha. Countries and companies where SCP is being produced do not consider worthwhile any fermenter with capacity less than 100,000 liters up to 500,000 liters. Disturbingly, such procurement actions included a rather large production plant in association with external assistance. Joint negotiations centered on the design, construction, and operation of a 50,000 liter fermentation facility consisting, not of one 50,000 liter fermenter and associated lesser fermenters and tanks as might be expected for scale up of a SCP plant, but rather, five 10,000 liter fermenters and associated lesser fermenters and tanks. It is believed this unit was not delivered although definitive evidence is lacking. The key players from Iraq on the negotiating team were the head of botulinum toxin production in 1990, two BW facility engineers and a MIC representative.

Iraq has also developed the capability to produce critical equipment (fermenters, centrifuges, spray dryers, etc.) and to produce critical supplies, e.g., standardized growth media. Interestingly, Iraq only developed standardized media of direct importance to its BW program rather than media types that would have more generalized medical/hospital applications. This effort continued at least through 1998.

It is also noteworthy that Iraq's experienced senior personnel who were active in Iraq's BW program in the 1980s remained intact as a unit throughout the inspection period.

In essence, Iraq retained the personnel for its BW program. It tried to retain equipment and supplies. When UNSCOM forced the acknowledgement of Iraq's BW program and subsequent destruction of equipment, facilities, and supplies, Iraq developed the indigenous capability to produce critical equipment and supplies. Although Al Hakam was completely destroyed, not all production capable equipment in Iraq was destroyed or rendered harmless. Iraq's reluctance to fully and openly declare the full extent of its BW program only enhances the perception that **Iraq still maintains a BW program**.

What impact has UN sanctions had on the (BW) weapons program? Very little! In some respects it has made it more difficult for Iraq to attain critical equipment and supplies, yet in other ways it has had relatively little effect. Even the difficulty to obtain critical supplies is a two-edged sword in that it has forced Iraq to develop an indigenous capability that otherwise might have been ignored. In so doing it has increased the difficulty in obtaining overt evidence of cheating. Iraq tried to maintained the essential elements for its BW program. Having failed in that effort and with increased scrutiny

by the world community concerning its imports, Iraq has developed the capability to obtain and/or manufacture critical requirements. There was no restriction to prevent Iraq from developing such capability.

The UNSCOM resident teams made note of Iraq's development of standardized bacterial growth media, including yeast extract, peptone, tryptone, and casein; all key ingredients in their declared BW program and for any continuing or future BW program. It is worth noting that these media types were the only ones for which standardized protocols were developed, whereas, for medical purposes, these ingredients would be low on the priority list.

Additionally, Iraq developed the capability to manufacture double-jacketed fermenters, spray dryers, and separating centrifuges. An expert team in 1997, which included a senior biologist, a spray dryer production manager from a commercial company, a fermenter production manager formerly with a fermentation supplier company, and centrifuge production experts as well as other engineers, assessed that Iraq was fully capable in expertise and equipment to manufacture acceptable quality items in each of these categories. The development of these items was a large effort that involved more than twelve major establishments under MIC.

Additionally, new equipment and supplies were continuously being seen at sites under monitoring by both resident and non-resident BW teams. Items included state-of-the art laboratory equipment, bacterial growth media, state-of-the-art genetic engineering equipment, and necessary restriction enzymes, etc. Large volume fermenters, centrifuges, and Class III biological safety equipment were imported but were never seen by UNSCOM. Most critical BW supplies and equipment are not difficult to smuggle into a country where the country is an active participant. UNSCOM had ample evidence of the porousness of the embargo. I would not expect sanctions, smart or not so smart, to have any significant deterrent to Iraq's continued development of its BW program.

How has the international opinion of the Iraqi biological weapon threat changed during this time period? After a brief period of concern in 1991, the international community as a whole appeared to have relaxed when no incriminating evidence had been found by the initial two BW inspection teams. This complacency extended through 1994. In 1994, one BW inspection team headed by, at the time, the senior BW specialists of two countries, had concluded that unless a site in Iraq possessed equipment that was attached to a biosafety level III cabinetry system, there was no need to monitor the site. On that basis, no sites within Iraq would have been subject to monitoring. By early 1995, with the accumulating evidence amassed by UNSCOM, most countries were rightly concerned about Iraq's BW capability. At the expert level (leading BW experts including personnel from all P5 members of the UNSC) this level of concern continued through 1998, but at the political/diplomatic level, some countries experts' concern was not reflected in the verbiage and actions by the respective leaders and diplomats. I cite this disparity between the experts and the diplomats because I believe it has implications should inspections resume.

As regards the accuracy and completeness of Iraq's declaration and the likelihood that it was continuing its BW program, nothing has occurred to change the opinion of the experts. Nor does it appear, in spite of the lip-service that is given to getting inspectors back into Iraq, that there has been any material change in the support that an inspection regime might expect from UNSC P5 members. It appears that most of the proposals for getting inspectors back into Iraq is based on the premise that "any inspectors are better than none." To be blunt, that is pure rubbish, just an illusion of inspections. Even while UNSCOM inspectors were still operable, Iraq was constantly trying to restrict monitoring inspectors activities, curb their access, and require notification of inspections, even to monitored sites. Such limitations to monitoring would make such a regime a farce; under such circumstances, monitoring inspectors would be worse than no inspectors because it would provide an inappropriate illusion of compliance to the world community. What countries really believe and what they will espouse are most likely two entirely different views. I was told by a senior diplomat in 1998 "it would not matter if you placed a BW-laden Al Hussein warhead that you found in Iraq on the UNSC table, it would not change opinions about lifting sanctions". He added "if the CW and missile files are closed, the world will not care about biology." It appears to me that this may still be the viewpoint of several nations.

The world's press in recent weeks has cited the opposition of most nations in the Middle East and Europe to any action against Iraq. It is cited that Iraq is weakened and does not pose any immediate and significant threat. It seems to me this does not address the terrorist threat posed by Iraq's WMD programs. One would think after 9/11, a more realistic appraisal of Iraq's capability and willingness to use WMD as terrorist weapons would be forthcoming. As I cited above, Iraq's BW program from its inception included a terrorist component.

PRIORITY, PURPOSE AND POWER: To answer these three questions, one must look at Iraq's history from 1990 onward. It obviously considered its BW program extremely high priority given the lengths it went to hiding and preserving the BW capability. Had Iraq made a full disclosure of all its weapons system in 1991, sanctions would have long since been lifted. Why would Iraq still be so secretive about its BW program unless it was considered a high priority. Iraq is convinced that possession of WMD is vital to its national security. Top Iraqi leaders have said that WMD

and long range missiles saved them in the Iran/Iraq war and was a deterrent to the coalition forces proceding on to Baghdad. If the BW program has this magnitude of priority, then purpose and power must logically flow from this priority, e.g., it is extremely important for their perceived purpose and for Iraq's or the regime's retention of power.

What priority does the Iraqi leadership place on rebuilding or maintaining this capability? It appears from Iraq's actions to preserve and to enhance its BW program that is among the highest priorities for Iraq. Throughout the BW monitoring phase (late 1994 to December 1998), as cited elsewhere above, Iraq was developing methodologies for indigenous media production and equipment production. These were joint efforts involving many organizations with one thing in common: all were part of MIC and/or were associated with Iraq's BW program prior to 1990. Additionally, Iraq through 1995 was trying to import equipment to greatly expand its BW capability. Iraq also retained its key BW staff intact as a group even after the destruction of the Al Hakam complex. In 1997 and 1998, the work location of additional key senior staff for viruses and genetic engineering could not be determined; Iraqi personnel repeatedly lied about their whereabouts.

What does Iraq consider to be the primary military purpose of a biological weapons arsenal? Officially, UNSCOM was never able to get Iraq to discuss its concept of use for BW agents, alleging that this entailed their national security: if Iraq had renounced and obliterated its BW program, why would this be so? However, a senior Iraqi official told us that it was perceived as a power weapon and would influence its neighbors to see things Iraq's way. When asked, if the program is so secret, how would Iraq's neighbors know Iraq possessed such weapons; his reply, "there are ways to make this known." As cited above, Iraq considers WMD vital to its national security; senior Iraqi officials have also repeatedly stated that BW was (and is) a vital armament step at least until it has a fully developed nuclear capability.

Also, clearly, their pursuit of both military and non-military BW programs is indicative of a BW terrorist application as well. Such application would undoubtedly evolve to meet changing situations and can be expected to be retained even after the development of its nuclear capability.

Regional military power, global strategic power? The size of Iraq's BW program and what appeared to be its desires for an expansion of its capabilities still suggests a regional power rather than global aspirations. This perception is also consistent with the "power weapon" concept cited above.

Options and Consequences:

What options does the US have to address the Iraqi biological weapons threat?

Several options could be considered, return of inspectors to Iraq or continuation of sanctions, smart or otherwise, as well as various military, diplomatic, and political initiatives. I will principally address the inspectors and sanctions issues.

Inspectors return to Iraq: This is very difficult on which to comment. The success or failure depends too much on uncontrollable elements. What will be the conditions under which the inspectors return? What support will the inspection regime have, given Iraq's recalcitrance and the likely lack of unanimous support in the UNSC? Will Iraq truly cooperate and reveal or destroy all its BW activity? Or will Iraq continue its established pattern of deception, denial, and concealment?

1 Established pattern of denial and concealment: I have already detailed above Iraq's denial and concealment of its BW program even after it acknowledged that it had conducted such a program. However, the pattern continued(s), not only through December 1998 but it now appears into 2002 as well. Increasingly, beginning in 1996 Iraq was attempting to portray its BW program as a minimal program conducted by ignorant scientists, although testimony and documentation implied the contrary. Then in 1997, Iraq began to deny significant items to which it had already acknowledged. On 5 August 1998, Iraq's Deputy Prime Minister,Tariq Aziz, reported in a letter to the UNSC: *The programme (sic BW program) was newly established. Its planning was not complete and it lacked the necessary personnel and expertise, particularly in respect of weapons. Because of the lack of specialized senior personnel, it had not become operational.* By Iraq's definition it may not have been "operational" but, by Iraq's own admission, it weaponized at least 157 R400 aerial bombs and 25 Al Hussein warheads, in addition to successfully testing large-scale drop tank delivery and fixed or rotary wing release of BW agents. *The equipment used in the context of the programme could not produce biological agents, and Iraq was not able to import the necessary equipment for this purpose.* Again, it is amazing that the equipment "could not produce biological agents," yet, by Iraq's admission, Iraq produced 19,000 liters of 20x concentrated botulinum toxin and 8,500 liters of 10x anthrax spores. UNSCOM believes the quantity was much larger. Aziz went on to lament that UNSCOM refused to "recognize the truth" of Iraqi statements.

In 1999, Iraq submitted a report to the UNSC in preparation for the UN convened panel to review the status of Iraq's WMD programs which continued this pattern of denial. More recently, an updated version of this report has been circulated. It essentially states that it "obliterated its program in 1991 and has met all the requirements for lifting sanctions," yet the world's leading experts have repeatedly disagreed with this statement. **In view of this attitude by Iraq**

it is extremely doubtful that any inspection regime will or can be successful.

2 Monitoring: Monitoring teams, unlike popular misperception, are not set up for discovery, e.g., finding undeclared sites or completing unfinished proscribed program investigations. Rather these teams were designed to be a deterrent to reconstituting a proscribed program using dual-use equipment at declared sites. In UNSCOM terminology this meant the large-scale military relevant programs; it did not address the very low-scale required for terrorist purposes. Implementation of monitoring by UNSCOM was predicated on Iraq fully and willingly cooperating with UNSCOM; that did not happen. Iraq would only give up and can be expected to give up only what the inspectors can find and prove.

It was also predicated on Iraq providing full and complete disclosure of its proscribed BW program; that did not happen. It was also predicated on Iraq making full and accurate disclosure of all facilities containing dual use equipment and capability; that did not happen.

To be effective, the monitoring system must pose a reasonable risk to Iraq of the monitoring system detecting violations of a significant scale. Even under the best of circumstances it would be almost impossible to detect small scale research, development, and production of BW agents by a State determined to conduct such activities. Without a sense of certainty by Iraq that there would be severe repercussions by a united UNSC, monitoring does not have a chance of true success.

A fundamental requirement for monitoring to be effective depends not only on having highly qualified inspectors but equally important on full support by the UNSC. Past history indicates that Iraq can hinder and in some cases outright block inspectors with impunity and then attempt to blame the incidents on the inspectors. The UNSC does not seem able to equate failure to cooperate with failure to comply.

What would be required for success? The right, accepted again by Iraq and enforced by all members of the UNSC, for immediate, unconditional access to physical locations, personnel, and documents as determined necessary by the inspectorate. Any limitations or conditions on access will produce large reductions in effectiveness and credibility of monitoring. The demand by the UNSC that Iraq provides a complete disclosure of its WMD with supporting evidence that can be verified and not accept the illusion of cooperation as meaning Iraq is in compliance. There must be a harsh penalty for non-compliance that is supported in advance by all P5 members of the UNSC.

Implicit in immediate and unconditional access to sites is a need for short travel times from base locations to sites to be visited. UNSCOM operated from a central site in Baghdad that provided Iraq with several hours unintended notice of inspections when such inspections were at locations in the far western, northern, or southern regions of Iraq. This should be changed for reliable monitoring. As such, additional satellite inspection teams should be established and located on a permanent basis in these outlying regions. This will have significant personnel, logistical, transportation, and financial implications that goes beyond that envisioned by UNMOVIC.

Another factor of concern with a monitoring system that would have limitations or conditions imposed on it is Iraq's consideration for using mobile production facilities. This was considered (and allegedly discarded) in 1987/1988 when Iraq decided to establish the Al Hakam production facility. A determined Iraq even with a greatly reinforced monitoring system might (if it has not already) reconsider this option. Such a facility on a limited scale would be virtually impossible for monitors to identify; it need not have and is unlikely to have any signatures that would identify it from other transport vans.

Finally, it nust be recognized that Iraq has and uses the full resources of a nation state with its centrally directed military industry and security apparatus to deal with a limited number of international inspectors reporting to an international body with shifting goals and attention.

3 Non-declared sites: Should Iraq consent to the return of inspectors, it is most unlikely that Iraq would then conduct overt BW activities at declared sites. It therefore follows that Iraq would do everything to prevent or hinder inspection of undeclared sites. Although UNMOVIC is on record as retaining options for undeclared site inspections, the degree that such inspection of an undeclared site would need to go through a series of review procedures before such an inspection could occur may not bode well for its success. The ability for UNMOVIC to keep information from leaking to Iraq is presumed to be no better than UNSCOM; as such, an undeclared visit would be undeclared in name only and only negative findings could be expected.

Continuation of sanctions: I have cited above the inability of sanctions to significantly effect Iraq's BW capabilities. Sanctions might make obtaining key supplies more difficult and require more devious measures but, as has been shown, sanctions will not be a significant deterrence to a BW program, even a military relevant sized program. It is my opinion that sanctions have not had and will not have a significant effect on the Iraqi regime as regards containing its BW program.

Other: I am not in a position to comment on the value of military, political, or diplomatic initiatives.

What are the potential consequences? Should Iraq be allowed to retain its BW (and other WMD programs) it will remain a menace, not only to its neighbors, but to the world at large because of the concomitant instability it would create in the region. The Gulf States would need to judge all their actions in light of the Iraqi threat. The regime is unpredictable. It is already openly supplying support to the Palestinians. Would Iraq even more overtly risk using WMD on Israel? What would be the repercussions from such a foolhardy action? Others are better equipped than I to speak to these matters.

The threat that Iraq's BW program poses as a bioterrorist weapon to any of its perceived enemies is enormous. While much attention is focused on bioterrorism against people, the economic devastation that could be wrecked on the food animal or food crop industry may be far greater in the long term effect. Clearly the greater danger for the US at home and abroad that is posed by Iraq's WMD activities is the potential for its use in terrorism, whether by Iraq directly or through support to terrorist organizations. Should Iraq be involved with using its BW expertise in bioterrorist activities, it may be impossible to find a "smoking gun" that would implicate Iraq. BW agents are unlikely to have a signature that will definitively pinpoint a laboratory or a country as the origin.

Concern for BW terrorism is not limited to immediate manifestation of such uses. It is worth recalling Iraq's developing and alleged weaponization of aflatoxin. Such an agent has no military relevant application and would only have relevance where an enemy did not know it was attacked or could not fight back. Iraq has shown a willingness to use CW agents on its neighbor and its own population, might it also have used or intended to use aflatoxin on such defenseless populations? It takes ten years or more for aflatoxin to manifest its carcinogenic and liver damaging effects.

Iraq's BW program in 2002: I intentionally left this discussion to the end because much of the above discussions affect this response. In 1990, as stated above, Iraq's BW program was still in expansion and development. It probably had three bacterial agents, one bacterial toxin, one mycotoxin and one anticrop agent in its arsenal. Although Iraq denies it, Iraq had the equipment and know how to dry BW agents in a small particle that would be highly dispersable into an aerosol. It still retains the necessary personnel, equipment (including spray dryer), and supplies to have an equal or expanded capability in this regard. It has had 12 years to advance its viral capability and, as I have cited elsewhere, this almost certainly includes smallpox as an agent. Even more ominous is Iraq's successful efforts to acquire the necessary equipment and reagents for adding genetic engineering to its BW repertoire. This was particularly alarming because, at the same time, key personnel in Iraq's virus and bioengineering BW program were no longer functional at their stated work locations. There is no doubt in my mind that Iraq has a much stronger BW program today than it had in 1990. Perhaps of most concern would be anthrax and tularemia bacteria and smallpox virus as well as antianimal and anticrop agents.