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Iraq: Status of Baghdad's Uranium Enrichment Program [redacted] (b)(3)

Iraq could develop enough fissile material for a nuclear weapon by mid-to-late decade, judging from the capabilities of its uranium enrichment program before Desert Storm and subsequent procurement activities. [redacted] Iraq's uranium enrichment efforts were halted by the onset of hostilities, although small-scale experimentation and theoretical research may have continued. Before Desert Storm, however, Iraq had explored numerous schemes to produce highly enriched uranium (HEU), including electromagnetic isotope separation, gas centrifuge, gaseous diffusion, laser, chemical, and aerodynamic techniques. [redacted] (b)(1) (b)(3)

Electromagnetic Isotope Separation (EMIS) Program

Iraq's prewar nuclear weapons program was most successful at enriching uranium using the EMIS process, an antiquated technique similar to that used in the Manhattan Project. This largely indigenous effort was the leading candidate for fissile material production at the time of the Gulf war.

-- [redacted] (b)(1)

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A large portion of Iraq's known EMIS equipment was either destroyed in coalition bombings or by UNSCOM inspectors or was tagged by inspectors for future monitoring. [redacted] (b)(1)

[redacted] (b)(1)

[redacted] (b)(3)

Gas Centrifuge Program

-- At the time of the Gulf war, Iraq's centrifuge program probably was on track to produce enough HEU for a weapon by the mid-to-late 1990s. UNSCOM inspection reports indicate that this effort was a subgroup of PC-3, the codename for Iraq's nuclear weapons program, located at Rashdiyah. When Desert Storm started, the program was poised to mass produce centrifuges and steps were being made to establish a pilot-scale enrichment plant. (b)(1)

-- Iraq's progress on gas centrifuge development is inconsistent with its claimed progress in feed material production. Iraq says it has produced only a few kilograms of uranium hexaflouride, enough for research but not weapons production, but the status of the centrifuge program as reported by UN inspectors indicates Iraq may be hiding feed material and feed material production facilities.

-- [redacted] Iraq pursued a range of centrifuge designs before the war, from domestically produced Beams-type oil-bearing centrifuges and Zippe-type magnetic-bearing centrifuges to more advanced models purchased abroad based on the URENCO G1 design utilizing maraging steel and carbon fiber rotor technology. The Iraqis also studied and had the designs for the more advanced supercritical URENCO G2 and TC11 models but are not believed to have actually acquired or built any units themselves. [redacted] (b)(3)

Iraq may be attempting to reconstitute its gas centrifuge enrichment program. Since intrusive inspections ended in 1998, Iraq has increased efforts to buy critical dual-use items that could support a gas centrifuge program, including aluminum tubes suitable for rotors, magnets, machine tools, essential chemicals, and centrifuge cascade related equipment.

-- Iraq has been seeking to procure thousands of aluminum tubes suitable for use as gas centrifuges [redacted] (b)(1)

-- Iraq would need to construct a facility using approximately 10,000 gas centrifuges of the type that we assess the aluminum tubes are suitable for before it could produce enough HEU for one weapon annually. [redacted] (b)(1)

-- Using aluminum in a centrifuge effort would be a major step back from the maraging steel and carbon fiber machines Iraq had pursued in its prewar effort, perhaps reflecting the loss of key personnel, procurement channels, and manufacturing capabilities. Iraq has been willing to use inefficient and outdated enrichment technologies before, such as in its prewar EMIS effort. [redacted] (b)(3)

Gaseous Diffusion Program

According to Iraqi declarations, Baghdad initiated work on developing barrier tubes for a gaseous diffusion program in 1982. After initial separation experiments failed, all large-scale work on gaseous diffusion was halted in the late 1980s and resources directed toward the centrifuge program.

(b)(3)

(b)(1)

-- The significant manufacturing and power infrastructure required for a diffusion plant also made the gas centrifuge method a more attractive alternative.

-- (b)(1)

(b)(1)

Baghdad would face significant hurdles in obtaining the specialized equipment needed to build a plant large enough to support a weapons program. (b)(3)

Laser Isotope Separation Program

Iraq claimed to have started research in 1981 on laser isotope separation. The initial goals of the program were to demonstrate on a laboratory scale the known methods of atomic vapor laser isotope separation and of molecular laser isotope separation. Iraqi researchers claimed to have encountered extensive technical difficulties with both techniques and said they were never able to achieve any significant enrichment. Iraqi attempts to use laser techniques to enrich uranium were largely halted by the end of 1987, although small-scale theoretical research may have continued. (b)(3)

Chemical Isotope Separation Program

In the mid-1980s Iraq investigated two types of chemical processes for enriching uranium, the French chemical exchange process (CHEMEX) and the Japanese ion exchange chromatography process. (b)(1)

(b)(1)

This pilot plant had a very limited production capability, about several kilograms per year of low enriched product, and appears to have been destroyed in the bombing of Tuwaitha. UNSCOM inspectors were unable to account for major components of the plant, and Iraq may have been able to salvage parts of the facility. (b)(3)

Aerodynamic Isotope Separation Program

Iraq may have conducted preliminary research of the aerodynamic uranium enrichment technique known as the Becker nozzle process at Tuwaitha in the mid-1980s. The effort appears to have been abandoned sometime in the late 1980s. (b)(1)

(b)(3)