Nuclear Latency (NL) Dataset
Country Coding Sheets

IRAQ
COW COUNTRY CODE: 645

List of Country's Enrichment and Reprocessing (ENR) Facilities

1. Al Tuwaitha Chemical Ion Enrichment Facility
2. Al Tuwaitha Laser
3. Al Tuwaitha Hot Cell
4. Al Tuwaitha Centrifuge
5. Al Tarmiya (north of Baghdad)
6. Ash Sharqat Enrichment Facility
7. Al Tuwaitha Gas Diffusion Facility
8. Laboratory Reprocessing Facility (Radiochemistry Laboratory)
9. Rashdiya Building 22

***Note**:* Following the Gulf War, Iraq's ENR facilities were dismantled or destroyed. Material was then placed under safeguards. However, the ENR plants did not operate under safeguards prior to 1991. We therefore code all of the Iraqi plants as unsafeguarded even though they were, in fact, inspected by the IAEA after the war.

Detailed Facility-Specific Information and Sources

1. Al Tuwaitha Chemical Ion Enrichment Facility

a. ENR type (diffusion, centrifuge, EMIS, chemical and ion exchange, aerodynamic isotope separation, reprocessing).

Enrichment, chemical and ion exchange.

b. Facility size (laboratory, pilot, commercial).

Laboratory.

c. Is the facility under construction or in operation? List the start and end year for construction and operation.

The construction start year could not be identified, but the facilities were completed by 1991 and potentially operated for a few months.[1]

d. Was the facility developed covertly? If so, identify years that facility was covert.

[1] Albright notes R&D occurred in 1991, but the facility was never constructed. Small amounts of uranium were produced.

Yes, the facility as developed covertly from inception to its discovery in 1991.

e. *Was the facility placed under IAEA safeguards? If so, identify the years that the facility was safeguarded.*

No (see the note above).

f. *Was the facility placed under regional safeguards? If so, identify the years that the facility was under regional safeguards.*

No.

g. *Did the facility have a military purpose?*

Yes, the facility was part of the nuclear weapons program. The facility was intended to produce feedstock for the EMIS program.

h. *Was the facility multinational? If so, identify the other countries that were involved.*

No.

i. *Was the facility built with foreign assistance? If so, list the supplier(s) and what they provided.*

No. Albright notes that while it is difficult to know exactly how much foreign assistance was received, that pilot plants for the chemical enrichment of uranium isotopes were built with equipment acquired from France, Sweden, and Germany. The facilities were based off open source French and Japanese programs.

j. *Sources:*

Albright, David. 1993. "A Proliferation Primer: Nuclear Proliferation." *Bulletin of the Atomic Scientists.* 49(5): 14.

Albright, David. 2002. "Iraq's Programs to Make Highly Enriched Uranium and Plutonium for Nuclear Weapons Prior to the Gulf War." Institute for Science and International Security. http://www.isis-online.org/publications/iraq/iraqs_fm_history.html. Accessed 06/21/2015.

Albright, David, Corey Gay, and Khidhir Hamza. 1999. "Development of the Al-Tuwaitha Site: What If the Public or the IAEA had Overhead Imagery." http://www.isis-online.org/publications/iraq/tuwaitha.html. Accessed 06/21/2015.

Chesser, Ronald R., Brenda E. Rodgers, Mikhail Bondarkov, Esmail Shubber and Carleton J. Phillips. 2009. "Piecing Together Iraq's Nuclear Legacy: A Forensic Investigation of Radioactive Contamination at Iraq's Central Nuclear Research

Center Confirms Saddam's Nuclear Program Never Made It Off the Ground, But It Did Endanger Iraqis." *Bulletin of the Atomic Scientists*. http://www.nuclearfiles.org/menu/key-issues/nuclear-weapons/issues/proliferation/iraq/39347588.pdf. Accessed 06/22/2015.

International Atomic Energy Agency. 2002. "Chronology of IAEA Inspections and Key Events." http://www.iaea.org/newscenter/focus/iaeairaq/chrono_augjan.shtml#january

Zentner, M.D., G.L. Coles, and R.J. Talbert. 2005. "Nuclear Proliferation Technology Trends Analysis." Pacific Northwest National Laboratory. Report 14480. 16.

2. Al Tuwaitha Laser

a. ENR type (diffusion, centrifuge, EMIS, chemical and ion exchange, aerodynamic isotope separation, reprocessing).

Enrichment, laser (MLIS and AVLIS).

b. Facility size (laboratory, pilot, commercial).

Laboratory (only one documented experiment occurred).

c. Is the facility under construction or in operation? List the start and end year for construction and operation.

Work on the laser separation began in 1981. Basic construction and operation on the facility took place until 1987 when the entire research program was downgraded to a "watching brief" status (Albright 2002).

d. Was the facility developed covertly? If so, identify years that facility was covert.

Yes, the facility was covertly developed. It was not until 1994 that the IAEA learned from member states that Iraq had pursued laser enrichment technology.

e. Was the facility placed under IAEA safeguards? If so, identify the years that the facility was safeguarded.

No (see the note above).

f. Was the facility placed under regional safeguards? If so, identify the years that the facility was under regional safeguards.

No.

g. Did the facility have a military purpose?

Yes, the facility was part of the nuclear weapons program. However, laser enrichment was not a priority for Iraq and the government did not prioritize the facility. The IAEA found no evidence to suggest that Iraq had progressed to integrated experiments as only laser excitation related to MLIS was completed.

h. Was the facility multinational? If so, identify the other countries that were involved.

No.

i. Was the facility built with foreign assistance? If so, list the supplier(s) and what they provided.

No. In 1982 Iraq created the Office of Studies and Development (OSD) to pursue uranium enrichment in secret. As part of this, EMIS equipment was installed in Building 73 at Al Tuwaitha. Building 73 is thought to have been part of a complex supplied by Italy, which also included a laboratory scale fuel reprocessing center (Building 9). EMIS development was based on open source documentation.

j. Sources:

Albright, David. 2002. "Iraq's Programs to Make Highly Enriched Uranium and Plutonium for Nuclear Weapons Prior to the Gulf War." Institute for Science and International Security. http://www.isis-online.org/publications/iraq/iraqs_fm_history.html. Accessed 06/21/2015.

Albright, David, Corey Gay, and Khidhir Hamza. 1999. "Development of the Al-Tuwaitha Site: What If the Public or the IAEA had Overhead Imagery." http://www.isis-online.org/publications/iraq/tuwaitha.html. Accessed 06/21/2015.

International Atomic Energy Agency. 2002. "Chronology of IAEA Inspections and Key Events." http://www.iaea.org/newscenter/focus/iaeairaq/chrono_augjan.shtml#january.

3. Al Tuwaitha Hot Cell

a. ENR type (diffusion, centrifuge, EMIS, chemical and ion exchange, aerodynamic isotope separation, reprocessing).

Reprocessing (hot cells).

b. Facility size (laboratory, pilot, commercial).

Laboratory.

c. *Is the facility under construction or in operation? List the start and end year for construction and operation.*

Construction of the facility began in 1982.[2] The facility operated from 1990 to 1991.[3]

d. *Was the facility developed covertly? If so, identify years that facility was covert.*

Yes, the facility was covertly developed from 1982 to 1991.

e. *Was the facility placed under IAEA safeguards? If so, identify the years that the facility was safeguarded.*

No (see the note above).

f. *Was the facility placed under regional safeguards? If so, identify the years that the facility was under regional safeguards.*

No.

g. *Did the facility have a military purpose?*

Yes, the facility was part of the nuclear weapons program.

h. *Was the facility multinational? If so, identify the other countries that were involved.*

No.

i. *Was the facility built with foreign assistance? If so, list the supplier(s) and what they provided.*

No. The Hot Laboratories at al Tuwaitha were apparently set up in the LAMA facility, which was built with French assistance. The LAMA building itself was not intended for reprocessing, but the Iraqis retrofitted it with new equipment. The equipment was mostly made in Iraq, though one source claims the extraction-stage of the reprocessing utilized Swedish mix-settlers. The LAMA building worked well for reprocessing, as it had radiation shielding, a special ventilation system, manipulators, and decontamination facilities already in place.

j. *Sources:*

Albright, David, Corey Gay, and Khidhir Hamza. 1999. "Development of the Al-Tuwaitha Site: What If the Public or the IAEA had Overhead Imagery." http://www.isis-online.org/publications/iraq/tuwaitha.html. Accessed 06/21/2015.

[2] 1982 is the year Iraq shifted towards enrichment for nuclear weapons and is from Chesser et. al. LAMA was the original building where the reprocessing occurred.
[3] Start of operation is provided by IraqWatch.org. End of operation is provided by Makhijani et al (2004).

http://www.isis-online.org/publications/iraq/tuwaitha.html

Albright, David. 1997/ 2002. "Iraq's Programs to Make Highly Enriched Uranium and Plutonium for Nuclear Weapons Prior to the Gulf War." Institute for Science and International Security. http://exportcontrols.info/print/iraqs_fm_history.html. Accesed 06/22/2105.

Chesser, Ronald R., Brenda E. Rodgers, Mikhail Bondarkov, Esmail Shubber and Carleton J. Phillips. 2009. "Piecing Together Iraq's Nuclear Legacy: A Forensic Investigation of Radioactive Contamination at Iraq's Central Nuclear Research Center Confirms Saddam's Nuclear Program Never Made It Off the Ground, But It Did Endanger Iraqis." *Bulletin of the Atomic Scientists*. http://www.nuclearfiles.org/menu/key-issues/nuclear-weapons/issues/proliferation/iraq/39347588.pdf. Accessed 06/22/2015.

Federation of American Scientists. "Al Tuwaitha Nuclear Center." http://fas.org/nuke/guide/iraq/facility/tuwaitha.htm. Accessed 06/22/2015.

International Atomic Energy Agency. "Al-Tuwaitha- LAMA Testing Laboratory." http://www-ns.iaea.org/projects/iraq/tuwaitha/lama.asp. Accessed 06/22/2015.

International Atomic Energy Agency. "Nuclear Capabilities of Iraq." http://www.iaea.org/Publications/Booklets/Iraq/iaeaplan.html#inspection.

Makhijani, Arjun, Lois Chalmers, and Brice Smith. 2004. "Uranium Enrichment: Just Plain Facts to Fuel an Informed Debate on Nuclear Proliferation and Nuclear Power." Institute for Energy and Environmental Research. Nuclear Policy Research Institute.

Zentner, M.D., G.L. Coles, and R.J. Talbert. 2005. "Nuclear Proliferation Technology Trends Analysis." Pacific Northwest National Laboratory. Report 14480.

4. Al Tuwaitha Centrifuge

a. ENR type (diffusion, centrifuge, EMIS, chemical and ion exchange, aerodynamic isotope separation, reprocessing).

Enrichment, centrifuge.

b. Facility size (laboratory, pilot, commercial).

Laboratory.

c. Is the facility under construction or in operation? List the start and end year for construction and operation.

Construction of the facility took place in 1987. The facility was a very small lab focused on testing individual centrifuges. Iraq shifted experimentation away from oil to magnet bearings and metal composite rotors.[4] The facility operated for just one year (1987). The equipment was moved to Rashdiya in 1987.

d. Was the facility developed covertly? If so, identify years that facility was covert.

Yes, the facility was covertly developed.

e. Was the facility placed under IAEA safeguards? If so, identify the years that the facility was safeguarded.

No (see the note above).

f. Was the facility placed under regional safeguards? If so, identify the years that the facility was under regional safeguards.

No.

g. Did the facility have a military purpose?

Yes, the facility was part of the nuclear weapons program.

h. Was the facility multinational? If so, identify the other countries that were involved.

No.

i. Was the facility built with foreign assistance? If so, list the supplier(s) and what they provided.

There is no evidence that there was assistance at this site, and it is possible early centrifuge work was indigenous. It is important to note however that the Iraqi centrifuge program relied heavily on dual use components and materials, and that German individuals were crucial to the development of the centrifuge program.

j. Sources:

Albright, David, Corey Gay, and Khidhir Hamza. 1999. "Development of the Al-Tuwaitha Site: What If the Public or the IAEA had Overhead Imagery." http://www.isis-online.org/publications/iraq/tuwaitha.html. Accessed 06/21/2015. http://www.isis-online.org/publications/iraq/tuwaitha.html

Albright, David. 1997/ 2002. "Iraq's Programs to Make Highly Enriched Uranium and Plutonium for Nuclear Weapons Prior to the Gulf War." Institute for Science and

[4] The construction dates are from IAEA Iraq Nuclear File: Key Findings. Albright (1997/2000) states operation began in 1988.

International Security. http://exportcontrols.info/print/iraqs_fm_history.html. Accesed 06/22/2105.

International Atomic Energy Agency. "Nuclear Capabilities of Iraq." http://www.iaea.org/Publications/Booklets/Iraq/iaeaplan.html#inspection.

International Institute for Strategic Studies. 2007. "Chapter Two: Nuclear Black Markets: Other Countries and Networks." In *Nuclear Black Markets: Pakistan, A.Q. Khan, and the Rise of Proliferation Networks- A Net Assessment.* http://archive.today/UsQbo. Accessed 06/08/2015.

Iraq Watch. "WMD Profiles: Nuclear: Iraq's Nuclear Weapon Program." http://www.iraqwatch.org/profiles/nuclear.html. Accessed 06/22/2105.

Makhijani, Arjun, Lois Chalmers, and Brice Smith. 2004. "Uranium Enrichment: Just Plain Facts to Fuel an Informed Debate on Nuclear Proliferation and Nuclear Power." Institute for Energy and Environmental Research. Nuclear Policy Research Institute.

5. Al Tarmiya (north of Baghdad)

a. ENR type (diffusion, centrifuge, EMIS, chemical and ion exchange, aerodynamic isotope separation, reprocessing).

Enrichment, EMIS.

b. Facility size (laboratory, pilot, commercial).

Pilot. There was a production goal of 15 kg per year using natural uranium feed.

c. Is the facility under construction or in operation? If under construction, list the construction years. If in operation, list the years of operation.

Construction of the facility started in 1982 and was completed in 1990. The original goal for the facility was to be operational by 1991, however technical problems plagued the facility and at the time of Iraq's invasion of Kuwait the facility was at least one year away from producing weapons grade material. Albright notes a small amount of uranium was enriched in 1990, so the facility is coded as operating from 1990-1991, because material was likely introduced into the facility, despite limitations.

d. Was the facility developed covertly? If so, identify years that facility was covert.

Yes, the facility was developed covertly. It is unclear when the facility became public information. The project was covert from 1982 to 1991. The facility was damaged by an air strike in 1991.

e. Was the facility placed under IAEA safeguards? If so, identify the years that the facility was safeguarded.

No (see the note above).

f. Was the facility placed under regional safeguards? If so, identify the years that the facility was under regional safeguards.

No.

g. Did the facility have a military purpose?

Yes, the facility was designed to provide HEU for nuclear weapons. Iraqi leadership decided in 1981 that HEU was a more promising path to nuclear weapons than plutonium.

h. Was the facility multinational? If so, identify the other countries that were involved.

No.

i. Was the facility built with foreign assistance? If so, list the supplier(s) and what they provided.

Yes. In 1987 Iraq signed a contract with the Yugoslavian company FDSP-FAKOM (Federal Directorate of Supply and Procurement) to build an EMIS production facility at al Tarmiya. Though EMIS equipment was largely based off open source US designs and some sources claim the exact enrichment process was indigenous to Iraq, the Yugoslavian firm played a major role in both the construction of the facilities and procurement of technologies and materials. One source notes that the contract included the construction of about 20 buildings for an overall cost of $110 million. FDSP-FAKOM contracted with the Yugoslavian firm EMO-OHRID for the supply and installation of electrical equipment while the Iraqi company Auqba bin Nafi General Establishment (ABN) contracted with FDSP for the actual construction of facilities. Reportedly, the entire construction process was highly secretive, with FDSP engineers designing the facility from inside ABN headquarters, while under supervision of ABN engineers. Iraqi officials have stated that FDSP did not know the true purpose of the plant, and that the Yugoslavians never saw the EMIS equipment being installed. FDSP did play a role in procurement of electrical equipment for the plant, and perhaps dual use component parts as well. One ISIS report notes that the companies supplying electrical equipment were mostly Yugoslavian, European, or American.

j. Sources:

Albright, David. 1997/ 2002. “Iraq’s Programs to Make Highly Enriched Uranium and Plutonium for Nuclear Weapons Prior to the Gulf War.” Institute for Science and

International Security. http://exportcontrols.info/print/iraqs_fm_history.html. Accesed 06/22/2105.

Ciricione, Joseph, Jon B. Wolfsthal, and Miriam Rajkumar. 2005. *Deadly Arsenals: Nuclear, Biological, and Chemical Threats*. Washington D.C.: Carnegie Endowment for International Peace.

International Atomic Energy Agency. "Iraq Nuclear File: Key Findings." http://www.iaea.org/OurWork/SV/Invo/factsheet.html. Accessed 06/22/2105.

Institute for Science and International Security. "EMIS Procurement." http://exportcontrols.info/print/emisprocurement.html. Accessed 06/22/2015.

Makhijani, Arjun, Lois Chalmers, and Brice Smith. 2004. "Uranium Enrichment: Just Plain Facts to Fuel an Informed Debate on Nuclear Proliferation and Nuclear Power." Institute for Energy and Environmental Research. Nuclear Policy Research Institute.

Nuclear Threat Initiative. 2014. "Country Profile: Iraq." http://www.nti.org/country-profiles/iraq/. Accessed 06/22/2015.

Zentner, M.D., G.L. Coles, and R.J. Talbert. 2005. "Nuclear Proliferation Technology Trends Analysis." Pacific Northwest National Laboratory. Report 14480.

6. Ash Sharqat Enrichment Facility

a. ENR type (diffusion, centrifuge, EMIS, chemical and ion exchange, aerodynamic isotope separation, reprocessing).

Enrichment, EMIS.

b. Facility size (laboratory, pilot, commercial).

Pilot.

c. Is the facility under construction or in operation? If under construction, list the construction years. If in operation, list the years of operation.

Construction of the facility began in 1987. It is not clear that the facility ever became operational. The facility was destroyed during the Gulf War.

d. Was the facility developed covertly? If so, identify years that facility was covert.

The facility was developed covertly. Discovery of the extent of Iraq's nuclear program was not known until after the war. It is possible that the EMIS program

would not have been found except for the defection of Iraqi scientists following the war.

e. *Was the facility placed under IAEA safeguards? If so, identify the years that the facility was safeguarded.*

No (see the note above).

f. *Was the facility placed under regional safeguards? If so, identify the years that the facility was under regional safeguards.*

No.

g. *Did the facility have a military purpose?*

Yes, the facility was designed to provide HEU for nuclear weapons. Iraqi leadership decided in 1981 the HEU was a more promising path to nuclear weapons than plutonium. Facility construction started in 1987.

h. *Was the facility multinational? If so, identify the other countries that were involved.*

No, this facility was built using Italian plans but work was done completely by Iraqis.

i. *Was the facility built with foreign assistance? If so, list the supplier(s) and what they provided.*

No. This facility was built by Iraq, based on the al Tarmiya facility.

j. *Sources:*

Albright, David. 1997/ 2002. "Iraq's Programs to Make Highly Enriched Uranium and Plutonium for Nuclear Weapons Prior to the Gulf War." Institute for Science and International Security. http://exportcontrols.info/print/iraqs_fm_history.html. Accesed 06/22/2105.

Ciricione, Joseph, Jon B. Wolfsthal, and Miriam Rajkumar. 2005. *Deadly Arsenals: Nuclear, Biological, and Chemical Threats*. Washington D.C.: Carnegie Endowment for International Peace.

Nuclear Threat Initiative. 2014. "Country Profile: Iraq." http://www.nti.org/country-profiles/iraq/. Accessed 06/22/2015.

Zentner, M.D., G.L. Coles, and R.J. Talbert. 2005. "Nuclear Proliferation Technology Trends Analysis." Pacific Northwest National Laboratory. Report 14480.

7. Al Tuwaitha Gas Diffusion Facility

a. *ENR type (diffusion, centrifuge, EMIS, chemical and ion exchange, aerodynamic isotope separation, reprocessing).*

Enrichment, gaseous diffusion.

b. *Facility size (laboratory, pilot, commercial).*

Laboratory.

c. *Is the facility under construction or in operation? If under construction, list the construction years. If in operation, list the years of operation.*

In 1987 Iraqi leadership realized that gaseous diffusion was not the best option. A porous barrier was not invented until 1986, which increases the likelihood that uranium was not introduced into machines at the facility. The facility did not become operational as the gaseous diffusion team was transferred to Rashdiya to work on the centrifuge program around 1987.

d. *Was the facility developed covertly? If so, identify years that facility was covert.*

Yes.

e. *Was the facility placed under IAEA safeguards? If so, identify the years that the facility was safeguarded.*

No (see the note above).

f. *Was the facility placed under regional safeguards? If so, identify the years that the facility was under regional safeguards.*

No.

g. *Did the facility have a military purpose?*

Yes, the facility was part of the weapons program. Gaseous diffusion was pursued during the late 1980s.

h. *Was the facility multinational? If so, identify the other countries that were involved.*

No.

i. *Was the facility built with foreign assistance? If so, list the supplier(s) and what they provided.*

No evidence of foreign assistance found. Apparently work on gaseous diffusion began in the early 1980s at al Tuwaitha before being moved to the Rashdiya complex.

Albright notes this work was discontinued because Iraq was having difficulty indigenously producing the necessary equipment and was unable to procure the equipment from abroad.

j. Sources:

Albright, David. 1997/ 2002. "Iraq's Programs to Make Highly Enriched Uranium and Plutonium for Nuclear Weapons Prior to the Gulf War." Institute for Science and International Security. http://exportcontrols.info/print/iraqs_fm_history.html. Accesed 06/22/2105.

Ciricione, Joseph, Jon B. Wolfsthal, and Miriam Rajkumar. 2005. *Deadly Arsenals: Nuclear, Biological, and Chemical Threats*. Washington D.C.: Carnegie Endowment for International Peace.

Nuclear Threat Initiative. 2014. "Country Profile: Iraq." http://www.nti.org/country-profiles/iraq/. Accessed 06/22/2015.

Zentner, M.D., G.L. Coles, and R.J. Talbert. 2005. "Nuclear Proliferation Technology Trends Analysis." Pacific Northwest National Laboratory. Report 14480. 16.

8. Laboratory Reprocessing Facility (Radiochemistry Laboratory)

a. ENR type (diffusion, centrifuge, EMIS, chemical and ion exchange, aerodynamic isotope separation, reprocessing).

Reprocessing.

b. Facility size (laboratory, pilot, commercial).

Laboratory.

c. Is the facility under construction or in operation? If under construction, list the construction years. If in operation, list the years of operation.

Construction on the turnkey facility began in 1979[5] and the facility became operational in 1982. Cold tests were performed from 1983 to 1987. The facility became fully operational in 1988 when it reprocessed safeguard–exempt spent fuel from the IRT-5000 reactor. It was dismantled in 1991 during the first Gulf War. The facility extracted between 2.7 to 5 grams of plutonium.

d. Was the facility developed covertly? If so, identify years that facility was covert.

Yes.

[5] The 1979 dates is from Zentner et al. while Albright states that the facility was acquired from Italy in 1976. Both sources have similar operational dates. Albright (1997/2000) states cold testing occurred from 1983-1987.

e. Was the facility placed under IAEA safeguards? If so, identify the years that the facility was safeguarded.

No (see the note above).

f. Was the facility placed under regional safeguards? If so, identify the years that the facility was under regional safeguards.

No.

g. Did the facility have a military purpose?

Yes, the facility was designed to produce plutonium, ostensibly for nuclear weapons. Iraq decided to pursue uranium enrichment for weapons after Israel destroyed the Osiraq reactor in 1981.

h. Was the facility multinational? If so, identify the other countries that were involved.

No.

i. Was the facility built with foreign assistance? If so, list the supplier(s) and what they provided.

Yes. During the late 1970's Iraq received hot cells and equipment for laboratory scale reprocessing from the Italian SNIA-Technit Compnay. The deal was conducted in secret and not revealed until 1980. It is thought that Italy supplied the laboratory, hot cells, glove boxes, and related equipment.[6]

j. Sources:

Albright, David. 1997/ 2002. "Iraq's Programs to Make Highly Enriched Uranium and Plutonium for Nuclear Weapons Prior to the Gulf War." Institute for Science and International Security. http://exportcontrols.info/print/iraqs_fm_history.html. Accessed 06/22/2105.

International Atomic Energy Agency. 1995. "Report on the Twenty-Eighth IAEA On-Site Inspection In Iraq Under Security Council Resolution 687 (1991)." http://www.iaea.org/OurWork/SV/Invo/reports/s_1995_1003.pdf. Accessed 06/22/2105.

Kroenig, Matthew. "Importing the Bomb: Sensitive Nuclear Assistance and Nuclear Proliferation." The Belfer Center.

[6] Zentner et al. refer to a second Italian-supplied reprocessing plant at the site, but no additional information could be found to support this.

http://belfercenter.ksg.harvard.edu/files/uploads/Kroenig_Importing_the_Bomb.pdf. Accessed 06/22/2015. 29.

Nuclear Threat Initiative. 2014. "Country Profile: Iraq." http://www.nti.org/country-profiles/iraq/. Accessed 06/22/2015.

Spector, Leonard S. and Jacqueline R. Smith. 1990. *Nuclear Ambitions*. Boulder, CO: Westview Press. 40.

Weissman, Steve and Herbert Krosney. 1981. *The Islamic Bomb: The Nuclear Threat to Israel and the Middle East*. New York City, NY: Times Books.

Zentner, M.D., G.L. Coles, and R.J. Talbert. 2005. "Nuclear Proliferation Technology Trends Analysis." Pacific Northwest National Laboratory. Report 14480. 102.

9. Rashdiya Building 22

a. ENR type (diffusion, centrifuge, EMIS, chemical and ion exchange, aerodynamic isotope separation, reprocessing).

Enrichment, centrifuge.[7]

b. Facility size (laboratory, pilot, commercial).

Laboratory.

c. Is the facility under construction or in operation? List the start and end year for construction and operation.

Iraqi effort shifted from gaseous diffusion to centrifuge around 1987 or 1988 when Kamel became director of the nuclear weapons program. Construction of the Building 22 was completed in 1988 taking only approximately three months to complete. The facility was not a production facility but a centrifuge testing location. Iraq operated the first prototype centrifuge in 1990. Iraq started a test using uranium hexafluoride gas in July 1990. The facility operated until the end of 1991.

d. Was the facility developed covertly? If so, identify years that facility was covert.

Yes, the facility and the acquisition of material were clandestine.

e. Was the facility placed under IAEA safeguards? If so, identify the years that the facility was safeguarded.

[7] Albright notes the team at Rashidya was given authority to work on gaseous diffusion and centrifuge enrichment. Gaseous diffusion was quickly de-emphasized, so it is unlikely material was introduced for the gaseous diffusion research.

No (see the note above).

f. Was the facility placed under regional safeguards? If so, identify the years that the facility was under regional safeguards.

No.

g. Did the facility have a military purpose?

Yes, the facility was part of Iraq's weapon program. Two types of centrifuges were developed. The oil and magnetic centrifuge were developed in parallel until mid 1989 when Iraq decided to pursue only the magnetic centrifuge. Zentner et al. state that no evidence was found to suggest that Iraq produced significant quantities of HEU using centrifuge technology.

h. Was the facility multinational? If so, identify the other countries that were involved.

No.

i. Was the facility built with foreign assistance? If so, list the supplier(s) and what they provided.

Yes. There is evidence that this facility garnered assistance from government-approved sources. An ISIS report on nuclear black markets notes that Iraqi centrifuge development relied on dual use technology and component parts purchased from both European and American companies. In 1988 for example Iraqi officials approached the German company H+H Metalform GmbH. This firm apparently provided materials and expertise to the Rashdiya centrifuge plant. The Iraqis apparently also procured crucial elements through front operating outside of Iraq.

One of the most well-known examples of this is the case of Matrix Churchill Ltd., a UK machine tool manufacturer that also built centrifuge components for Iraq and acted as a procurement agent for the Iraqi centrifuge program, obtaining other materials and parts from European suppliers and diverting them to Iraq. Following the Gulf War, it became clear that the British Government had been aware of, and perhaps even endorsed, Matrix Churchill Ltd.'s activities. Three Matrix Churchill Ltd. executives escaped prosecution when information was found showing that British intelligence had known about this supply chain, and about the ultimate military-end use of the items. It is thought that the British government may have even encouraged some of the secret transfers.

j. Sources:

Albright, David. 1997/ 2002. "Iraq's Programs to Make Highly Enriched Uranium and Plutonium for Nuclear Weapons Prior to the Gulf War." Institute for Science and International Security. http://exportcontrols.info/print/iraqs_fm_history.html. Accessed 06/22/2105.

Institute for Science and International Security. "Iraq Acquisition of Gas Centrifuge Technology: Part I: H+H Metalform—Funnel for the Iraqi Gas Centrifuge Program." http://www.exportcontrols.org/centpart1.html. Accessed 06/22/2015.

International Institute for Strategic Studies. 2007. "Chapter Two: Nuclear Black Markets: Other Countries and Networks." In *Nuclear Black Markets: Pakistan, A.Q. Khan, and the Rise of Proliferation Networks- A Net Assessment.* http://archive.today/UsQbo. Accessed 06/08/2015.

Makhijani, Arjun, Lois Chalmers, and Brice Smith. 2004. "Uranium Enrichment: Just Plain Facts to Fuel an Informed Debate on Nuclear Proliferation and Nuclear Power." Institute for Energy and Environmental Research. Nuclear Policy Research Institute.

Mednews. 1991. "Special Report: How Saddam Got the Bomb." Middle East Defense News, Proliferation. 5(1).

Nuclear Threat Initiative. 2014. "Country Profile: Iraq." http://www.nti.org/country-profiles/iraq/. Accessed 06/22/2015.

Zentner, M.D., G.L. Coles, and R.J. Talbert. 2005. "Nuclear Proliferation Technology Trends Analysis." Pacific Northwest National Laboratory. Report 14480. 35.