

## **Iraq Nuclear Facility Dismantlement and Disposal Project**

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### **ABSTRACT**

The Al Tuwaitha nuclear complex near Baghdad contains a significant number of nuclear facilities from Saddam Hussein's dictatorship. Because of past military operations, lack of upkeep and looting there is now an enormous radioactive waste problem at Al Tuwaitha. Al Tuwaitha contains uncharacterized radioactive wastes, yellow cake, sealed radioactive sources, and contaminated metals. The current security situation in Iraq hampers all aspects of radioactive waste management. Further, Iraq has never had a radioactive waste disposal facility, which means that ever increasing quantities of radioactive waste and material must be held in guarded storage.

The Iraq Nuclear Facility Dismantlement and Disposal Program (the NDs Program) has been initiated by the U.S. Department of State (DOS) to assist the Government of Iraq (GOI) in eliminating the threats from poorly controlled radioactive materials, while building human capacities so that the GOI can manage other environmental cleanups in their country. The DOS has funded the International Atomic Energy Agency (IAEA) to provide technical assistance to the GOI via a Technical Cooperation Project. Program coordination will be provided by the DOS, consistent with U.S. and GOI policies, and Sandia National Laboratories will be responsible for coordination of participants and for providing waste management support. Texas Tech University will continue to provide in-country assistance, including radioactive waste characterization and the stand-up of the Iraq Nuclear Services Company. The GOI owns the problems in Iraq and will be responsible for the vast majority of the implementation of the NDs Program.

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## **BACKGROUND**

The Al Tuwaitha Nuclear Research Center, located 18 km southeast of downtown Baghdad, was the main site for nuclear research and the Iraqi nuclear weapons program. Al Tuwaitha facilities cover over one square kilometer and included two research reactors (Osiraq and IRT-5000), a fuel fabrication facility, facilities for plutonium separation, uranium enrichment, waste storage facilities and many other facilities.

The Osiraq reactor was bombed by Israel in 1981 and the IRT-5000 reactor was bombed and disabled during the 1991 Operation Desert Storm. Although the nuclear reactors remained inoperative, the facilities were used for storage of nuclear materials between 1992 and 2003. In 2003, following Operation Iraqi Freedom, a small contingent of coalition forces occupied the large site at Al Tuwaitha. When the regime collapsed, Iraqi looters breached the damaged the installation and carried off contaminated scrap metal, scientific equipment and tens of 50 gallon barrels that contained yellow cake (uranium dioxide). The residents poured the yellow cake on the ground, in sewers, and in the waterways of areas surrounding the Al Tuwaitha compound and on village outskirts.

## **CURRENT SITUATION**

The fresh nuclear fuel, spent nuclear fuel and enriched uranium have been removed from the country, along with approximately 1,000 radioactive sealed sources. Bunker B at the Al Tuwaitha was secured in 2003 and then used as a storage site for radioactive materials from the site and elsewhere in Iraq. Aside from this activity, the Al Tuwaitha site and the other nuclear sites continued deteriorating. The first post-conflict characterization and public health study at Al Tuwaitha began in 2005 when a joint team from Texas Tech University Center for Environment Radiation Studies and the Iraqi Ministry of Science and Technology (MoST) obtained funding for a characterization-public health project. Supported by the U. S. Army, the Texas Tech team obtained 400 soil samples (with GPS coordinates) and initiated training for the Iraqi team.

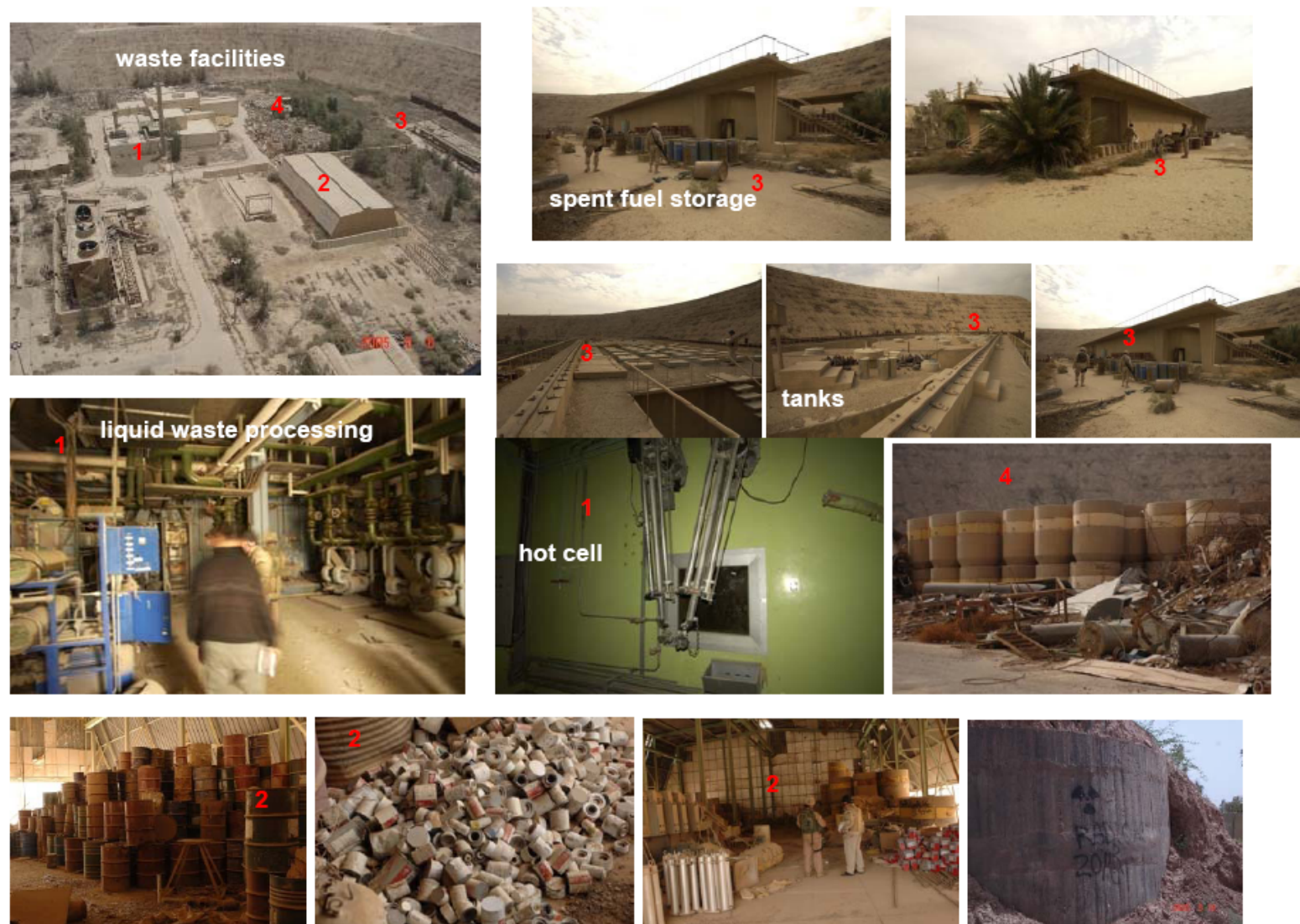
The sites that previously housed Iraq's nuclear facilities remain in a radioactively-contaminated and hazardous condition. Figure 1 presents a collection of photographs of the current conditions at the Osiraq Reactor site at Al Tuwaitha. Figures 2 presents photographs of wastes and waste management facilities at Al Tuwaitha. In addition to the waste management facilities shown in Figure 2, there are wastes in the "Russian" low-level radioactive waste (LLW) cemetery at Al Tuwaitha. Figure 3 shows the tops of the Russian LLW wells; each well is believed to be 4 m deep, and the inventory was lost. All of these facilities, and others not shown, are in urgent need of final decommissioning, dismantlement and site remediation.

In addition to the urgent problems at Al Tuwaitha, Iraq has never had a radioactive waste disposal facility. Iraq has no national strategy or system for radioactive waste management.

The Iraqi MoST is participating in the NDs Program as the "owner" of Al Tuwaitha; although ownership of the Al Tuwaitha nuclear complex is not defined in Iraqi law. The Iraq Radioactive



Figure 1. Photographs of the Osirak Reactor site at Al Tuwaitha Nuclear Complex



**Figure 2. Photographs of some of the wastes and waste management facilities at Al Tuwaitha**



**Figure 3. “Russian” Cemetery for LLW at Al Tuwaittha**

Sources Regulatory Authority (IRSRA) has been authorized and IRSRA staff are working to develop a program to manage sources of ionizing radiation in Iraq. In addition to the physical problems, and the young regulatory infrastructure, the current security situation in Iraq hampers all aspects of radioactive waste management.

### **IRAQ NUCLEAR DISMANTLEMENT AND DISPOSAL PROGRAM**

Iraq began discussing its many radioactive waste problems with the IAEA during a DOS-arranged July 2004 meeting between Minister Rashad Omar of the Iraqi MoST and senior IAEA officials. In late 2004, Iraq officially requested that the IAEA assist Iraq with decommissioning, dismantlement, and disposal of its former nuclear facilities, including organizing an international assistance program for this purpose. The IAEA agreed to assist through a Technical Cooperation Project. The project's groundwork was set at an IAEA meeting in Vienna in February 2006, attended by the Iraqi MoST, representatives from sixteen countries, including the U.S., and the European Commission.

In addition to the IAEA assistance, the DOS's Bureau of International Security and Nonproliferation, Office of Nuclear Energy, Safety and Security initiated the Iraq NDs Program. The NDs Program will assist the GOI in eliminating the threats from poorly controlled radioactive materials, while building human capacities so that the GOI can manage other environmental cleanups in their country.

In addition to the DOS's Bureau of International Security and Nonproliferation, the current ND's Program includes participants from:

- DOS's Iraq Weapons of Mass Destruction (WMD) Scientist Redirect Program,
- IAEA's Waste Safety Section,
- U.S. Nuclear Regulatory Commission's International Nuclear Regulatory Development Project,

- U.S. Environmental Protection Agency's International Nuclear Cooperation Projects in Russia,
- Oak Ridge National Laboratory and Department of Energy's MAXIMUS Project, and
- Texas Tech University's Center for Environmental Radiation Studies.

Sandia National Laboratories responsibilities are to prepare a plan to coordinate / integrate the work of the participants and to provide technical assistance for the Iraq NDs Program.

## **OBJECTIVES**

The overall objectives of the Iraq NDs Program are to cleanup radioactively contaminated facilities and safely dispose of the radioactive wastes in Iraq. There are several near-term objectives for the program:

1. Developing management plans to organize, schedule, monitor and ensure the integration of a multitude of participants to meet all operational, quality assurance, safety, and security requirements,
2. Develop draft regulations to protect the citizens, workers and future generations from the hazardous effects of ionizing radiation,
3. Characterize the sites and wastes to determine the inventory of materials needing disposal. Part of the characterization task will involve the development of a prioritization scheme for the sites and the waste streams,
4. To carry out the enormous task of actual decommissioning and demolition of Al Tuwaitha. This objective will likely include the development of centralized and/or secure storage facilities. Once remediated, sites will be demolished and closed,
5. Siting, characterizing, licensing, constructing and operating appropriate waste disposal facilities to permanently eliminate the hazards of radioactive waste in Iraq, and
6. The characterization and possible sale of the large volumes of yellow cake in storage in Iraq. Proceeds from such a sale could potentially fund the enormous task of implementing the NDs Program.

In addition to the above objectives, this work will engage Iraqi personnel in meaningful work commensurate with their qualifications while permanently eliminating the safety and security threats associated with poorly controlled radioactive materials. A cornerstone of this project will be in capacity-building for the government of Iraq. During the course of these cleanup activities many scientists, technicians, and administrators will be trained in the regulations, standards, and procedures for remediation of environmental contamination appropriate to the challenges facing post-war Iraq. Other crucial benefits include:

- Secure and final disposal of Iraq's dangerous radioactive materials,
- Sale and removal of yellow cake from Iraq,
- Relieve border monitoring problems associated with contaminated scrap metal
- Institutionalize regulatory infrastructure, and
- Capacity-building so that the GOI can manage other environmental challenges in their country.

## **IMPLEMENTATION**

The Iraqi MoST controls the former nuclear facilities and it is proposed that MoST will also own the radioactive waste disposal facility when it is constructed. For these reasons the proposal is that MoST should take the lead in developing the radioactive waste management and disposal program, and nuclear facility dismantlement program. MoST should also execute the dismantlement program via contracts with a proposed new "Iraq Nuclear Services Company" formed from former WMD Scientists. In the proposal for U.S. support, Sandia and the other participants will provide training and technical consultative assistance to MoST to help accomplish the tasks. The current security situation must improve for full and cost-effective implementation of the NDs Program. The GOI will be responsible for the vast majority of the physical implementation of the Iraq NDs Project with assistance and training provided by the Iraq NDs Program.

## **SUMMARY**

Al Tuwaitha nuclear complex, 18 km from downtown Baghdad, covers over one square kilometer and included two research reactors (Osiraq and IRT-5000), a fuel fabrication facility, facilities for plutonium separation, uranium enrichment, waste storage facilities and many other facilities. The Osiraq reactor was bombed by Israel in 1981 and the IRT-5000 reactor was bombed and disabled during the 1991 Operation Desert Storm. When Saddam's regime collapsed in 2003, Iraqi looters breached the damaged the installation, accidentally spread yellow cake and carried off contaminated scrap metal.

The sites that previously housed Iraq's nuclear facilities remain in a radioactively-contaminated and hazardous condition. In addition to the urgent problems at Al Tuwaitha, Iraq has never had a radioactive waste disposal facility. Iraq has no national strategy or system for radioactive waste management. The Iraq NDs Program has been initiated by the DOS to assist the GOI in eliminating the threats from poorly controlled radioactive materials, while building human capacities so that the GOI can manage other environmental cleanups in their country.