

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

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### **ABSTRACT**

The Al Tuwaitha nuclear complex near Baghdad contains a number of facilities from Saddam Hussein's nuclear weapons program. Past military operations, lack of upkeep and looting have created an enormous radioactive waste problem at the Al Tuwaitha complex, which contains various, uncharacterized radioactive wastes, yellow cake, sealed radioactive sources, and contaminated metals that must be constantly guarded. Iraq has never had a radioactive waste disposal facility and the lack of a disposal facility means that ever increasing quantities of radioactive 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 is funding the IAEA to provide technical assistance via Technical Cooperation projects. Program coordination will be provided by the DOS, consistent with GOI policies, and Sandia National Laboratories will be responsible for coordination of participants and 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 implementation of the NDs Program.

### **BACKGROUND**

The Al Tuwaitha Nuclear Research Center, located 18 km southeast of Baghdad, was the main site for 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 and other purposes

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<sup>1</sup> Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. (SAND2006-5095A)

The Osiraq reactor was bombed by Israel in 1981 and the IRT-5000 research reactor was bombed by the U.S. during the Gulf War. Other facilities were damaged or destroyed during the Gulf War. Additional facilities at Al Tuwaitha were damaged or destroyed during Operation Iraqi Freedom and subsequent looting.

## **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. The sites that previously housed Iraq's nuclear facilities remain in a radioactively-contaminated and hazardous condition. Figure 1 shows some of the Russian low-level radioactive cemetery at Al Tuwaitha. Each well is in Figure 1 is believed to be 4 m deep, and the inventory was lost. Figures 2 and 3 present a collection of photographs of the current conditions at Al Tuwaitha; which is in urgent need of final decommissioning, dismantlement and site remediation.



**Figure 1. Russian Cemetery for LLW at Al Tuwaitha**

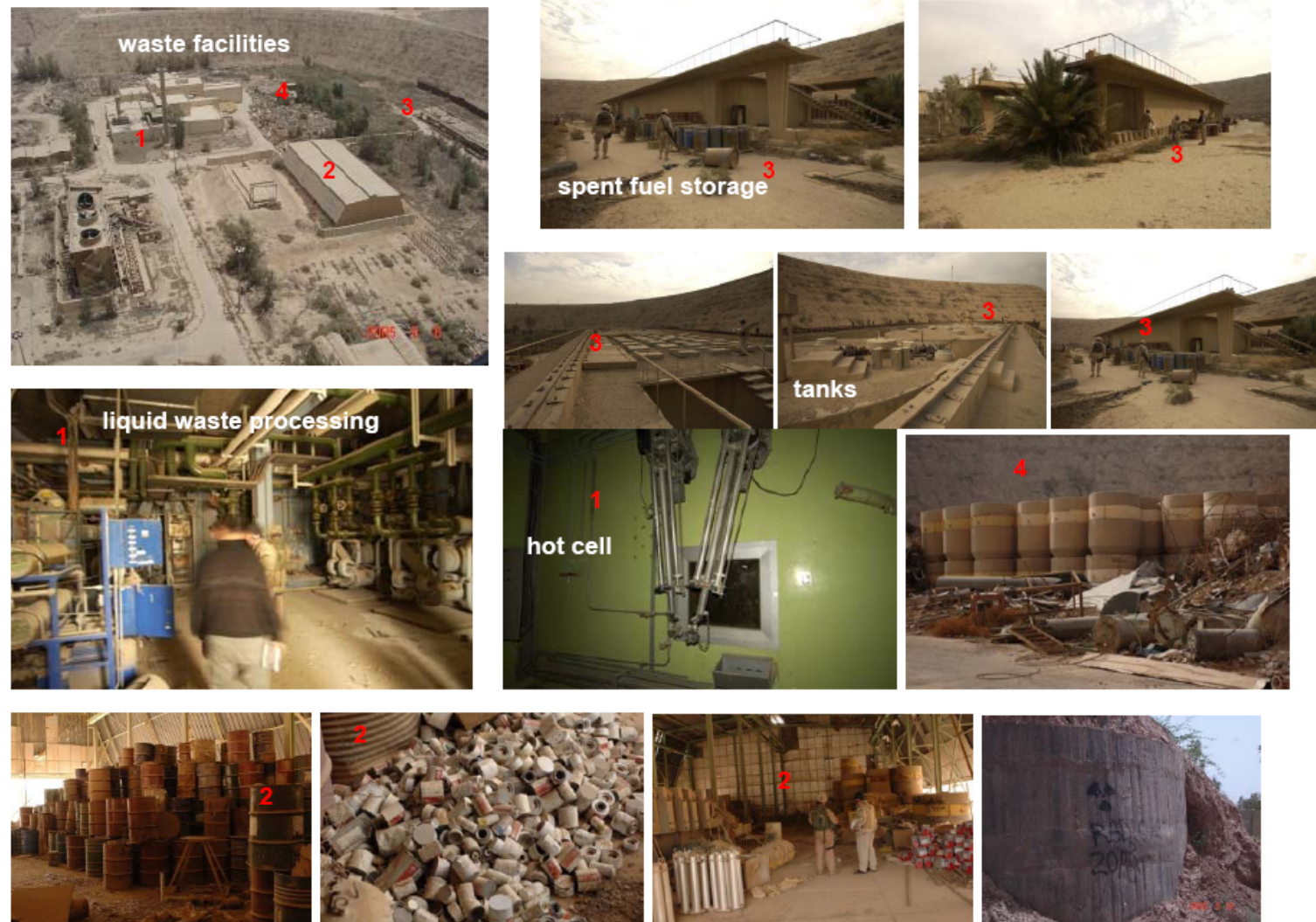
In addition to the urgent problems at Al Tuwaitha, Iraq has never had a radioactive waste disposal facility. Iraq's radioactive waste conditioning facility and radioactive waste storage facility are in disrepair and in need of refurbishment. It is believed that radioactively contaminated materials have been dumped at border crossings.



**Figure 2. Photographs of the Osirqa Reactor site at Al Tuwaitha Nuclear Complex**

[http://www.nti.org/e\\_research/profiles/Iraq/Nuclear/2117\\_3364.html](http://www.nti.org/e_research/profiles/Iraq/Nuclear/2117_3364.html)

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**Figure 3. Photographs of Waste Management Facilities at Al Tuwaitha**

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Iraq has no national policy, strategy, or system for radioactive waste management and there is no legally defined owner of Al Tuwaitha. The Iraq Radioactive Sources Regulatory Authority (IRSRA) has been authorized and staff are working to develop a program to manage sources of ionizing radiation in Iraq. The security situation in Iraq hampers all aspects of IRSRA's activities.

## **IRAQ NDs PROGRAM**

The Iraq began discussing its radioactive waste problems with the IAEA during a Department of State (DOS)-arranged July 2004 meeting between Minister Rashad Omar of the Iraqi Ministry of Science and Technology and senior IAEA officials. The IAEA encouraged Iraq to continue this dialogue. 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.

The Iraqi Government has requested assistance to prepare plans and programs to decommission contaminated facilities in the country. The project's groundwork was set at an IAEA meeting in Vienna in February 2006, attended by the Iraqi Minister for Science and Technology, representatives from sixteen countries, including the US, and the European Commission.

The DoS's Bureau of International Security and Nonproliferation (ISN), Office of Nuclear Energy, Safety and Security (NESS), contracted with Sandia National Laboratories (Sandia) to prepare a plan to coordinate/integrate the work of the participants and to provide technical assistance for the Iraq Nuclear Facility Dismantlement and Disposal Program (Iraq NDs Program).

The DoS's Bureau of International Security and Nonproliferation (ISN), Office of Nuclear Energy, Safety and Security (NESS), contracted with Sandia National Laboratories (Sandia) to prepare a plan to coordinate/integrate the work of the participants and to provide technical assistance for the Iraq Nuclear Facility Dismantlement and Disposal Program (Iraq NDs Program). This is a multi-year project, however, at present, funding is only in place for the first year. The Iraqi MoST "owns" (e.g. controls) the former nuclear facilities. It also owns the existing radioactive waste treatment facility, which was not damaged during the 2003 conflict. However, it has suffered from significant looting. It is not clear that it is feasible to restore the facility to operation or that the radioactive waste treatment processes and machinery it contains are those appropriate to the needs. The facility was designed to support a different program. This proposal hypothesizes that MoST will also own the radioactive waste disposal facility when it is constructed. (Iraq has never had a disposal facility.) 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 US support, Sandia Laboratories will provide training and technical consultative assistance to MoST to help accomplish the tasks.

During the first year, the IAEA in cooperation with a team of US and international experts will assist the GOI in: developing draft regulatory standards; recommending characterization

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programs; completing the inventory of radioactive materials and wastes; and developing a Management System for full decontamination and decommissioning of the nuclear complex at Al Tuwaitha and the development of a plan to permanently dispose of all radioactive wastes in Iraq.

Because of ongoing violence in Iraq, much of the assistance will be provided through meetings and training outside of Iraq. The GOI will be responsible for the vast majority of the physical implementation of the NDD Project with assistance and training provided by the NDD Program.

## **OBJECTIVES**

The overall goal of the Iraqi NDs Program is to safely dispose of radioactively contaminated materials that were part of the former nuclear program in Iraq. There are six main objectives for the program that are outlined in this Project Management Plan (PMP). They include the following:

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. Developing the regulatory environment necessary to protect the citizens, workers and future generations from the hazardous effects of ionizing radiation. This will include the development of a robust enforcement arm to verify the work is carried out in compliance with the regulations.
3. Characterizing all the sites and wastes to determine what the inventory of materials will be for disposal. Part of the characterization task will involve the development of a prioritization scheme for the sites and the waste streams.
4. An enormous task will be carrying out the actual decommissioning and demolition program to segregate, stabilize and package the wastes. This objective will likely include the development of centralized and/or secure storage facilities. Once remediated, sites will be demolished and closed.
5. This objective will include locating potential sites for disposal, characterizing those sites, licensing, design and construction of disposal sites, developing robust engineered barriers to isolate the waste, and transporting the waste to the disposal sites. All of these tasks must be completed within the regulatory framework developed in objective 1.
6. This objective is likely to be independent from the other five, but has the potential to impact them based on the final disposition. Large volumes of yellow cake ( $U_3O_8$ ) exist in Iraq. The actual objective is to characterize the material, sell it commercially and use the proceeds to fund the Iraqi NDs Program.

The Iraq NDs Program will contribute to nonproliferation goals by:

- facilitating the sale and removal of the remaining yellowcake and other natural uranium compounds from Iraq,
- making possible the final disposal of dangerous radioactive sources,
- providing rewarding professional employment for former Iraq WMD scientists, and
- making it possible to collect and dispose contaminated scrap metal which hampers efforts to monitor Iraq borders.

The overall goals of the US Iraq NDs Program are to:

1. improve the radiological health and safety conditions for citizens living near nuclear facilities,
2. dispose the yellowcake by sale and removal from the region

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3. secure final disposal of Iraq's dangerous radioactive sources,
4. help relieve border monitoring problems associated with contaminated scrap metal,
5. develop and strengthen Iraq governmental regulatory institutions, IRSRA and MoE/RPC,
6. provide constructive employment of Iraq former WMD scientists, and
7. develop MoST's project management skills

In addition to these goals, it is expected that the program will also provide a mechanism to continue support to the newly formed Iraq Radioactive Source Regulatory Authority (IRSRA) created by CPA Order 72.

A meeting was held at the IAEA in Vienna, Austria on 21 – 23 February 2006 to discuss a proposed project on the decommissioning of the former nuclear complex located in Iraq. The purpose of this meeting was to determine the extent of damage to Iraq's nuclear facilities that used radioactive material prior to the Gulf wars, with the view of assessing the impact on the general public and the environment. This meeting is viewed as an initial kick-off to a project that will support the decommissioning of these facilities and the remediation of areas where radioactive material and waste were buried.

The meeting was attended by forty-two participants from sixteen countries and the European Commission. A number of presentations were made to define the scope of the project and indicate challenges that will be faced. A proposed general approach to move forward was discussed and agreed upon. A link to the IAEA website describing the program follows:

Following the meeting ISN/NESS (formally NP/SC) organized an interagency working group to develop a proposal to assist in the Iraq NDs Project. The working group members are as follows:

→ DOS - ISN/NESS David Kenagy 202 647-6768 - Coordinator for US project to develop a radioactive source regulatory infrastructure in Iraq.

→ DOS - ISN/CTR Richard Jarvis 202 647-0845 - DOS Iraq WMD Scientist Redirect Program.

The working group met and held consultations for several months to develop this proposal. The proposal that emerged is basically limited to help train and organize the Iraqis to do the cleanup job on the ground themselves. We also expect to provide a limited amount of specialized equipment

#### SUBOBJECTIVES

A robust Iraqi civilian S&T enterprise is necessary to absorb WMD scientists into peaceful activities. After decades of isolation, the Iraqi S&T community is severely out of date. Engaging Iraqi scientists with skills needed to solve critical problems in Iraq, such as water resources management, improving public health, controlling hazardous and radioactive materials, and revitalizing agriculture will help provide meaningful

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Scientists and technologists will make an important contribution to achieving stability in Iraq. Unemployed scientists have the potential to engage in non-peaceful activities, regardless of their background. Providing meaningful employment to these scientists directs their capabilities toward constructive activities. It also provides incentives for them to contribute to the peaceful reconstruction of Iraq. A stable Iraq is a necessary condition for preventing the re-emergence of factions who might seek to revitalize WMD programs in the future.

The Arab Science and Technology Foundation (ASTF) and the Cooperative Monitoring Center (CMC) at Sandia National Laboratories have developed a collaboration to identify, contact, and engage members of the Iraqi science and technology community. Goals for the cooperation include developing joint science and technology projects that engage Iraqi scientists in peaceful research and development activities; engaging Iraqi experts to rebuild key elements of the Iraqi infrastructure; and developing new Iraqi business opportunities that provide long-term sustainability to Iraqi S&Tob

#### **Program Coordinator**

Department of State - ISN/NESS David Kenagy 202 647-6768 - coordinator for US project to develop a radioactive source regulatory infrastructure in Iraq.

#### **Program Participants**

Department of State - ISN/CTR DOS Iraq WMD Scientist Redirect Program

Environmental Protection Agency - manage EPA's International Nuclear Cooperation Projects in Russia.

International Atomic Energy Agency –Department of Nuclear Safety and Security, Division of Radiation, Transport and Waste

Iraq Radioactive Source Regulatory Authority – Establishes radwaste regulations, regulates waste and licenses disposal facilities.

Nuclear Regulatory Commission

Iraq Ministry of Environment – Establishes environmental regulations, regulates environmental remediation, monitors the environment and operates the personnel monitoring program

Ministry of Industry – Iraq Nuclear Services Company (staffed by WMD Scientist Retraining Program) – Collects and analyzes samples, operates radwaste treatment facility, operates the radwaste disposal facility, collects contaminated scrap and dismantles nuclear facilities.

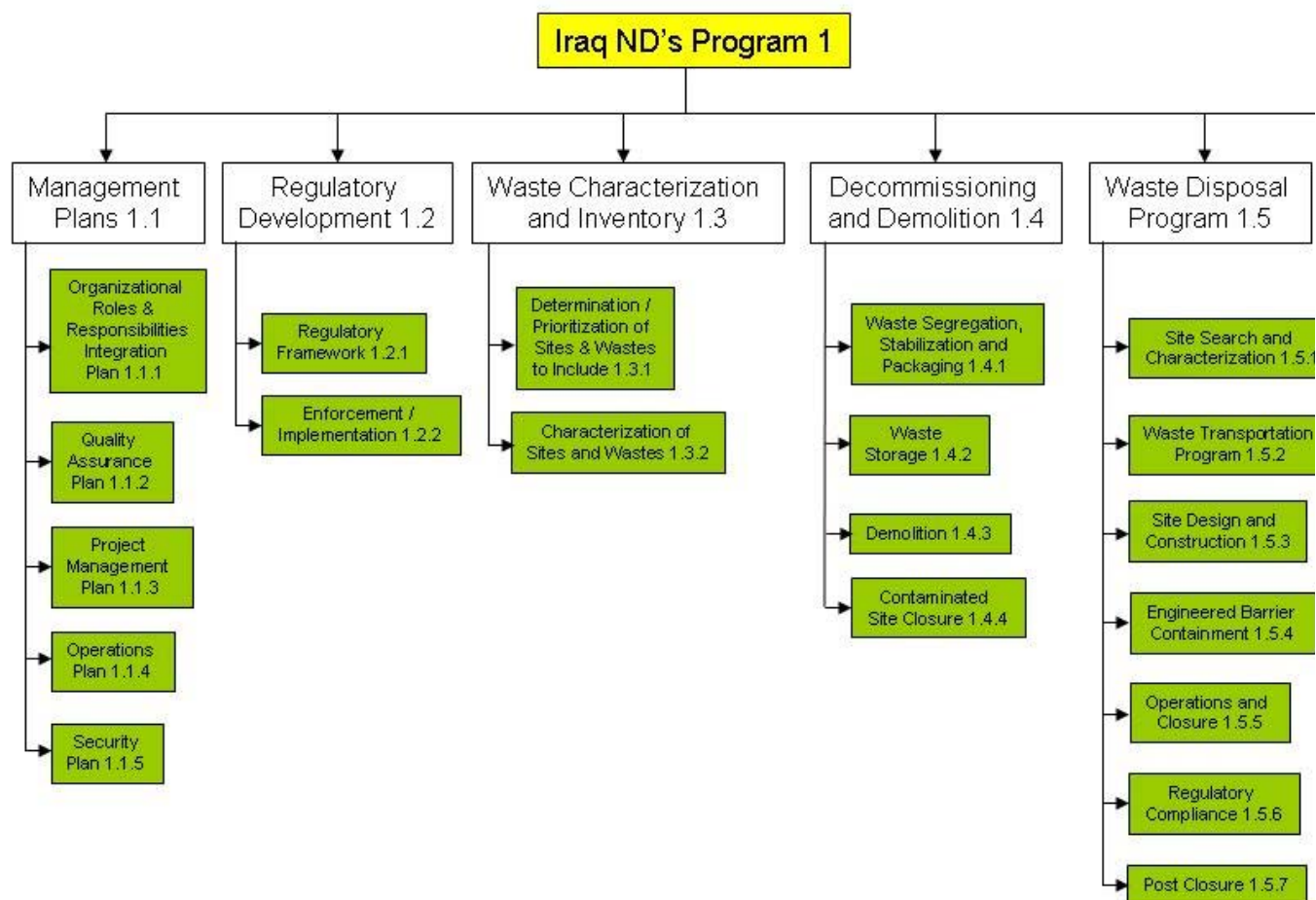
Iraq Ministry of Science and Technology – Owns former nuclear facilities, radwaste treatment facility and radwaste disposal facility. Develops radwaste management program and nuclear facility dismantlement program. Executes contracts with Iraq Nuclear Services

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Oak Ridge National Laboratories – Provides technical expertise related to sale of yellowcake

Sandia National Laboratories –

Texas Tech University - developed Iraq WMD Scientist Redirect program; currently managing  
Environmental Monitoring project at Tuwaitha.



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