

**RESEARCH TRIP FOR SUSTAINABLE DEVELOPMENT OF DRY LANDS  
PROJECT - JORDAN COMPONENT  
BIOSOLIDS CHARACTERIZATION AND RECYCLE**

by  
Christopher Y. Choi, Ph.D.  
Department of Agricultural and Biosystems Engineering  
The University of Arizona, Tucson, Arizona, 85721, U.S.A.

I traveled to Jordan from Dec. 28, 2004 to Jan. 7, 2005 for an ongoing project supported by USAID. Before my travel to Jordan, I communicated with Saad Al-Ayyash and Wael Suleiman regarding my travel schedule and meetings including an ad hoc committee meeting in Jordan. The primary objectives of my visit were:

- (i) to discuss NCARTT's role in the biosolids land application project
- (ii) to review the current status of the collaborative project
- (iii) to hold an ad hoc committee meeting
- (iv) to invite ASEZA to current research activities
- (v) to assess biosolids treatment, disposal, and beneficial reuse plans
- (vi) to offer technical assistance
- (vii) to tour the WWTP construction and project sites (at Samra WWTP, Aqaba WWTP, Wadi Hassan, and ArRamtha Station)

**Specific Activities in Jordan**

I had a meeting with Dr. Abdelnabi Fardous at the National Center for Agricultural Research and Technology Transfer (NCARTT). We discussed NCARTT's role in the current biosolids land application project at ArRamtha station. Abdelnabi mentioned a meeting in Amsterdam held in December and an upcoming biosolids workshop in Sydney, Australia with Palestinian and Israeli scientists and engineers. The workshop was organized by the USAID Amman Office. Overall, the meeting was very informative. My impression is that NCARTT will play an important role in actual biosolids recycling efforts.

I had a meeting with Bassam Hayek and Wael Suleiman. Their feelings toward our collaborative efforts were clearly positive. Bassam was well-informed about Wael and Ali's technical tour of Tucson. We discussed technical issues regarding biosolids treatment, regulation, and recycling. I have been informed that the ad hoc committee meeting is scheduled on Thursday. I have requested that all key committee members, including Amal Hijaji (USAID, Amman), be present at the meeting. We also discussed who should attend the biosolids workshop in Australia.

In the afternoon, Bayan, Wael, and I visited biosolids treatment sites in Wadi Hassan (Figure 1) and NCARTT's ArRamtha site (Figure 2.). Both sites were well-suited for research activities. Engineer Louei Qarahn of NCARTT guided us through ArRamtha.



Figure 1. Experimental setup at Wadi Hassan WWTP



Figure 2. Experimental setup at ArRamtha Station

Saad Al-Ayyash, Wael Suleiman, and I met with Murad Zaatreh who has taken over biosolids work at the Aqaba Special Economic Zone (ASEZA), as Moaiad ElKhatib is in charge of another task. Salim Al-Moghrabi also joined the meeting. I recall that Salim attended the meeting with Bilal Bashir during my first visit. We discussed ASEZA's changing role regarding biosolids reuse and their new organization, the Aqaba Water Company.

All of us (Saad, Wael, Murad, Salim, and I) visited the Aqaba WWTP. The construction of Aqaba WWTP was nearly complete (Figure 3). Project Engineer Abdelsalam Shunnar gave a technical tour of the construction site. The operation will begin in March as scheduled. Amazingly, all stored biosolids were removed, and we were told that biosolids were recycled at the nearby Al-Haq farm. There are no additional biosolids stored.

We had additional meetings in the afternoon. Moaiad ElKhatib joined us in the middle of the meeting.



Figure 3. Biosolids Drying Beds at Aqaba WWTP

Saad Al-Ayyash, Wael Suleiman, Pete Waller and I met with Bilal Bashir. We were told that ASEZA is no longer interested in biosolids treatment or recycling. However, ASEZA will be responsible for the regulations, permits, and environmental monitoring of biosolids land application. Actual wastewater/biosolids operations are now in the hands of a new privately-owned company, the Aqaba Water Company, which was established a few months ago. Saad and Wael were never informed about this new arrangement. Bilal agreed that he would send an ASEZA representative to the ad hoc committee in Amman.

Saad, Wael and I met Kamal Al-Zoubi, the General Manager of Aqaba Water Co. He was willing to work with us regarding biosolids issues. Kamal's attitude regarding biosolids land recycling was positive and constructive.

Jamal Al-Rashdan (of the Water Authority of Jordan (WAJ), who has visited UA) arranged a meeting with Saleh Malkawi. Saleh was interested in general issues regarding wastewater and biosolids reuse. I learned that Mohammad Najjar (Director of Build-Operate-Transfer (BOT) at WAJ) is responsible for reviewing the As Samra Wastewater Plant design, construction, operation, technology transfer in collaboration with participating companies and various agencies. He was very interested in technical issues regarding land application of biosolids, and he was knowledgeable about land availability at and near the As Samra plant. Mohammad provided me with technical information and design and construction maps for both the new and old As Samra WWTPs. I am told that the new wastewater plant will generate about 4 % solids biosolids through anaerobic digestion. Both Mohammad and Saleh indicated to me that they would attend the ad hoc meeting. The new As Samra WWTP will be operational by July 2006.

In the afternoon, Wael, Saad, and I visited the As Samra construction site (Figure 4). The site manager, Mohammad Edaily, gave a tour of the entire site (including the old ponds, biosolids lagoons, etc.). We noted that old lagoons should be cleaned up first. It is not clear whether there is groundwater contamination due to these biosolids lagoons. The site is limited to recycling biosolids for land application.

Bayan Athamneh, Wael Suleiman and I worked together to review existing data sets at RSS. We went over various technical issues. Wael has been a coordinator and supervisor for the ongoing biosolids project. Bayan has been actively involved in every stage of the research. She is also in charge of data processing and report writing. We worked on a collaborative PowerPoint file for the ad hoc committee.



Figure 4. AsSamra WWTP Construction Site

### **Day 9 (January 6):**

Ad hoc committee met at the RSS. Attendees included:

Manar Al-Fayyad (Univ. of Jordan)

Hosni Hamdan (Ministry of Environment)

Ahmad Ulimat (WAJ)

Khalil Jamjoum (NACARTT)

Saad Alayyash (HCST) – on behalf of Raed Al-Tabini

Bassam Hayek (RSS)

Wael Suleiman (RSS)

Bayan Athamneh (RSS)

Amal Hijaji (USAID) – non-member; it is her first time attending this meeting, although she was invited previously

Ziad Al-Ghazawi (JUST)

Mohammad Najjar (WAJ) – non-member; very much interested in biosolids issues; main contact person for As Samra WWTP construction and maintenance

Saleh Malkawi (WAJ)

Murad Zaatreh (ASEZA) – Bilal Bashir kept his promise to send an ASEZA representative

Wael, Bayan, and I presented an introduction, the progress of our collaborative biosolids research, discussed current and future issues in Jordan, and offered suggestions. The meeting lasted for two hours (Figure 5). Amal raised concern about land



Figure 5. Ad-Hoc Committee Meeting

application research and its site at ArRamtha. She said she was not informed about the land application research. Bassam later explained the original proposal and Amal appeared to understand the scope of the research and its objectives. Saleh and Mohammad asked many questions and showed lots of interest in various land application options. They also requested a copy of my PowerPoint presentation (attached).

In the afternoon, I had a meeting with Mohammad Shahbaz at the Higher Council for Science and Technology (HCST). He mentioned that Saad has officially taken over the current USAID Drylands project. However, Mohammad still wanted to be informed regarding our progress.

I had additional meetings with Bayan and Wael in the afternoon. We discussed the future direction of our research, communication issues, and multi-institutional collaboration possibilities. I requested the current Jordanian Biosolids Standards in order to discuss their future revision. Wael brought the Standards written in Arabic. They promised to translate it into English (Later, Bayan sent the English version via email; see Appendix I).