

**Sustainable Development of Drylands
in Asia and the Middle East:
Jordan Component**

**Visit Report
May 30 to June 18, 2004**

**Report Number
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Prepared

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Table of Contents

Table of Contents.....	2
I. Introduction.....	3
II. Water Demand Management Conference.....	3
III. Recycling of Wastewater and Biosolids Workshop: <i>Maximizing Benefits and Safety</i>	3
IV. Carbon Credit for Jordan	4
1. WERSC.....	4
2. USAID	4
3. JUST	5
4. RSS/ERC.....	5
5. CDM with John Pasch	5
6. ASEZA.....	6
a. Meeting 1	6
b. Meeting 2	6
c. Updated Scope of Work for ASEZA	8
7. USAID and CDM in Aqaba.....	8
8. BRDP	9
V. Drought Workshop: The Role of Proxy Records in Understanding Drought and its Influence on Reclaimed Water Resources	9
VI. Conclusion	9

Introduction

Dr. Tamimi traveled to Jordan to participate in the Water Demand Management conference held between May 30 and June 3, 2004. Dr. Tamimi presented a paper that can be found in appendix A.

A workshop organized by The University of Arizona – IALC as part of the sustainable development of drylands project was held at National Center for Agricultural Research and Technology Transfer, NCATT. Dr. Tamimi coordinated the workshop along with BRDP staff.

Dr. Tamimi then joined Mr. Bob Freitas and visited the project Jordanian partners to consult and to develop year 2 Scope of Work.

Water Demand Management Conference

The University of Arizona/IALC Sustainable Development of Drylands in Asia and the Middle East project supported the wastewater reuse track of the water demand management conference held at the Movenpick resort in the Dead Sea from May 30 to June 3, 2004.

Five papers were presented at the conference and were published in the conference proceedings. The papers were developed by the faculty and staff comprising the technical assistance team of the project. The titles of the papers are as follows:

0. Cultural Interpretation and Implementation of Water Conservation Policies by Erin Addison
0. Assessment of Irrigation Systems and Use of Tertiary Water vs. Potable water in ASEZA Landscape by Pete Waller
0. An Economic Analysis for Water allocation in Aqaba by Peter Waller and Akrum Tamimi
4. Irrigation With Reclaimed Water And Risk Of Microbial Crop Contamination by Chris Choi et al
0. Sustainable Development of Drylands in Asia and the Near East by Akrum Tamimi and Bob Freitas

Recycling of Wastewater and Biosolids Workshop: *Maximizing Benefits and Safety*

The brochure for the workshop is shown in appendix B. The workshop was held at National Center for Agricultural Research and Technology Transfer, NCARTT. The University of

Arizona Technical Assistance Team members who participated in the workshop will be presenting their reports separately to IALC.

Carbon Credit for Jordan

Dr. Prabhu Dayal, a P.E. in Arizona and an Adjunct Research Scientist at the Dept. of Soil, Water and Environmental Science, the University of Arizona, traveled to Jordan with Mr. Bob Freitas to introduce the carbon credit idea for Jordan. In the following paragraphs his ideas are presented. A report from Dr. Prabhu Dayal will elaborate more on the topic of carbon sequestration.

Identification, assessment and planning of a carbon sequestration sinks program for the growth of arid land species using wastewater in Jordan has been proposed by Dr. Dayal. This program will identify and assess specific arid land species suitable for growth and carbon sequestration using wastewater in Jordan. The program will identify the infrastructure and training needs and develop workshops both in Jordan for the development of seedlings, monitoring and measurement protocol for the growth and carbon sequestration potential under various field conditions suitable for arid lands. The program will also develop sampling and analysis protocols for the measurement of toxic element intake by the arid land species from the wastewater. Dr. Dayal is proposing to publish final reports on the subject detailing the results of carbon sequestration efforts and the potential for development of a model pilot project for carbon offset trading and banking under the World Bank Prototype Carbon Fund in Jordan.

0. WERSC

A meeting at WERSC took place on June 9th at 10:30 am. Dr. Tamimi, Dr. Dayal, Mr. Freitas, Dr. Manar Fayyad, Dr. Halalshah and Dr. Duqqah. Dr. Fayyad indicated that she is interested in preparing and submitting a proposal to IALC for funding related to establishing a demonstration project analogous to the bio-solids work being done by RSS which will focus on the incorporation of anaerobic processes into the treatment of wastewater. This demonstration project will initially focus on serving communities outside of the wastewater treatment network as providing a low cost, low technology solution for community wastewater treatment and pollution abatement. The demonstration will also seek to relieve the burden of expansion on the centralized wastewater treatment plants. The scope of the study will be worked on jointly with WERSC and U of A faculty.

0. USAID

On June 10, 2004 at 9:00am Dr. Tamimi, Mr. Freitas, Dr. Dayal met with Dr. Amal Hijazi and Mr. Jim from USAID – Amman Mission. Dr. Dayal presented his concept about the carbon sequestration for Jordan. USAID was not interested in having this as part of the work.

The status of the Visitor's Center at Wadi Mousa was discussed and Dr. Tamimi indicated that IALC is waiting to have a response about the TOR from USAID and CDM to make sure that the tender documents that will be produced by the local contracted engineering firm will be up to the standards of USAID.

The water balance study for ASEZA was discussed and the master plan requested by ASEZA was introduced to Jim who indicated to try to work only on a water balance and allocation of the reclaimed part of the water for ASEZA. The work would be coordinated between The

University of Arizona – IALC technical assistance team: Dr. Tamimi and Dr. Pete Waller on one side and with ASEZA, WAJ and the Aqaba Water Company on the other side.

In discussing the biosolids, USAID is interested in concentrating on working with Jordanian institutions to develop and update the biosolids standards.

For year 2 of 4 SOW, USAID indicated that they are interested in The University of Arizona – IALC developing the SOW with detailed information such as, a work plan that has detailed information of where, when and who for each activity. A budget also was requested to be part of the SOW. Mr. Freitas and Dr. Tamimi indicated that this will be developed soon and a copy would be sent to USAID.

It was indicated that if core money is to be spent on an activity, it will be nice but not necessary to have the approval of USAID - Amman, however, if mission money is to be spent on an activity, USAID – Amman would need to approve the activity.

0. JUST

A visit to Jordan University of Science and Technology took place on June 10, 2004 at 2:00 p.m. Dr. Tamimi, Dr. Dayal and Mr. Freitas met with Dr. Ghazawi and then with Dr. Wajih Owais, the University President. The TEEAL library was brought into the discussion by Dr. Ghazawi and Dr. Owais showed a great appreciation of TEEAL.

The topic of re-use technology linkages for on-farm applications came up during the discussion with Dr. Ziad Ghazawi of JUST. Linkages between farmers and extension services can be fostered by a leading Jordanian university, such as JUST, which has developed a re-use site that was funded under USAID implementation activities. The IALC project can seek to extend that knowledge and employ the expertise developed at JUST in the subject of reclaimed water re-use, especially as applied in the northern part of Jordan.

0. RSS/ERC

A meeting at RSS/ERC took place with Engr. Wael Suleiman. Dr. Hayek who was out of town called during the meeting to discuss some of the issues of the biosolids proposal. RSS was encouraged to deliver a technical report for phase I of the biosolids project that deals with characterizing the biosolids. The site for the 2nd phase of the biosolids project: application of biosolids was also discussed. RSS needs to determine and to justify the location of the application of biosolids in consultation with the biosolids ad hoc committee.

0. CDM with John Pasch

A meeting with Mr. John Pasch from CDM, USAID contractor for implementing the activities for Phase II of the reuse project, met with Dr. Tamimi, Dr. Waller and Mr. Freitas. Mr. Pasch indicated that he is very interested in working with IALC and would like to share the information for Wadi Mousa Visitor's Center and for the WFG in Aqaba. He indicated that the lead agricultural engineer at CDM is Dr. Mohammed Abu Awad.

In addition, Mr. Pasch indicated that he will be interested to have Dr. Tamimi give a presentation about IALC, the sustainable development of drylands project, and the activities that IALC will be doing and those activities which IALC can do. The presentation would take place during a kick off workshop CDM is planning to have in August. The University of Arizona – IALC staff agreed to do that and thought of it as a good idea.

It was recommended by Mr. Pasch to have Dr. Tamimi visit Al-Bireh biosolids pilot project in Al-Bireh, West Bank. Mr. Pasch will arrange for the visit.

0. ASEZA

Two meetings took place at ASEZA. The details of which are listed below.

. Meeting 1

Date: Sunday June 13, 2004 at 9:00 a.m.

Location: Dr. Bilal Bashir's Office at ASEZA headquarters

Present: Dr. Bashir - ASEZA, Bob Freitas - IALC, Dr. Salim Al-Moghrabi - ASEZA, Pete Waller – The University of Arizona, Akrum Tamimi – IALC

Main Points:

- The new Aqaba WWTP producing tertiary quality effluent will start operation in October, 2005 as per Dr. Bilal Bashir.
- Since ASEZA will be dealing with biosolids in Aqaba it is important to have ASEZA represented in the Biosolids ad hoc committee formed to steer RSS/ERC work in biosolids. Bob Freitas and Akrum Tamimi will follow on this with BRDP.
- Aqaba Water Company has been formed and will deal with water and wastewater issues in Aqaba starting July 1, 2004. At that time, IALC will contact Mr. Kamal Zubi who probably will be heading the water company.
- ASEZA requested updating biosolids standards and would like to be involved in the ad hoc committee working on biosolids with the RSS/ERC project.
- ASEZA is interested in receiving a course on biosolids characterization and risk analysis in Aqaba to be delivered by IALC. This will be looked into and discussed with USAID Mission in Jordan.
- ASEZA is interested to see a Scope of Work for activities to be conducted in Aqaba for discussion and feed back. Dr. Tamimi will develop these and send them to ASEZA. By the time this report is being compiled, Dr. Tamimi has already sent the minutes to ASEZA along with an updated SOW and there was no comments.
- Dr. Bilal Bashir indicated that IALC can work directly with Engr. Mohammed K. Balqar, Commissioner for land and infrastructure at ASEZA and Dr. Bilal set up a meeting with Mr. Balqar at 12:00 noon the same day to discuss the following:
 - Water Friendly Garden
 - Training on landscape architecture for ASEZA's architectural engineers
 - Designing the irrigation systems(s) by Dr. Pete Waller for ASEZA

. Meeting 2

Date: Sunday June 13, 2004 at 12:00 noon

Location: Mr. Balqar Office at ASEZA headquarters

Present: Mr. Mohammed K. Balqar - ASEZA, Bob Freitas - IALC, Engr. Ghassan A. Ghanem – Director of Municipal affairs and public works at ASEZA, Engr. Samah: architectural Engineer at dept. of land of infrastructure who works closely with Dima Abu Thiab, Pete Waller – The University of Arizona, Akrum Tamimi – IALC

Main Points

- Mr. Balqar did not know about the IALC Sustainable Development of Drylands Project. Akrum Tamimi and Bob Freitas explained most of the aspects for the Jordan component and materials on IALC were given to Mr. Balqar that included CDs and printed materials.
- Since the WFG design is in its final stages, Akrum Tamimi requested to have a process to provide ASEZA's top management the opportunity to discuss and finalize the design so as ASEZA can send a letter of acceptance to BRDP/IALC to that effect.
- Mr. Balqar indicated that Karen Vitkay and Dr. Margaret Livingston from The University of Arizona School of Landscape Architecture should submit a final set of questions requesting information from ASEZA staff for the WFG and finalize the design. A presentation by Karen and/or Dr. Livingston to ASEZA staff would be done during the summer and then a letter from Dr. Balqar would be issued to BRDP and IALC stating that ASEZA accepts the design and the design can be turned in to USAID – Amman Mission for implementation.
- USAID regulations require ASEZA's official acceptance in writing of the design and also requires a written confirmation for the use of the designated land for implementing the Water Friendly Garden and that water and/or tertiary quality water will be available for the garden.
- Akrum Tamimi would send an email to Dr. Margaret Livingston and Karen Vitkay to send a final list of questions and needed information to ASEZA so as to finalize the design.
- In regard to designing the irrigation system for ASEZA, Dr. Balqar requested that Pete Waller work directly with Engr. Ghassan's staff to train them on designing irrigation systems. The Aqaba irrigation system would be designed by ASEZA staff and supervised by Dr. Waller. Dr. Waller would spend the entire week working with ASEZA staff starting Sunday June 13 until Thursday June 17, 2004. Dr. Waller would provide a report on the steps and what has been done in Aqaba as part of his report on the trip to Jordan. Dr. Pete Waller will come back in August for two days to continue the training activity further and would be available for potential further training.
- Akrum Tamimi will send an email to Mr. Balqar cc'ing all involved with information on the project and the correspondence that took place between IALC and Engr. Thayer on the training and landscape architecture.

. Updated Scope of Work for ASEZA

From the above information and from a short meeting conducted with Dr. Amal Hijazi on June 14, 2004 the following Scope of Work can be deducted for ASEZA:

0. Water Friendly Garden: Finalize the design and get approval from ASEZA in writing so as to turn in designs and technical report to USAID for implementation.
0. Irrigation System Design: Dr. Pete Waller will work with Mr. Ghassan Ghanem and his staff to provide training on irrigation system design for Aqaba and will supervise and work with the trained staff that include Engr. Hani Habab from USAID/CDM on designing all irrigation systems in Aqaba. The participation of Hani Habab has been provided by IALC as a courtesy for cooperation.
0. Landscape Architecture Training: ASEZA is still interested in training 2 to 3 architectural engineers on landscape architecture in Arizona under the supervision of Dr. Margaret Livingston from The University of Arizona School of Landscape Architecture.
0. Wastewater Allocation Budget: As requested by USAID, IALC will provide a wastewater allocation balance study to ASEZA. The water balance study will concentrate on wastewater. Information for the study will be collected from ASEZA and in cooperation with WAJ and the Aqaba Water Co. The numbers will be verified and the final draft will be shared with ASEZA, WAJ and the Aqaba Water Co. for verification of the numbers before the final report on the study can be released.

0. USAID and CDM in Aqaba

On June 14 and at 4:00 p.m. Dr. Tamimi and Bob Freitas from IALC met with Dr. Hijazi and Mr. Mihran from CDM. The tender documents for the Wadi Mousa Visitor's Center were the main topic. Mr. Freitas requested that CDM take the task and prepare the tender documents for the center but Mr. Mahran from CDM indicated that the tender documents for the center are not in his SOW. Bob indicated that IALC stepped in to solve a problem when PA Consulting, USAID previous contractor, failed to do so and IALC thought that they can help the situation. But Mr. Mahran from CDM stated again and again that the tender documents for the center are not part of his SOW.

To launch a local bid to supply the service of preparing tender documents for Wadi Mousa Visitor's Center, Dr. Tamimi prepared Terms of Reference, TOR, to be used in soliciting offers. Dr. Tamimi sent these TOR to USAID for approval to guarantee that they are enough to make the local consultation firm who will be preparing the tender documents abide by USAID rules and regulations and that the Tender Documents would be up to a level acceptable by USAID. It was requested that CDM review the TOR and approve them. CDM indicated that it would be impossible to do that.

At the end Mr. Freitas indicated that IALC will fulfill its promise and will solicit services from local engineering firms to develop tender documents for Wadi Mousa Visitor's Center. The production of such documents would only be for one time, if they meet or don't meet CDM/USAID standards with the emphasis that IALC will work hard to make sure that the developed tender documents are up to CDM/USAID standards.

O. BRDP

Many meetings with BRDP took place to discuss the project activities and procedure in dealing with them as effectively as possible. One of the issues that were stressed upon is invoicing. The process of invoicing IALC is summarized in 3 steps:

- A contract between BRDP and a Jordanian organization is to be prepared outlining the service that the Jordanian organization is performing for the project with detailed tasks, SOW, deliverables and budget. The signed contract by BRDP and the Jordanian organization has to be faxed and emailed to The University of Arizona – IALC.
- A modification to the Original BRDP contract needs to be performed. The modification is performed by The University of Arizona – IALC and the modified contract is sent to BRDP for signature. The signed modified contract is sent by fax and mail to The University of Arizona – IALC who will sign it and send it back to BRDP.
- After receiving the modified signed version of the contract, BRDP has to invoice The University of Arizona for the subcontract amount. The University of Arizona – IALC, then transfers the funds to BRDP.

The SOW for year 2 of 4 the life of the project was prepared by Mr. Freitas with inputs from Engr. Mohammed Shahbaz from BRDP and from Akrum Tamimi. Modifications of the SOW were made in many meetings and discussions amongst BRDP and IALC.

. Drought Workshop: The Role of Proxy Records in Understanding Drought and its Influence on Reclaimed Water Resources

The drought workshop to be held between July 11 and 15, 2004 was planned for during this trip to take place at the Hashemite University.

. Conclusion

The objectives of the visit were achieved and the visit was a success.

Appendix A

The University of Arizona / IALC Sustainable Development of
Drylands in Asia and the Middle East
Project: Jordan Component

Recycling of Wastewater and Biosolids Workshop:
Maximizing Benefits and Safety
Brochure

WORKSHOP SPEAKERS



Dr. Gerba, Dr. Gerba, a Professor of Soil, Water, and Environmental Sciences at The University of Arizona, has 30 years experience in the area of wastewater and waste recycling in

agriculture. He has been involved in numerous projects on use of soil aquifer treatment for reuse of domestic wastewater for crop production, composting of domestic solid waste, use of wastewater for surface water pollution and control from animal feeding operations, His expertise is in the area of pathogen fate and removal by treatment processes and risk assessment.



Dr. Waller is an Associate Professor in the Department of Agricultural and Biosystems Engineering at the University of Arizona. Dr. Waller's current research

interests include measuring water, salinity, and nutrient status with remote sensing, modeling of irrigation systems uniformity and leaching, and use of reclaimed water in urban irrigation systems.



Dr Choi is an Associate Professor in the Department of Agricultural and Biosystems Engineering at the University of Arizona. Dr. Choi's current research interests include:

environmental effects on the fate of pathogens in biosolids and the role of irrigation methods on microbial food safety.

Recycling of Wastewater and Biosolids:

Maximizing Benefits and Safety

Monday, June 7, 2004 To
Thursday, June 10, 2004

Workshop Held

@

National Center for
Agricultural Research and
Technology Transfer, NCARTT,
Baq'a', Jordan

	
BRDP	NCARTT
	
	
USAID	IALC

Introduction

In arid regions reclaimed wastewater can be a valuable resource. Understanding the risks from contaminants present in the wastewater is essential for its safe utilization. Any potential recycling operation must take into consideration risks from metals, trace organics and pathogens. Effective treatments and standards must be in place to control the risks from these contaminants. This workshop reviews various recycling schemes treatments currently in operation around the world and in Jordan. The health effects contaminate detection and monitoring, and removal by treatment processes will be reviewed. Demonstration of contaminate detection and the application of risk analysis to set standards will also be presented.

In Jordan, recent changes in regulations concerning municipal wastewater treatment have resulted in a significant increase in treated domestic wastewater production and, accordingly, biosolids quantities. Biosolids generated at municipal wastewater treatment plants are usually thickened, dewatered using drying beds, and then disposed of at adjacent dumping sites and landfills. Anaerobic lagoons are occasionally de-sludged for operational purposes, and biosolids are then inadequately stored in nearby areas. In other words, none of the biosolids produced are currently being reused or recycled. These current practices cannot be continued indefinitely. Adverse impacts include potential operational problems such as leachate management (especially in rainy seasons) and gas hazards. The present workshop will include guidelines for biosolids treatment and land application, currently the most widely-employed reuse option in many countries. Emphasis will be placed on inexpensive biosolids treatment and application strategies under Jordanian arid- and semi-arid conditions.

Who should attend?

Irrigation engineers and managers, environmental scientists and engineers, educators (including university professors), farm managers, landscapers, landscape architects, local authorities from parks and garden departments, personnel in charge of department safety, collection systems personnel, plant personnel, water and wastewater operators.

TOPICS TO BE COVERED

Dr. Gerba will review case examples of water recycling programs for different types of application including landscape and crop irrigation, recreational, and domestic use. The health effects and methods of detection of contaminants will be reviewed. The removal of contaminants by different treatment processes will be covered. Methods for the detection of endocrine disruptors, indicator bacteria, viruses, and protozoan parasites will be demonstrated. A practical exercise will be conducted to illustrate how risk assessment can be used to determine the impacts of contaminants on health and how it can be used to establish standards for wastewater and biosolids recycling.

Dr. Waller will introduce methods to calculate surface and drip irrigation uniformity and efficiency. Statistical methods based on spatial variability of soils and irrigation emission device variability will be combined with hydraulic methods in order to characterize deep percolation and runoff from irrigation systems. Finally, leaching and runoff of pollutants will be estimated. A computer laboratory workshop will show participants how to use an Excel spreadsheet that estimates leaching for different drip and surface irrigation systems. A field trip will include a demonstration of methods to evaluate irrigation system performance:

participants will collect water from emission devices, and estimate irrigation uniformity. The field trip will also review irrigation system components such as controllers, valves, emission devices, and piping systems

Dr. Choi will cover the history and status of biosolids reuse in the United States, including the EPA Rule 503. He will also introduce the fundamentals of biosolids. Sludge dewatering and drying technologies, including belt presses, centrifuges, direct dryers, indirect dryers, and combined mode dryers, will be reviewed. Schematics and photographs of typical dewatering and drying systems will be also included. The lecture will focus on inexpensive drying processes to achieve high quality biosolids and land application strategies in arid and semi arid lands. In addition, the role of irrigation methods on microbial food safety will be addressed. Emphasis will be placed on how to minimize produce contamination by enteric pathogens during production under various climate conditions.

Program

Monday, June 7, 2004		
Time	Topic	Presenter
8:45	Registration	
9:15	Opening Remarks	BRDP
9:30	Opening Remarks	USAID/IALC
9:45	Remarks	WAJ/MOA
10:00	Break	
10:30	History and Status of Biosolids Reuse	Chris Choi
11:15	History and Status of Wastewater Reuse	Chuck Gerba
12:00	Discussion	
12:30	Lunch and Field Trip to Abu Nusair WWTP	NCARTT
Tuesday, June 8, 2004		
8:45	Introduction to Pathogens in Wastewater and Biosolids	Chuck Cerba

9:30	Impact of Treatment Technologies on Pathogen Fate in Wastewater and Biosolids	Chuck Gerba
10:15	Break	
10:45	Indicator Organisms and Their Detection	Dima Kayed
11:30	Biosolids - CFR 40 Rule 503	Chris Choi
12:30	Lunch	
2:00	Demonstration of Indicator Detection in Wastewater and Biosolids	Dima Kayed
4:00 - 7:00	Demonstration of Irrigation Technology - Tour of Jordan Valley with NCARTT	Peter Waller
Wednesday, June 9, 2004		
8:45	Introduction to Chemical Contaminates in Wastewater and Biosolids, and Impact of Treatment Technologies on Pathogen Fate in Biosolids and Wastewater	Chuck Gerba
9:45	Biosolids Dewatering and Drying Technologies	Chris Choi
10:30	Break	
11:00	Urban Irrigation with Wastewater	Peter Waller
11:45	Methods for the Detection of Pathogens in Wastewater and Biosolids	Chuck Gerba
12:30	Lunch	
2:00	Demonstration of Indicator Detection in Wastewater and Biosolids	Jaime Naranjo & Dima Kayed
Thursday, June 10, 2004		
8:45	Biosolids Drying Technologies using Solar Beds and Beneficial Reuse Strategies	Chris Choi
9:30	Irrigation Efficiency, Uniformity, and Leaching	Peter Waller
10:15	Break	
10:45	Role of Irrigation Methods on Microbial Health Risk during Wastewater and Biosolids Reuse	Chris Choi
11:30	Application of Microbial Risk Assessment to Standard Setting and Safety Evaluation	Chuck Gerba
12:30	Lunch	
2:00	Demonstration of Methods for the Detection of Pathogens in Wastewater and Biosolids and Continuation of Indicator Detection	Jaime Naranjo & Dima Kayed
3:15	Break	
3:30	Workshop Review, Evaluation and Wrap up	