Sustainable Development of Drylands in Asia and the Middle East Project

Jordan Component

Environmental Laboratories Assessment Study

Part I

By Dima Kayed, Charles Gerba, and Robert Freitas

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NOTE:
Appendices and supporting materials will be available at OALS-IALC offices. Please contact Bob Freitas or Esther Miklofsky.

Sustainable Development of Drylands Project
IALC Implemented
USAID Funded

I. Introduction

On assignment from the IALC Sustainable Development of Drylands Project, Ms. Dima Kayed, PhD candidate in microbiology, was able to contact a number of individuals and visit three key laboratories in Jordan that may be involved in work related to wastewater and bio-solids sample analysis. Ms. Kayed's primary objectives were to make contact with the various administrators and faculty that may be involved with the IALC Project and visit the various laboratories to assess their capabilities.

The assessment study entailed determining the instrumentation available in each laboratory, the types of analysis performed versus what is needed in terms of wastewater and bio-solids analysis. Additionally, the visits allowed Ms. Kayed to become acquainted with the personnel working in the laboratories, their educational/training levels and what additional training may be needed.

USAID-Amman

Dr. Amal Hijazi, the Project Management Specialist and Mission Environment Officer, Water Resource and Environment Office, USAID was the first person contacted to initiate the study. During the meeting, it was decided to limit Ms. Kayed's visit to three laboratories due to time constraints. The laboratories selected were located at the following institutions:

- the Environmental Research Center (ERC) at the Royal Scientific Society (RSS),
- the Water and Environment Research and Study Center (WERSC) at the University of Jordan, and
- the National Center for Agricultural Research and Technology Transfer (NCARTT), at the main headquarters located in the North part of Amman in the Baqa'a.

Badia Research and Development Programme

Ms. Kayed met with Mr. Mohammad Shahbaz, Programme Director of the Badia Research and Development Programme, in the Higher Council of Science and Technology at the Royal Scientific Society. Various aspects of the project, which focused mainly on wastewater re-use, were discussed. Mr. Shahbaz emphasized the importance of setting up models with careful assessment of these models and applications. The three pilot studies that were being conducted at Wadi Musa, Jordan University of Science and Technology (JUST) and Aqaba sites as a means of introducing wastewater re-use were examined.

Additionally, Mr. Shahbaz focused on cultural aspects to consider in the application of wastewater re-use and bio-solids as a concept. A subject of discussion was the importance of determining and setting standards, guidelines and specifications for the

application of bio-solids. This will be used to justify the use of bio-solids to the Jordanian government and the Jordanian people.

University of Jordan

Ms. Kayed briefly met with Dr. Muhammad Shatanawi, Professor of Water Resources and Irrigation and Dean at the College of Agriculture at the University of Jordan. He facilitated Ms. Kayed's visit to the WERSC lab located on the premises of the University of Jordan in the College of Agriculture by contacting the center's director, Dr. Manar Fayyad.

II. Historical Background

The growth in bio-solids production in Jordan is largely due to an increase in treated domestic wastewater quantities as a result of the installation of new domestic wastewater treatment plants (DWTPs), as well as the upgrades to existing ones. This growth creates the need for adoption of economically and environmentally acceptable management schemes that take into account the interest in re-use and energy recovery possibilities.

In 2001, about 85% of the generated domestic wastewater in Jordan was treated using wastewater stabilization ponds (WSP) while the remaining 15% was treated using mechanical treatment systems. This has resulted in the accumulation of bio-solids in the lagoons, and the concomitant question arose on how to dispose of and re-use the bio-solids.

III. Environmental Research Center at the Royal Scientific Society

Contact: Dr. Bassam Hayek, Director

The Environmental Research Center (ERC) was established on September 19, 1989. ERC provides technical consultations and services and promotes the technological change in different environmental areas through its specialized laboratories and services. It comprises three divisions/units: Water Quality Studies Division, Air Quality Studies Division and Environment Management Studies Division. The Water Quality Studies Division comprises three subunits namely: Water Quality Projects Unit, Microbiological Testing Unit and the Chemical Testing Unit. This center is involved in practical applied research mainly in water quality and water re- use assessment. The technical services provided include water quality analysis, applied research to provide solutions to certain problems and bio-solids analysis.

Following the wastewater management policy issued by the Ministry of Water and Irrigation (MWI) in 1998, some of the major projects are aimed at expanding and developing existing WSP and shifting the treatment processes to mechanical. This shift

adds to the excessive amounts of bio-solids already accumulated in the lagoons. Due to these changes, the ERC would become involved in bio-solids analysis and characterization.

The ERC started some bio-solids analysis and characterization in 1992 and has been involved in routine bio-solids analysis since 2000. Three parameters are used to characterize bio-solids: physical, chemical and microbiological. Some of the tests include TSS, VS, pH, detection of heavy metals and trace elements and analysis for nematode cysts and thermotolerant pathogens. Once the bio-solids analysis and characterization is completed, it is hoped the bio-solids may be used as fertilizer and as a soil conditioner.

Ms. Kayed visited the four main laboratories at the ERC. The inorganic lab is new and is in the process of beginning to run sample tests. Some of the equipment noted there were an ICP-MS, a Mercury analyzer, and a Fluorescent microscope (see Appendix Aa for list of equipment). I visited two labs which analyze food, wastewater and sludge samples. One of these two labs conducts basic tests, wet chemistry and the second lab screens samples for organics. These two labs are termed water lab 1 and water lab 2 respectively. Some of the equipment found in these labs includes a GC, HPLC, AA, polarograph, spectrofluorometer, rotary evaporator, mechanical shaker and hot plates (see Appendix Aa). The fourth laboratory visited was the microbiology lab. Dr. Hussein Khleifat is the Laboratory Head. It is well equipped with centrifuges, incubators, an autoclave, a hood, pH meter, refrigerators, and freezers.

Some of the tests performed at this laboratory include total coliform counts, using membrane filtration (MF) and most probable number (MPN), fecal streptococcal counts, total heterotrophic bacterial counts, Actinomyctes plate counts, detection and enumeration of Fungi and thermotolerant coliform counts (TTCC) to name a few (see Appendix Ab). Very little work has been done with the parasites *Giardia* and *Cryptosporidium*, however the Filta-Max system/Dynabeads for their detection is used at this center (See Appendix Ad).

There are about 15-20 personnel at ERC mainly with a Masters degree. A list of personnel, laboratory equipment and tests performed is found in Appendix Ac. Also collected were a number of brochures. A number of pictures were taken of the various instruments at the different laboratories. The ERC is accredited and certified by ISO 9001, which was renewed in 1998, as well as by Lloyds Registry for Quality Assurance, LRQA. It is worth noting that the ERC at the Royal Scientific Society is the center, which provides consultations and resources in Jordan and the Middle East and is the only center of its kind in the Middle East.

Suggestions by Dr. Hayek:

Dr. Hayek had a few suggestions on what type of feedback he would like from IALC. He would like to learn of any new technologies for soil testing and would like to partake in some type of specialized training to enhance the available capabilities of the

personnel at the Center. He believes that these consultations and advice would be very helpful.

Dr. Hayek's team at ERC is ready to start on the bio-solids characterization study as soon as possible and is very enthused about the project. Some of his questions were as follows:

- Is there a deadline for finances to be allocated?
- Are there any restrictions on funding for 2003?
- Dr. Hayek may need to request an extension on the first phase of the study and wanted to know if this possible?

Remarks:

Ms. Kayed's visit to the ERC was very informative and positive. The laboratories are well equipped with trained personnel. At present, the center is mainly focused on the characterization and analysis of bio-solids as it relates to this part of its proposed project. They have experience in bio-solids analysis but may require updates on new technologies or methodologies. The center does not appear to be equipped to run viral analysis. Viral analysis may be an appropriate focus for training or workshops from the IALC Project.

RSS 6C

RSS 6C Different Equipment

RSS Centrifuge

RSS Atomic Absorbtion Analyzer with Furnaces

RSS Distiller

RSS Flourescent Microscope

RSS HPLC

RSS Inorganic

RSS Inorganic Analyzer

RSS Inorganic Lab
Different Equipment

RSS Inorganic Lab
Equipment

RSS Laminar flow hood
Micro Lab

RSS MA-15 Equipment

RSS Microbiology Lab

RSS TOC

RSS Wet Lab

Inorganic Lab - RSS Equipment

IV. Water and Environment Research and Study Center (WERSC) at the University of Jordan

Contact: Dr. Manar Fayyad, Director

The Water and Environment Research and Study Center (WERSC) was established as a research unit in 1982. The center plays a leading role in developing and implementing national plans to develop and manage Jordan's water resources. Its activities are directed towards irrigation management, treated wastewater re-use in irrigation, water hydrology, water conservation in arid areas, water quality, water harvesting and artificial recharge. Some of the objectives of the center are:

(1) Conducting scientific research related to protecting and managing water resources and protecting the environment, subject to the conditions in Jordan,
(2) Knowledge and technology transfer in addition to providing technical consultation to the local community in areas related to the environment and water, and
(3) Identifying and analyzing problems related to water and the environment in Jordan for the purpose of finding solutions.

The WERSC is a research facility and provides services for analysis of drinking water and wastewater. Ms. Kayed was able to visit three laboratories at the center. The laboratory, which involves tests on wastewater, was on the top floor of the facility and isolated. The drinking water laboratory was separate and well equipped with HPLC, GC and AA. This was also called the wet lab where basic chemical tests were conducted.

The microbiology lab was well equipped. Most of the microbiological testing has focused on testing for total and fecal coliforms, nematodes, E. coli using the colilert system as well as algae identification and chlorophyll a detection. A list of laboratory equipment and chemical, physical and biological tests performed is found in Appendix B, a and b. A brochure and pictures of the various equipment are available.

Due to time constraints, Ms Kayed was unable to meet all the personnel working at the center, but did meet four or five students who work and are fulfilling requirements for a graduate degree.

Remarks:

The center is well equipped with instruments and personnel. It is somewhat familiar with collecting water samples for viral analysis namely collection and concentration. The center does not appear to have knowledge or experience screening water samples for viral analysis utilizing cell culture lines or molecular methodologies. The center is also limited in its capabilities for analyzing water samples for pathogens. As of yet, no samples have ever been screened for the parasites *Giardia* and *Cryptosporidium*. To summarize, the WERSC, while capable in many aspects of sample

analysis, does have some deficiencies in its capabilities to analyze water samples for viruses, parasites, and bacterial pathogens. These deficiencies may need to be addressed through future workshops and training visits by the IALC project.

Un of Jordan Chemistry Lab WERSC

Un of Jordan Chemistry Lab WERSC

WERSC 6C

WERSC Atomic Absorb-tion

WERSC Chemistry Lab

WERSC Colitest Machine

WERSC Micro Lab

WERSC Micro Lab Dis-

WERSC Micro Lab Incuba-

WERSC PH Meter

V. The National Center for Agricultural Research and Technology Transfer (NCARTT) at Baqa'a, Northern Amman

Dr. Abdul-Ghani Fardous, General Manager**:**

The National Center for Agricultural Research and Technology Transfer (NCARTT) began operation in July 1985. The center now operates according to a special By-law as a semi-autonomous institution with administrative and financial independence. NCARTT consists of a main headquarter located 12km North of Amman at Baqa'a and six Regional Centers located in Dier Alla, Ramtha, Khaldeia, Mushaqer, Rabba and Shoubak. The center operates 12 research stations representing different agro-ecological conditions of the country.

NCARTT is mandated to conduct and/or coordinate applied agricultural research and transfer of technology activities at the national level in collaboration with public and private agricultural institutions. NCARTT's mandate also provides for the identification, testing, transfer and adoption of improved technologies. NCARTT receives its core funding from the government. Funding is also received for specific projects from national and international institutions. Some of NCARTT's responsibilities include:

(1) preparation of agricultural research plans and programs that support the objectives of agricultural policy;

(2) development and adaptation of agricultural technology appropriate for local conditions and the coordination of agricultural research and technology transfer activities;

(3) adoption and transfer of locally developed agricultural technologies and it's dissemination to agents and farmers, a follow-up on their adoption by farmers in cooperation with the appropriate organizations as well as providing the proper agricultural technical information;

(4) developing the skills of agricultural specialists and technicians through training, specialized courses, conferences and workshops; and

(5) conducting economic studies on farm production systems and agricultural projects and the evaluation of the effects of various social, economic and political factors in the agricultural sector.

NCARTT currently has around 600 national permanent full-time staff. 200 are scientific and technical graduate staff. Of these, 165 are full-time researchers and 35 are technicians. The remaining are support staff (clerks, accountants, laborers etc.). The ratio of technicians and other support staff to researcher is 2 and 3-4 respectively. About 40% of the scientific staff and more than 90% of the PhD holders are concentrated at the main

headquarters at Baqa'a, which includes the central offices, laboratories and Agricultural Information Library.

NCARTT encompasses various research programs namely: the Rainfed Agriculture, Irrigated Agriculture, Plant Genetics Resources unit, Low Rainfall Areas, Water Management and the Environment, Technology Transfer, Training and Information and Integrated Livestock. See brochures for details on these programs. NCARTT has a 5-year work plan (2001-2005) that covers different aspects of various subjects and consists of the following:

(1) Management and the use of conventional and non-conventional water for agricultural production.
(2) Fertigation.
(3) Agro-biodiversity.
(4) Olive production improvement.
(5) Integrated pest management.
(6) Animal livestock nutrition and alternate fodder crops.
(7) Promotion of herbal and medicinal plants.

The NCARTT laboratories perform various tests which include:

- Chemical and physical analysis of soil and plant tissue as requested by the researchers.
- Soil, water and plant tests requested by farmers and the private sector.
- Different tests for imported organic fertilizers as required by law.
- Diagnostic tests for different plant diseases, viruses etc.

During Ms. Kayed's brief visit to NCARTT (by far the largest facility of the three visited in Jordan) she was able to visit (walk-through) 4 laboratories. However, as it was towards the end of the day, many of the staff/technicians had gone for the day. Among the labs visited, was the laboratory which is involved in screening plants for diseases, mainly viruses. The laboratory is equipped with an ELISA reader as an initial screening tool followed by serological methodologies to determine the type of virus. The microbiology laboratory was equipped with incubators, refrigerators, hoods, centrifuges to name a few. This lab conducts analysis of soil and water samples. The major tests performed are total suspended solids (TSS), Biological Oxygen Demand (BOD), chemical oxygen demand and fecal coliforms. The two remaining laboratories, the fertilizer and soils labs mainly screen fertilizers and soil samples for heavy metals. Samples are assayed using the Atomic Absorption (AA) apparatus.

Remarks:

This facility is mainly a research facility and also provides services to farmers and the private sector. It may have a role performing analysis of samples from a project

concerning land application of the bio-solids following characterization. It could play a role in analyzing the bio-solids. It may also play a role in helping to provide criteria and guidelines for land application of the bio-solids as well as follow-up studies post-applications.

Ms. Kayed's visit to NCARTT was brief and arranged with little advance notice due to time constraints. As such, she was not able to obtain a list of equipment, personnel or tests performed from the four laboratories visited, however she was able to obtain a number of brochures on the center that may prove helpful.

NCARTT Equipment

VI. Preliminary Conclusions

Ms. Kayed's impression of the three laboratory's capabilities, the Environmental Research Center (ERC) at RSS, the Water and Environment Research and Study Center (WERSC) at the University of Jordan, and the National Center for Agricultural Research and Technology Transfer (NCARTT) main headquarters, was very positive. All were very well equipped with instruments and are capable of conducting a vast array of chemical and biological tests.

Ms. Kayed observed that the laboratories are well staffed and equipped and the personnel well trained. Also, it was noted that each of the teams at the various centers are very enthusiastic about the IALC Project and hope to establish a cooperative relationship.

Regarding the relative strengths of the laboratories, it appears at this time that the ERC laboratories may play a major role in bio-solids characterization and analysis, whereas the WERSC may play a more major role in wastewater analysis. It was Ms. Kayed's impression that NCARTT will play a more prominent role in the land application of bio-solids and resulting follow-on work. It will also be a major resource

consulting center for farmers and the private sector on various issues, such as cropping patterns.

The three laboratories Ms Kayed visited appear to be deficient in the ability to perform viral analyses of water, wastewater and bio-solids. Additionally, detection of the more harmful pathogens is limited for the sample types expected to be performed for wastewater and bio-solids. Finally, capabilities in the detection of endocrine disruptors were not apparent.

Appendix A1

Certification ISO 9001 - 1998, renewed
Lrqa - Lloyds register quality assurance.

Royal Scientific Society
Environmental Research Centre

Accreditation - Micro. - UKAS 200 nominated for

Secondary Quality Manual	Annex No. (4)
Title of Annex:	Issue No. (2); Date 1/11/2001
Equipment Inventory List	Revision No. (1); Date 1/11/2001

4 major labs:
Inorganic - new
food / sludge / water
Water lab 1 - basic tests - wet chemistry
Water lab 2 - organics
microbiology

personnel - 45-50 people
mainly M.S.

Provide technical consultation

ANNEX NO. (4)

Equipment Inventory List

Appendix A I

Royal Scientific Society
Quality Assurance Department
Equipment Inventory List

Center : ERC ☐☐Division : WQSD ☐Lab/Unit : Chemical Analyses ☐☐

No.	Equipment	Manufacturer	Model/Cat. Number	Manufacturer Serial Number	RSS Computer Number	purchased Date	Responsible Staff	Remarks
1	COD digester and	Behrotest	TRS 100	108552	10010097	1990	Hala Habboub	
	Control unit							
2	Conductometer	Metrohm	2510	[illegible]	[illegible]	1986	Amjad Amir	
3	Conductometer	Metrohm	712	05128	[illegible]	1996	Amjad Amir	
4	Refrigerated bath Circulator	Haake	RTE220	[illegible]	[illegible]	1992	Ashraf Haddadeen	
5	Digestion unit	Buchi	433	1176379	[illegible]	1992	Saad Kreishan	
	Distillation unit		315	[illegible]	[illegible]	1986	Moh'd Abu-Sheikh	
	Control unit		436	[illegible]	[illegible]	1992	Saad Kreishan	
6	Dosimat	Metrohm	665	11B-248	[illegible]	1986	Hala Habboub	
	Sample changer		624	[illegible]	[illegible]	1986		
	Titroprocessor		682	[illegible]	[illegible]	-		
	Control unit		657	[illegible]	[illegible]	1986		
7	Dosimat	Metrohm	655	5E3-387	[illegible]	1986	Hala Habboub	
	Titroprocessor		682	[illegible]	[illegible]	1986		
	Sample changer		624	[illegible]	[illegible]	-		
	Control unit		657	[illegible]	[illegible]	1986		
8	Dosimat	Metrohm	662	[illegible]	[illegible]	1986	Moh'd Abu-Sheikh	
9	Dosimat	Metrohm	665	[illegible]	[illegible]	1986	Ashraf Haddadeen	
10	Dryer	Gerhardt	-	-	[illegible]	1986	Saad Bdeir	
11	Drying oven	Memmert	-	[illegible]	[illegible]	1994	Amjad Amir	Scraped
12	Drying oven	Memmert	-	-	[illegible]	1990	Amjad Amir	Scraped
13	Drying oven	Fisher	200 Series		[illegible]	1986	Amjad Amir	
14	Flame photometer	Eppendorf	ELEX6361	[illegible]	[illegible]	1996	Saad Bdeir	
	Sample table	Eppendorf	5118	[illegible]	[illegible]	1996		
	Compressor	Eppendorf	5343	[illegible]	[illegible]	1996		
15	Heating mantle	Kemar	EI 14-02	144	[illegible]	1995	Moh'd Abu-Sheikh	Scraped
16	Heating mantle	Kemar	EI 14-00	135	[illegible]	1993	Moh'd Abu-Sheikh	
17	Hot plate with stirrer	VELP		[illegible]	[illegible]	1992	Moh'd Abu-Sheikh	
18	Ice-machine	Ziegra	-	-	[illegible]	1984	Saad Bdeir	
19	Incubator (BOD)	WTW	[illegible]	[illegible]	[illegible]	1986	Tharwa Qudah	
20	Incubator (BOD)	WTW	[illegible]	[illegible]	[illegible]	1985	Tharwa Qudah	

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Dr. Bassam Hayek

Form No. RSSPMP0710 | Rev. (1)

Royal Scientific Society
Quality Assurance Department
Equipment Inventory List

Center : ERC ☐☐ **Division : WQSD** ☐ **Lab/Unit : Chemical Analyses** ☐☐

No.	Equipment	Manufacturer	Model/Cat. Number	Manufacturer Serial Number	RSS Computer Number	purchased Date	Responsible Staff	Remarks
21	Ion Chromatograph	Dionex	DX 300	934518	10010751	1994	Moh'd Abu-Sharkh	
	Ion Chromatograph	Dionex	QIC-3	854901	10010541	1986		
	Integrator	TSP	Chromjet CH1	983/14878-5	10010542	1994		
22	pH/ Ion meter	Metrohm	692	6F5/191	10010808	1996	[illegible]	
23	Centrifuge instrument	Heraeus	Labofuge 15000	00127218	10010872	1994	Moh'd Abu-Sharkh	
24	[illegible]	Metrohm	415 B	-	10020008	1986	Moh'd Abu-Sharkh	
25	Mettler balance	Mettler	AE200	16690	10290032	1988	Amjad Amir	
26	Muffle furnace	Naber	-	59603	10380014	1980	Amjad Amir	
27	Ultrapure water system	Barnstead	D4741	831960346200	10010846	1996	Hussein El-Khatib	
28	PH meter	Metrohm	654	00150594	10080176	1984	Ashraf Haddadeen	
29	Photometer	Metrohm	662	00250089	10080461	1986	Hussein El-Khatib	
30	Refrigerator	[illegible]	380	134816	10310077	1996	Hussein El-Khatib	
31	Spectrophotometer	Jenway	6105	1101	10080753	1993	Hussein El-Khatib	
32	Spectrophotometer	Unicam	UV4	UV321130	10010895	1993	Hussein El-Khatib	
33	Thermoreactor	Metrohm	475	182/125	10010072	-	[illegible]	
34	Turbidimeter	HACH	18900	900105149	10080604	1992	[illegible]	
35	Ultrasonic	Branson	8200	-	10010742	1992	[illegible]	
36	Vacuum pump with filter	Brand	Vacuubrand	[illegible]	10080204	-	Amjad Amir	
37	Vacuum pump (sliding vane)	Brand	RD4	1700	10020042	-	Amjad Amir	
38	Rotavapor	Buchi	461	1083117	10010009	1988	[illegible]	
39	Water bath	Memmert	W600	142 - 530	10010008		[illegible]	
40	Water bi-distilling system	GFL	2104	102840932	10010748	1992	Moh'd Abu-Sharkh	

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Royal Scientific Society
Quality Assurance Department
Equipment Inventory List

Center : ERC | Division : WQSD | Lab/Unit : Chemical Analyses

No.	Equipment	Manufacturer	Model/Cat. Number	Manufacturer Serial Number	RSS Computer Number	purchased Date	Responsible Staff	Remarks
41	Digestor B 426	Buchi	B425	254325	10010598	1986	Saad Kutishat	
42	Printer/Mouse	SENWAY	J025	1232		1991	Hussein El-Khatib	
43	Conductometer	Metrohm	E587	181 108	10080257	1986	Amjad Amir	
44	COD digester	STROHLEIN		8348426	10010269		Hala Habbash	
45	Mini hot plate/Stirrer	VWR	330	0110		1997	Moh'd Abu-Shaikh	
46	Refiner	Rainin	RP725		10010684	1989	Ashraf Hadidi	
47	Bi-distiller	Lee	DTS	1352	10170020		Emad Iblidi	
48	Refrigerator	Local made			10510057	1986	Ibrahim Al-Maisara	
49	Refrigerator	Local made			10510060	1994	Ibrahim Al-Maisara	
50	D.O Meter	YSI	57	14063	10010078	1985	Ibrahim Al-Maisara	
51	D.O Meter	YSI	58	2282	10080375	1988	Ibrahim Al-Maisara	
52	D.O Meter	YSI	57	11145	10080350	1983	Ibrahim Al-Maisara	
53	D.O Meter	YSI	58	G 2000970	10080457	1988	Ibrahim Al-Maisara	
54	[illegible]	CARLOERBA	F500	-	10080752	1992	Ibrahim Al-Maisara	
55	[illegible]	CARLOERBA	F500	-	10080753	1992	Ibrahim Al-Maisara	
56	Colorimeter	Lamotte	M.TEL	M17530787		1994	Ibrahim Al-Maisara	
57	[illegible]	Metrohm	665	7971178	10010027	1988	Emad Iblidi	
58	Conductometer	WTW	LF95	1911035	10080717	1994	Emad Iblidi	
59	pH Meter	WTW	pH 91	1911010	10080715	1994	Emad Iblidi	
60	Kjeldahl distillation unit	Buchi	B-324	1450227	-	1998	Saad Kutishat	
61	Rotary vane vacuum pump	Vacuubrand	RZ-5	20602718	-	1998	Amjad Amir	
62	COD digester (control unit)	JP selecta	RAT4000051	225641	-	1997	Hala Abu-Hamza	
	COD digester (Block digester)	JP selecta	RAT4000040	222514	-	1997	Hala Abu-Hamza	
63	DO meter	YSI	58	G 8000842	-	1988	Belal Jaber	
64	TOC Analyzer	Tekmar	TOC-500	9810601	-	1998	Amjad Amir	Not working
65	Diaphragm Vacuum Pump	Vacuubrand	MZ-2	21117920	-	1998	Amjad Amir	
66	Titrino	Metrohm	751	7217	-	1999	Tharwa Qoudah	
	Sample Changer	Metrohm	730	10173	-	1999	Tharwa Qoudah	
	Printer	Citizen	iDP562-RS	80892514	-	1999	Tharwa Qoudah	
67	PC 180 - Pentium (Lee)	LEO	140a	-	-	-	Emad Iblidi	
68	Distillation Unit	G.F.L.	-	10111298A	-	1999	Tharwa Qoudah	

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ICP-MS
Mercury Analyzer
Floriscent Microscope } Inorganic Lab

Royal Scientific Society
Quality Assurance Department
Equipment Inventory List

Center : ERC			Division : WQSD				Lab/Unit : Chemical Analyses		
No.	Equipment	Manufacturer	Model/Cat. Number	Manufacturer Serial Number	RSS Computer Number	purchased Date	Responsible Staff	Remarks
69	Drying Oven	Binder	ED115	[illegible]	-	2000	Amjad Amer	
70	Drying Oven	Binder	ED115/E2	00-12294	-	2001	Amjad Amer	
71	Refrigerator (Lead [illegible])	[illegible]	-	-	-	2001	[illegible]	
72	[illegible]	Precision	Model 815 Cat No. [illegible]	[illegible]	-	2000	[illegible]	
73	[illegible]	Isopad	-	-	-	2000	[illegible]	
74	Printer	Epson	LX-300	CLYC [illegible]	-	2000	[illegible]	
75	Printer	Epson	LX-300	CLCY [illegible]	-	2000	Amjad Amer	
76	Printer	Epson	LX-300	CLCY [illegible]	-	2000	[illegible]	
77	[illegible]	Metrohm	[illegible]	[illegible]	-	2001	[illegible]	

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Royal Scientific Society
Quality Assurance Department
Equipment Inventory List

Center : ERC ☐☐ Division : WQSD ☐ Lab/Unit : Specialized Analyses ☐

No.	Equipment	Manufacturer	Model/Cat. Number	Manufacturer Serial Number	RSS Computer Number	purchased Date	Responsible Staff	Remarks
1	Water Pollution Analyser	Thermo Quest	Trace GC 2000	TR201-498	-	1999	Eman Tellua	
	-GC/Headspace							
	-ECD Detector							
	-Computer							
2	GC/ECD/ECD	Hewlett Packard			10010001	1987	Bashar Sameeh	
	-GC		5890A	3435C04102				
	-Autosampler Controller		HP7673	2730A08236				
	-Autoinjector		HP7673	2704A07018				
	-ECD A			P2382				
	-ECD B			L3828				
	-Personal computer		HP300	2621A44450				
	-Printer		2225A	2651S30501				
3	GC/FID/NPD	Hewlett Packard			10010004	1987	Bashar Sameeh	
	-GC		5890A	2643A11313				
	-Autosampler Controller		HP7673	2718A04697				
	-Autoinjector		HP7637	2704A03704				
	-FID							
	-NPD							
	-Integrator		3392A	2602A10032				
4	GC/MSD	Hewlett Packard			10010080	1995	Bashar Sameeh	
	-GC		5890SERIES II	3406G24220				
	-Autosampler Controller		G1313AX	3310G00488				
	-Autoinjector		18593B	3325G10888				
	-MSD		HP5972	3301G00867				
	-Personal computer		HP VECTRA XM2	3317F35250				
	-Printer		Laser Jet 4 Plus	JPXW109944				
	-Vacuum pump	Edwards	Edwards	A07107024				
5	High performance Liquid Chromatography (HPLC) :	Shimadzu			-	1998	Bashar Sameeh	
	- Column Oven		CTO-10 AVP	C 21333200 278 KL				
	- System controller		SCL-10 AVP	C 21513301 944 SA				
	- Pump		LC-10 ATVP	C 20973301 087 LP				
	- Auto Injector		SIL-10 ADVP	C 21203301 530 23				
	- Diode array Detector		SPD-M10 AVP	C 20033301 815 37				
	- Fluorescence Detector		RF-10 AXL	C 20053301 538 81				
	- UV - Vis Detector		SPD-10 AVP	C 20093301 366 LP				

Prepared by : Bashar Sadiq	Date : 1/11/2001	Checked by (Laboratory / Unit Head) :		Date : 1/11/2001
Approved by (Division Head) :	Date : 1/11/2001	Authorized by (Centre Director) :	Dr. Bassam Hayek	Date : 1/11/2001

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Royal Scientific Society
Quality Assurance Department
Equipment Inventory List

Center : ERC ☐ ☐ Division : WQSD ☐ Lab/Unit : Specialized Analyses ☐ ☐

No.	Equipment	Manufacturer	Model/Cat. Number	Manufacturer Serial Number	RSS Computer Number	purchased Date	Responsible Staff	Remarks
6	Atomic Absorption Spectrophotometer	Philips			10010704	1992	Ibrahim Abdel-Rad	
	-AAS Flame Atomizer		PU9400X	942415040047x				
	-Electrothermal Atomizer		PU9390X	942310700404				
	With autosampler		PU9380X					
	-Vapour system		VP 90	942333560004				
	-Air compressor		PU9335	9422990080				
	-Voltage stabilizer	Weigrow	MV 30					
7	Polarograph				10010084	1993	Ibrahim Abdel-Rad	Not in use (awaiting spareparts)
	-Stand	Metrohm	VA 663	180134				
	-Controller	Metrohm	E608	002/00081				
	-Recorder	Metrohm	E506	109400				
8	Spectrofluorometer	Kontron	SFM 25	04920036	10080754	1992	Eman Ta'an	
	-Plotter 800	Kontron	800	700288				
9	Rotary evaporator					1993	Eman Ta'an	
	-Control unit	Buchi	R-114V	10034620				
	-Water bath	Buchi	B-480	10034003				
	-Vacuum pump	Knf	K83.3	875114				
10	Oven	Memmert	N40	820140			Ibrahim Abdel-Rad	
11	Water circulator	Julabo	F20-V13	8732007	10010053		Eman Ta'an	
12	Microwave	Moulinex	FM63	215	10080042		Ibrahim Abdel-Rad	
13	pH-Meter	Orion	720A	6021	10080704	1991	Ibrahim Abdel-Rad	
14	GPC				10010730	1993	Bashar Samouh	
	-Manual apparatus	Omni-Fit						
	-Bio-Beads	Bio-Rad	S-X3	45042A				
15	Sub-boiling distillation unit	Berghof	MR-13C	6308803	10010344		Ibrahim Abdel-Rad	
16	Mechanical shaker (quantity of 2)	Ruml Equip.	RS-12	1WLS-110 / 8,1WS-109	10080039	1993	Bashar Samouh	
17	Hot plate with stirrer (quantity of 2)	VELP	1020012	2800743 / 2800750		1992	Ibrahim Abdel-Rad	
18	Soxhlet apparatus	Gerhardt	Ss16	01122003	10010715	1992	Bashar Samouh	
19	Freezer	Frigidaire			WT08		Bashar Khalid	
20	Refrigerator	LG	GR-131S	808ER00000		1999	Bashar Khalid	
21	Refrigerator	Hitachi	R-330AKPW	2190900020	WT08	2000	Bashar Khalid	

Prepared by : *Bashar Sadiq* [signature]	Date : 1/11/2001	Checked by (Laboratory / Unit Head) : [signature]	Date : 1/11/2001
Approved by (Division Head) :	Date : 1/11/2001	Authorized by (Center Director) :	Date : 1/11/2001

Form No. RSSPMP0710	Rev. (1)

Dr. Bassam Hayek

A.A.S UNICAM
Model: AAM6

Royal Scientific Society
Quality Assurance Department
Equipment Inventory List

Center : ERC | Division : WQSD | Lab/Unit : MLU

No.	Equipment	Manufacturer	Model/Cat. Number	Manufacturer Serial Number	RSS Computer Number	purchased Date	Responsible Staff	Remarks
1	Air sampler	Spi	-	7341	10010608	1987	Ali Omari	
2	Autoclave	Webeco	H	82151	10010617	1987	Ali Omari	
3	Balance	Kern	D465 570	70219	10290087	1988	Samer Tawalbeh	
4	Centrifuge minifuge	Heraeus	RF	115054	10010003	1988	Ali Omari	
5	Circulation water bath	Kottermann	3048	140197	10270118	1985	Ihab Rajabi	
6	CO2-Incubator	Heraeus	B 5060	8613796	10460003	1988	Marvat Kamal	
7	CO2-Incubator	Heraeus	B 5060	8613795	10460005	1988	Marvat Kamal	
8	Colony counter	WTW	BZG-28	383627	10120032	1985	Samer Tawalbeh	
9	Fluorometer	Sequoia-Turner	112	2001356	10080307	1985	Ali Omari	
10	Heating plate	Labinco	331	-	10360048	1989	Samer Tawalbeh	
11	Heating plate	Corning	pc-35	-	10370033	1992	Samer Tawalbeh	
12	Homogenizer	Janke&Kunkel	TP 18/10	383405	10360033	1987	Ihab Rajabi	
13	Incubator	Kottermann	2736	440105	10310036	1987	Ihab Rajabi	
14	Incubator	Memmert	-	873454	10010900	1985	Marvat Kamal	
15	Incubator	Memmert	B-15	870309	10310038	1985	Ihab Rajabi	
16	Incubator	Memmert	B-30	833451	10010546	1987	Marvat Kamal	
17	Inverted light microscope	Nikon	Diaphot-TMD	900084	10190027	1989	Samer Tawalbeh	
18	Laminar airflow cabinet	Gelaire	BSB4	30099	10010568	1987	Ali Omari	
19	Laminar airflow cabinet	Gelaire	BSB4A	10576	10010605	1987	Ali Omari	
20	Microscope Bx300	Wild	Bx300	613005	10190020	1986	Marvat Kamal	
21	Oven	Kottermann	2712	484083	10270080	1985	Samer Tawalbeh	
22	Incubator	Heraeus	BK 500	50001518	10310017	1986	Ihab Rajabi	
23	Refrigerator	Philips	-	421900800043	10510028	1980	Marvat Kamal	
24	Refrigerator	Mistral	B1378	HJ3300/2PX/LV	10510059	1987	Ihab Rajabi	
25	Rotary shaker	Mast	MA344A	760	10010086	1990	Ali Omari	
26	Suction pump	Sartorius	16617	80561	1001060607	1987	Marvat Kamal	
27	Super mixer	Heidolph	RCAX2000	00153	10390042	1986	Marvat Kamal	
28	Super mixer	Janke&Kunkel	VF2	377394	10360032	1986	Ihab Rajabi	
29	Ultrasonic bath	Branson	B-2200 E4	C-118/88	10270130	1989	Samer Tawalbeh	
30	UV-Chamber	Heraeus	5201	0487055	10270121	1987	Samer Tawalbeh	
31	Lyophilization machine	EDWARDS	Micro Modlyo	1170	-	1996	Ali Omari	
32	Fluorescent Microscope	NIKON	LABOPHOT2	463460	10190033	1996	Ihab Rajabi	
33	Autoclave	Sanoclav	Las-201	1850248	10400018	1986	Samer Tawalbeh	Limited use
34	Water bath	GFL	Type 1013	10406587 C	10270119	1987	Ihab Rajabi	
35	Water Bath	GFL	1013	10407187 C	10270116	1987	Marvat Kamal	
36	Refrigerator	Hitachi	R-320 AK7	2100100193	10510103	1999	Marvat Kamal	
37	Refrigerator	Gibson	GS35	129288	10510095	1998	Samer Tawalbeh	
38	pH meter	Mettler-Toledo	MP-220	08029794	13330131	2000	Ihab Rajabi	
39	Centrifuge	Sigma	4-15	72729	10011232	2000	Ali Omari	
40	Centrifuge	Sigma	3-15	72780	10011255	2000	Ali Omari	
41	Washing Machine	MIELE	G7735	264898	10360031	1985	Samer Tawalbeh	
42	Super Mixer	Janke - Kunkel	VF2	315661	10360042	1986	Marvat Kamal	
43	Flask Shaker	GFL	3005	10321500	-	2000	Ihab Rajabi	
44	Temperature Record	Kane - May	KM1342	4022609	-	2001	Ihab Rajabi	

Prepared by : Ihab AL-Rajabi	Date : 1/11/2001	Checked by (Laboratory / Unit Head) :	Date : 1/11/2001
Approved by (Division Head) :	Date : 1/11/2001	Authorized by (Centre Director) : Dr. Bassam Hayek	Date : 1/11/2001

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ISO 17 or 25 for Lab. Accreditation.
- quality control samples
WHO, WHO, USGS, ERA

Royal Scientific Society
Environmental Research Centre (ERC)

ERC Secondary Quality Manual	Annex No. (8)
Title of Annex:	Issue No. (2); Date 1/11/2001
Methods and Procedures for Calibrations/ Tests	Revision No. (1); Date 1/11/2001

ANNEX NO. (8)

Methods and Procedures for Calibrations / Tests

Appendix a II

Royal Scientific Society
Quality Assurance Department

List of Test/Calibration Methods/ Procedures

Centre: ERC [1][7] Division: WQSD [1] Laboratory/Unit: CAL [1][1]

No.	Test/ Calibration	Method/ Procedure Used	Equipment Used	Internal Code	Remarks
1	pH	SM - 4500-H B	pH- meter	pH	
2	Electrical Conductivity	SM - 2510-B	EC-meter	EC	
3	Redox Potential	SM - 2580 B	Ion meter	Eh	
4	Temperature	SM - 2550 B	Thermometer	T (°C)	
5	Residual Free Chlorine	SM - 4500-Cl G	Colorimeter	Cl_2	
6	Hydrogen Sulfide (Colorimetry)	SM - 4500-S^{-2} D	Colorimeter	S^{-2}	
7	Color	SM - 2120 B	--	Color	Visual
8	Turbidity	SM - 2130 B	Turbidimeter	Turbidity	
9	Methylene blue active substances	SM - 5540-C	Spectrophotometer	MBAS	
10	Carbon dioxide	SM - 4500- CO_2 C	Dosimate, pH meter	CO_2	
11	Bicarbonate / Carbonate	SM - 2320 B	Dosimat, pH meter	CO3 / HCO3	
12	Acidity	SM - 2310-B	Dosimate, pH meter	acidity	
13	Alkalinity	SM - 2320-B	Dosimate, pH meter	alk.	
14	Dissolved Oxygen	SM - 4500-O G	Oxygen- meter	DO	Field Test
15	Dissolved Oxygen (Titration)	SM - 4500-O C	titroprocessor	DO	

Prepared by : Date: 1/11/2001 **Checked by (Lab/ Unit Head) :** Date: 1/11/2001

Approved by (Division Head): Date: 1/11/2001 **Authorized by (Centre Director) :** Dr. Bassam Hayek Date: 1/11/2001

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Royal Scientific Society
Quality Assurance Department

List of Test/Calibration Methods/ Procedures

Centre: ERC [1][7] Division: WQSD [1] Laboratory/Unit: CAL [1][1]

No.	Test/ Calibration	Method/ Procedure Used	Equipment Used	Internal Code	Remarks
16	Chemical Oxygen Demand	SM - 5220-B	Digestor, Titroprocessor	COD	
17	Biochemical Oxygen Demand	SM - 5210-B	Incubator, titroprocessor	BOD	
18	Total dissolved solids	SM - 2540-C	Vacuum pump, oven Analaytical balance	TDS	
19	Total suspended solid	SM - 2540-D	Vacuum pump, oven Analaytical balance	TSS	
20	Fixed and volatile solids	SM - 2540-E	Oven, Furnace, Analatical balance, Vacuum Pump	TFS,TVS	
21	Fat, oil and grease (Gravimetry)	SM - 5520- B	Analaytical Balance Rotavapor, Dryer	FOG	
22	Phenols (Total by colorimetry)	SM- 5530 C	Steam Distillation unit, photometer	phenols	
23	Sodium	SM - 3500-Na B	Flame photometer	Na^{+}	
24	Potassium	SM - 3500- K B	Flame photometer	K^{+}	
25	Calcium	SM - 3500-Ca B	Dosimate	Ca^{+2}	
26	Magnesium	SM - 3500-Mg B	Dosimate	Mg^{+2}	
27	Total Hardness (as CaCO3)	SM - 2340-C	Dosimate	TH	
28	Permanganate value	Testing of water (Merck, P169)	Digester, Dosimat	PV	

Prepared by : Date: 1/11/2001 **Checked by (Lab/ Unit Head) :** Date: 1/11/2001

Approved by (Division Head): Date: 1/11/2001 **Authorized by (Centre Director) :** Dr. Bassam Hayek Date: 1/11/2001

Royal Scientific Society
Quality Assurance Department

List of Test/Calibration Methods/ Procedures

Centre: ERC [1][7] Division: WQSD [1] Laboratory/Unit: CAL [1][1]

No.	Test/ Calibration	Method/ Procedure Used	Equipment Used	Internal Code	Remarks
16	Chemical Oxygen Demand	SM - 5220-B	Digestor, Titroproccesor	COD	
17	Biochemical Oxygen Demand	SM - 5210-B	Incubator, titroproccesor	BOD	
18	Total dissolved solids	SM - 2540-C	Vacuum pump, oven Analaytical balance	TDS	
19	Total suspended solid	SM - 2540-D	Vacuum pump, oven Analaytical balance	TSS	
20	Fixed and volatile solids	SM - 2540-E	Oven, Furnace, Analatical balance, Vacuum Pump	TFS,TVS	
21	Fat, oil and grease (Gravimetry)	SM - 5520- B	Analaytical Balance Rotavapor, Dryer	FOG	
22	Phenols (Total by colorimetry)	SM- 5530 C	Steam Distillation unit, photometer	phenols	
23	Sodium	SM - 3500-Na B	Flame photometer	Na^{+}	
24	Potassium	SM - 3500- K B	Flame photometer	K^{+}	
25	Calcium	SM - 3500-Ca B	Dosimate	Ca^{+2}	
26	Magnesium	SM - 3500-Mg B	Dosimate	Mg^{+2}	
27	Total Hardness (as CaCO3)	SM - 2340-C	Dosimate	TH	
28	Permanganate value	Testing of water (Merck, P169)	Digester, Dosimat	PV	

Prepared by : Date: 1/11/2001 **Checked by (Lab/ Unit Head) :** Date: 1/11/2001

Approved by (Division Head): Date: 1/11/2001 **Authorized by (Centre Director) :** Dr. Bassam Hayek Date: 1/11/2001

Royal Scientific Society
Quality Assurance Department

List of Test/Calibration Methods/ Procedures

Centre: ERC [1][7] Division: WQSD [1] Laboratory/Unit: CAL [1][1]

No.	Test/ Calibration	Method/ Procedure Used	Equipment Used	Internal Code	Remarks
29	Chloride	SM - 4500-Cl D	Titroprocessor	Cl^-	
30	Bromide	SM - 4110, B	High Performance Ion Chromatograph (HPIC)	Br^-	
31	Sulphate	SM - 4110, B	(HPIC)	SO_4^{-2}	
32	Sulfite	SM - 4500-SO_3^{-2} B	Dosimate	SO_3^{-2}	
33	Nitrate	SM - 4110, C	(HPIC)	NO^-_3	
34	Nitrite	SM - 4500- NO_2 B	Photometer	NO_2^-	
35	Ammonia	SM - 4500-NH_3 C (20th ed.) SM - 4500-NH_3 C (18th ed.)	Kjeldahl D.U. Photometer	NH_3 NH_3 NH_3	
36	Total Kjeldahl Nitrogen	SM - 4500-N org B	Kjeldahl digestor, Kjeldahl distillation, Dosimat	T.Kj. N	
37	Phosphate	SM - 4500- P C SM 4500-P D	Photometer	PO_4^{-3}	Vanadomolybdophosphoric acid stanuous choride
38	Total phosphours	SM - 4500- P C SM- 4500-P D	Digestor, photometer	T-P	
39	Cyanide (distillation)	SM - 4500-CN F	Distillation unit, Ion meter	CN^-	
40	Fluoride	SM - 4500- F C	ion meter	F^-	

Prepared by : Date: 1/11/2001 **Checked by (Lab/ Unit Head) :** Date: 1/11/2001

Approved by (Division Head): Date: 1/11/2001 **Authorized by (Centre Director) :** Date: 1/11/2001

Dr. Bassam Hayek

Royal Scientific Society
Quality Assurance Department

List of Test/Calibration Methods/ Procedures

Centre: ERC [1][7] Division: WQSD [1] Laboratory/Unit: CAL [1][1]

No.	Test/ Calibration	Method/ Procedure Used	Equipment Used	Internal Code	Remarks
41	Tannin and Lignin	SM - 5550 B	Spectrophotometer	Tannin&Lignin	
42	Volatile Fatty acid (Sample preparation)	SM - 5560 C	Distillation apparatus	VFA	
43	Silt density index	ASTM D 4189-82 (1987)	SDI apparatus	SDI	
44	Oxyhalides (ClO_2, ClO_3, BrO_3)	EPA method 300.1 Revision No. 1, 1997	Ion Chromatography	ClO_2, ClO_3, BrO_3	

Prepared by : Date: 1/11/2001
Checked by (Lab/ Unit Head) : Date: 1/11/2001
Approved by (Division Head): Date: 1/11/2001
Authorized by (Centre Director) : Dr. Bassam Hayek Date: 1/11/2001

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Royal Scientific Society
Quality Assurance Department

List of Test/Calibration Methods/ Procedures

Centre : ERC [1][7] Division: WQSD [1] Laboratory/Unit: SAL [1][2]

No.	Test/ Calibration	Method/ Procedure Used	Equipment Used	Internal Code	Remarks
9.	Aluminum ,Cadmium, Calcium, Manganese, Molybdenum, Nickle, Silver, Vanadium, Zinc, Cobalt, Chromium, Copper, Iron, Lithium, Lead, Magnesium	SM-3111 B (AA Spectrometric Method)	Atomic Absorption	Al, Cd, Ca, Mn, Mo, Ni, Ag, V, Zn, Co, Cr, Cu, Fe, Li, Pb, Mg	
10.	Mercury	SM- 3112 B (AA Cold- Vapor Method)	Atomic Absorption	Hg	
11.	Tin, Selenium, Arsenic, Antimony	SM- 3114 C (AA Spectrometric Method)	Atomic Absorption	Sn, Se, As, Sb	

Prepared by : Date: 1/11/2001 **Checked by (Lab/ Unit Head) :** Date: 1/11/2001

Approved by (Division Head): Date: 1/11/2001 **Authorized by (Centre Director) :** Dr Bassam Hayek Date: 1/11/2001

Form No. RSSPMP0902 | Rev. (1)

Royal Scientific Society
Quality Assurance Department
List of Test/Calibration Methods/ Procedures

Centre: ERC [1][7] Division: WQSD [1] Laboratory/Unit: MTU [1][3]

No.	Test/ Calibration	Method/ Procedure used	Equipment Used	InternalCode	Remarks
A.	**WATER AND WASTEWATER**				
1	Total coliform count (TCC) - Most Probable Number (MPN) - Membrane Filtration (MF)	 SM-9221B, C SM -9222B	Incubator, Filtration Unit and pump	TCC	
2	Thermotolerant coliform count (TTCC) - Most Probable Number (MPN) - Membrane Filtration (MF) - Seven- hour test - Direct Test (A-1 Medium)	 SM-9221E, C SM -9222D SM- 9211 B SM- 9221 E 2	Incubator, Filtration Unit and pump	TTCC	
3	*E-coli* in natural bathing beaches H. endo broth	SM-9213D3	Filteration unit, Incubator, pump		
4	Differentiation of the Coliform bacteria	SM- 9225	Incubator		
5	Faecal streptococci count -Most Probable Number (MPN)	 SM -9230B, SM-9221 C	Incubator	F. Strept.	
6	Total heterotrophic bacterial count (THBC) - Pour Plate - Spread Plate - Membrane Filter	 SM- 9215 A, B SM- 9215 A, C SM - 9215 A, D	Incubator, colony counter	THBC	
7	Detection & Enumeration of *Pseudomonas aeruginosa.*	SM- 9213E	Filteration system Incubator	-	
8	Detection and Enumeration of Sulphate reducing Bacteria	SM- 9240 D3	Incubator, Anaerobic Jars	SRB	
9	Detection & Enumeration of Sulphite reducing Bacteria - Membrane filtration - Enrichment in liquid media	1 ISO 6461/2 (1986) ISO 6461/1 (1986)	Incubator, Anaerobic Jars	-	
10	Detection of Pathogenic Bacteria	SM -9260	Incubator	PB	
11	Actinomycetes plate count	SM 9250 B	Incubator		
12	Detection and Enumeration of Fungi - Pour plate - Spread plate - Membrane filter	 SM - 9610 B SM- 9610 C SM- 9610 D	Incubator	FG	

Prepared by : Date: 1/11/2001 **Checked by (Lab/ Unit Head) :** Date: 1/11/2001

Approved by (Division Head): Date: 1/11/2001 **Authorized by (Centre Director) :** Dr. Bassam Hayek Date: 1/11/2001

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Litter - Lactose broth - Glucose
XLD Mac.

Royal Scientific Society
Quality Assurance Department

List of Test/Calibration Methods/ Procedures

Centre: ERC [1][7] Division: AQSD [2] Laboratory/Unit: AQU [2][1]

No.	Test/ Calibration	Method/ Procedure Used	Equipment Used	Internal Code	Remarks
1.	Sulfur dioxide test	Following Equipment Manual Procedure	SO2 Analyzer	SO2	
2.	Hydrogen Sulfide	Following Equipment Manual Procedure	SO2 / H2S Analyzer	H2S	
3.	Carbon Monoxide	Following Equipment Manual Procedure	CO Analyzer	CO	
4.	Nitrogen Oxides	Following Equipment Manual Procedure	NOx Analyzer	NOx	
5.	Stack Emissions	Following Equipment Manual Procedure	Flue Gas Analyzer	–	
6.	Automobile Exhaust	Following Equipment Manual Procedure	Automobile Exhaust Analyzer	–	
7.	Radon Gas	Following Equipment Manual Procedure	Radon Analyzer	Rn	
8.	Pollen Grain	Following Equipment Manual Procedure	Pollen Grain Traps	–	
9.	Total Suspended Particulate	Following Equipment Manual Procedure	High Volume Sampler	TSP	
10.	Particulate Matter Less than 10 µm	Following Equipment Manual Procedure	High Volume Sampler with Selective Inlet	PM10	
11.	Gas Analyzer Calibration	Following Equipment Manual Procedure	Calibrator with Permeation Oven & Standard Gases	--	

Prepared by : Jihad Al Sawair Date: 1/11/2001 **Checked by (Lab/ Unit Head) :** Faysal Amani Date: 1/11/2001

Approved by (Division Head): Date: 1/11/2001 **Authorized by (Centre Director) :** Dr. Bassam Hayek Date: 1/11/2001

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Abbreviations:
- SM = Standard Methods for the Examination of Water and Wastewater 20th ed., 1998.
- MSD= Mass Selective Detector
- GC= Gas Chromatography
- ECD= Electron Capture Detector.
- EPA= Environmental Protection Agency.
- FID = Flame Ionization Detector
- NPD= (Nitrogen-Phosphorous) Detector.
- DFG = Pesticide Commission, DFG, Germany.
- WHO= World Health Organization
- WPA= Water Pollution Analyzer
- TCLP= Toxicity Characteristic Leaching Procedure.
- ASTM = American Society for Testing and Material
- HPIC = High Performance Ion Chromatography

Royal Scientific Society
Quality Assurance Department

Personnel List Appendix A III

Centre : ERC [1][7] Division: WQSD [1] Laboratory/Unit: [ ][ ]

Name	RSS ID NO.	Current Position	Qualification	Related Experience	Employment Date
Dr. Mohamed Saidam	1329	Division Head	Ph. D. (Env. Eng.)	16 years experience in environmental field	7/1/1986
Mr. Nael Al Mulki	1811	Researcher	M.Sc.(Env. Eng.)	7 years experience in environmental field	19/11/1994
Mr. Wael Suleiman	1702	Researcher	M.Sc. (Water & Env. Eng.)	9 year experience in environmental field	27/7/1992
Mr. Nizar Hatasah	1717	Researcher	M.Sc. (Water & Irrig. Eng.)	9 years experience in environmental field	1/10/1992
Mrs. Fida'a Jibril	1806	Researcher	M. Sc. (Chemical Eng.)	7 years experience in environmental field	12/11/1994
Mr. Ziad Hamad	1823	Researcher	M.Sc. (Water & Env. Eng.)	6 years experience in environmental field	1/2/1995
Mr. Othman Al-Madallbeh	2209	Researcher	M.Sc. (Water & Env. Eng.)	3 years experience in environmental field	1/11/1999

Prepared by : Nael Mulki Date : 1/11/2001 **Checked by (Lab/Unit Head) :** Date : 1/11/2001

Approved by (Division Head): Date : 1/11/2001 **Authorized by (centre Director):** Dr. Bassam Hayek Date : 1/11/2001

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Quality Assurance Department

Personnel List

Centre: ERC [1][7] Division: WQSD [1] Laboratory/Unit: Chemical Analyses [1][1]

Name	RSS ID NO.	Current Position	Qualification	Related Experience	Employment Date
Mr. Ahmad Al Duradkah	1291	Unit Head	B.Sc. (Indust. Chemistry)	12 years in Water and Food Analysis 4 years as Administrative Assistant	7/5/1985
Mr. Emad Eddadu	1420	Lab. Head, Analyst	B.Sc. (Chemistry)	16 years in chemical analysis	3/10/1987
Mr. Fuad Abu Sharkh	1378	Analyst	M.Sc.(Analy. Chemistry)	15 years in environmental analytical chemistry	10/2/1987
Mr. Amjad Amer	1760	Analyst	B.Sc. (Chemistry)	8 years in chemical analysis	20/10/1993
Ms. Rula Abu Al-Hasan	1808	Analyst	M.Sc. (Env.Siesce & Manag.)	7 years in chemical analysis	19/11/1994
Mr. Ashraf Al-Hashlamoon	1809	Analyst	B.Sc. (Applied Chemistry)	7 years in chemical analysis	19/11/1994
Mr. Hussein Al-Khateeb	1334	Lab. Technician	Undergraduate Diploma (Chemical Analysis)	16 years sample collection and chemical analysis	27/1/86
Mr. Ibrahim Al-Muhasen	1260	Lab. Technician	Undergraduate Diploma (Civil Engineering)	12 years in sample collection	13/11/1984
Ms. Tharwa Qoutish	2107	Analyst	B.Sc (Chemical Engineering)	4 years	12/8/1997
Mr. Ra'id Jabir	1712	Lab. Technician	Undergraduate Diploma (Env. Engineering)	9 years in Env. microbiology & chemistry & sample collection	7/9/1992
Mr. Saad Kraishan	2149	Analyst	M.Sc in Chemistry	3 years in chemical analysis	November 1998
Mr. Khalid Nawasra	2313	Lab Technician	Diploma Chem. Eng.	10 years experience	24/7/2001
Hala Zahdi Habbouh	2226	Analyst	B.Sc in Chemistry	1 year experience	15/5/2000

Prepared by : Date : 1/11/2001 **Checked by (Lab/Unit Head) :** Date : 1/11/2001

Approved by (Division Head): Date : 1/11/2001 **Authorized by (centre Director):** Dr. Bassam Hayek Date : 1/1/2001

Form No. RSSPMP0406 | Rev. (1)

Filta-Max™

Filta-Max—World Leader for the Capture and Recovery of *Cryptosporidium* and *Giardia*

Filta-Max is the world's leading technology for the capture and recovery of *Cryptosporidium* and *Giardia*. The system was developed and is manufactured by Genera Technologies, Ltd., which was acquired by IDEXX in August 2000.

Filta-Max is the only US EPA-approved capture concentration system that can sample a continuous flow of 50 liters of raw water. Other approved tests can sample only up to 10 liters at a time. Filta-Max has been validated for high-volume finished water—up to 1,000 liters at a time.

- US EPA Method 1623-approved
- UK DWI-approved

- **Filta-Max Product Specifications**
- **Patent Information**

Appendix A IV

How to Use Filta-Max

Step 1.
Place the filter module in the filter housing.

Step 2.
Connect the filter housing to the required water source for sampling.

Step 3.
Attach the filter module to the wash station plunger head.

Step 4.
Wash the sample with elution buffer.

Step 5.
Concentrate.

Step 6.
Repeat Steps 4 and 5 to concentrate the final sample to 25 ml.

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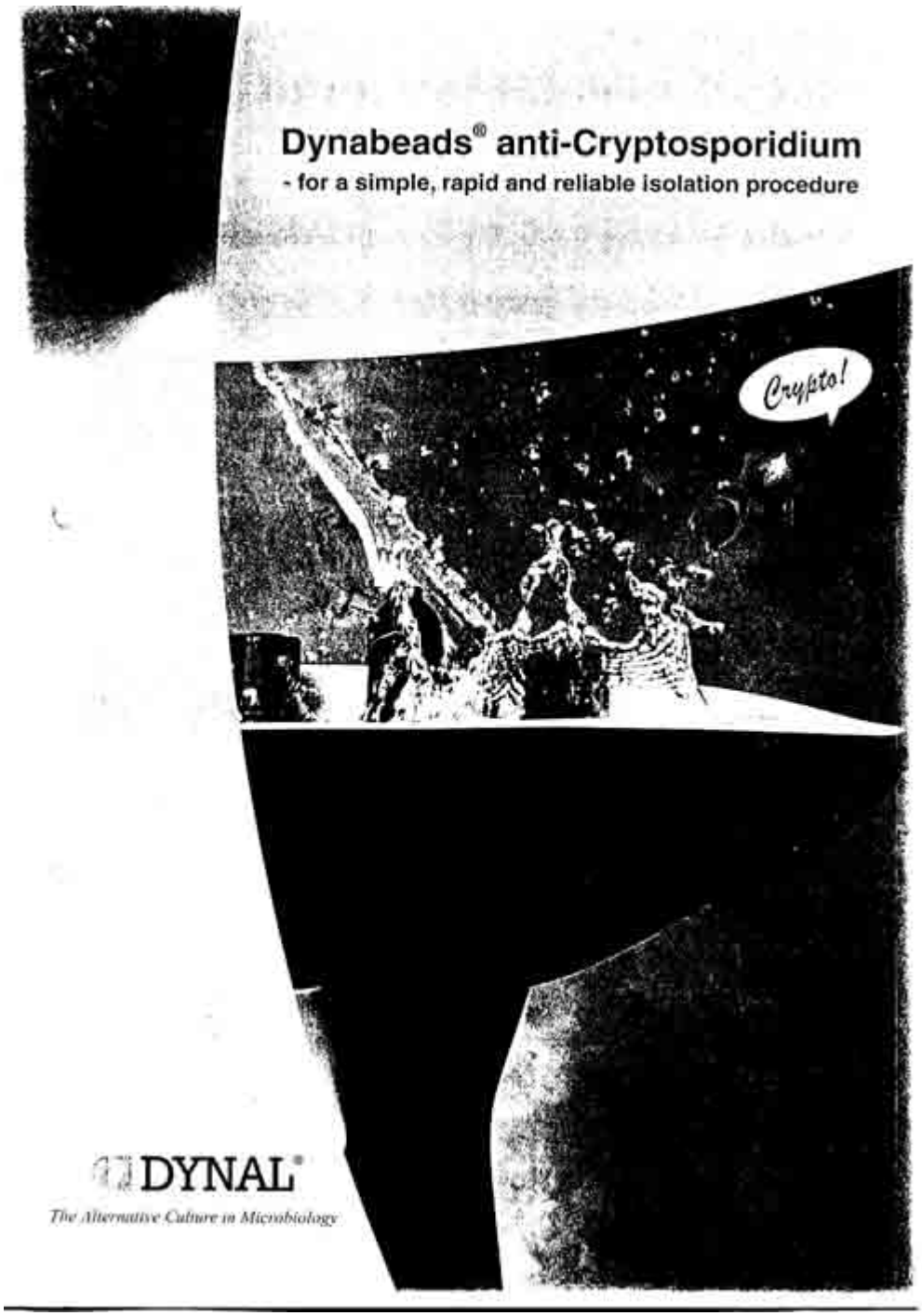

Dynabeads® anti-Cryptosporidium
- for a simple, rapid and reliable isolation procedure
Crypto!
DYNAL®
The Alternative Culture in Microbiology

ImmunoMagnetic Separati

What is IMS?

The detection of *Cryptosporidium* oocysts is a very expensive, time-consuming and labour intensive process. In addition, recovery and reproducibility is inadequate.

Dynal®, the inventor and world leader of IMS, now introduces Dynabeads® for the isolation of *Cryptosporidium*. This innovative technique greatly improves oocyst recovery and significantly reduces operator hands-on time, as well as total test time.

The IMS technology is based on superparamagnetic microspheres called Dynabeads®. Dynabeads® anti-Cryptosporidium are coated with specific antibodies directed against key target antigens of *Cryptosporidium* oocysts. IMS is an effective replacement for cumbersome and inefficient methods like floatation purification and has many benefits over conventional techniques.

The IMS technique is simple. Mixing the sample concentrate with Dynabeads® anti-Cryptosporidium enables the formation of Dynabeads®-Oocyst complexes. Application of a magnetic field using a magnetic test tube holder (Dynal MPC) allows the selective capture and isolation of the complexes from the sample concentrate. The oocysts are dissociated from Dynabeads® by a simple pH alteration. The purified oocysts are then ready for detection.

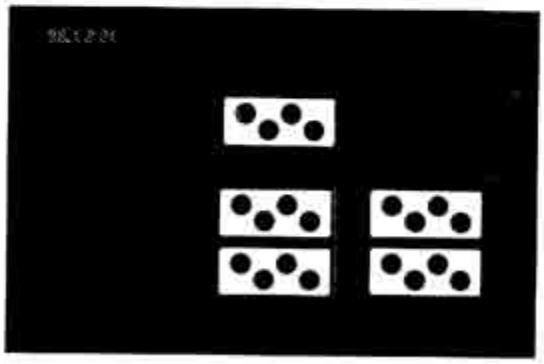
Benefits

- **Improved oocyst recovery.**
- **Simple procedure.**
- **Reduced background debris aids detection by microscopy.**
- **One clean 8-10 mm slide well per sample.**
- **Saves up to 6 hours hands on processing time.**

Sensitivity

The sensitivity of this technique is very high, and as few as 1 oocyst / 10 ml water concentrate can be isolated for subsequent detection. Oocyst recovery above 90% is frequently observed.

One clean slide well per sample



Following conventional separation techniques, the final suspension for microscopical analysis may require 12 slide wells or more and contain considerable background debris. Using Dynabeads® anti-Cryptosporidium, the final suspension for microscopical analysis requires only one well and the background debris is minimized.

(MS) of Cryptosporidium

A comparison of results

A drinking water sample processed by the conventional separation technique. Note the background debris which may hamper identification.

The same sample processed using Dynabeads® anti-Cryptosporidium. Note the clarity of the oocysts with reduced background debris.

The Procedure

Oocyst capture

1. Add Dynabeads® anti-Cryptosporidium and SL™-buffer to 10 ml water sample concentrate.
2. Affix tubes to a rotary mixer and mix samples for 1 hour. *During this time Dynabeads® anti-Cryptosporidium will capture the oocysts.*

70 minutes

IMS

3. Place tubes in a Dynal MPC®-1. *Oocysts bound to Dynabeads® anti-Cryptosporidium will migrate to the tube wall in contact with the magnet.*
4. Remove and discard supernatant. *Dynabeads® bound oocysts are retained on the tube wall in contact with the magnet.*

5 minutes

Dissociation

5. Transfer Dynabeads®-bound oocysts to a microcentrifuge tube and place the tubes in the Dynal MPC®-M.
6. Remove and discard supernatant.
7. Add acid and vortex. Let stand for 5 minutes. *This will dissociate Dynabeads® from oocysts.*
8. Remove Dynabeads® from dissociated oocysts using the Dynal MPC®-M.
9. Transfer supernatant containing the released oocysts onto a slide well containing neutralizing alkali.

15 minutes

ORDERING INFORMATION

Product Description	Prod. No.	Volume
Dynabeads® anti-Cryptosporidium kit	730.01	10 Tests
For isolation of Cryptosporidium oocysts. Includes 1 ml Dynabeads® anti-Cryptosporidium and SL™-buffer.		
Dynal MPC®-1	120.01	Unit
Magnetic test tube holder that accommodates 1 x 10 ml tube.		
Dynal MPC®-M	120.09	Unit
Magnetic test tube holder that accommodates 10 x 1.5 ml microcentrifuge tubes.		
Dynal® MX1	159.07	Unit
Sample mixer for 8 x 10 ml tubes.		
Dynal Sample Mixer	947.01	Unit
US version. 110V bi-directional sample mixer for 12 x 10 ml tubes.		
Dynal® L10 tubes	740.03	5 Tubes
Reusable flatsided tubes for optimal magnetic concentration.		

DYNAL®

The Alternative Culture in Microbiology

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NIHON DYNAL K.K. [illegible]

DYNAL FRANCE S.A. [illegible]

DYNAL PTY LTD [illegible]

Appendix I

Types of Chemical and Physical tests performed at the WERSC.

No	Test	Apparatus
1.	Electrical conductivity (EC)	EC meter
2.	pH-Value (pH)	pH meter
3.	Dissolve oxygen (DO)	DO meter
4.	Temperature (C°)	Temperature meter
5.	Color	Spectrophotometer
6.	Turbidity	Spectrophotometer
7.	Total dissolve solid (TDS)	Balance & Oven
8.	Total suspended solid (TSS)	Balance & Oven
9.	Calcium (Ca)	Capillary Ion Analyzer(CIA) - Atomic absorption(AA)
10.	Magnesium (Mg)	Capillary Ion Analyzer(CIA) - Atomic absorption(AA)
11.	Sodium (Na)	Flame photometer- Atomic absorption (AA)
12.	Potassium (K)	Flame photometer- Atomic absorption (AA)
13.	Lithium (Li)	Flame photometer- Atomic absorption (AA)
14.	Chloride (Cl)	Capillary Ion Analyzer (CIA)-titration
15.	Bicarbonate (HCO_3)	Capillary Ion Analyzer (CIA)-titration
16.	Sulfate (SO_4)	Spectrophotometer-Capillary Ion Analyzer (CIA)
17.	Nitrate (NO_3)	Spectrophotometer-Capillary Ion Analyzer (CIA)
18.	Nitrite (NO_2)	Spectrophotometer-Capillary Ion Analyzer (CIA)
19.	Carbonate (CO_3)	Capillary Ion Analyzer (CIA)-titration
20.	Bromide (Br)	Ion selective electrode-Capillary Ion Analyzer (CIA)
21.	Fluoride (F)	Ion selective electrode-Capillary Ion Analyzer (CIA)
22.	Iodide (I)	Ion selective electrode-Capillary Ion Analyzer (CIA)
23.	Phosphate (PO_4)	Spectrophotometer-Capillary Ion Analyzer (CIA)
24.	Total phosphate (TPO_4)	Spectrophotometer-Capillary Ion Analyzer (CIA)
25.	Total nitrogen (TN)	Kjeldahl
26.	Ammonia (NH_4)	Spectrophotometer-Capillary Ion Analyzer (CIA)
27.	Cyanide (CN)	Ion selective electrode-Capillary Ion Analyzer (CIA)
28.	Heavy metals	Atomic absorption (AA)-Polarography
29.	Biological oxygen demand (BOD)	BOD
30.	Chemical oxygen demand (COD)	COD digester
31.	Phenols	Spectrophotometer
32.	Oil and Grease	Balance
33.	MBAS (Detergents)	Spectrophotometer-Capillary Ion Analyzer (CIA)
34.	Chloroamines	High Pressure Liquid Chromatography (HPLC)
35.	Total organic carbon(TOC)	TOC analyzer
36.	Organic Constituents	Gas chromatography(GC)-High Pressure Liquid Chromatography (HPLC)
37.	Haloalkanes aromatic	Gas chromatography(GC)-High Pressure Liquid Chromatography (HPLC)
38.	Hydrocarbon	Gas chromatography(GC)-High Pressure Liquid Chromatography (HPLC)
39.	Pesticides	Gas chromatography(GC)-High Pressure Liquid Chromatography (HPLC)
40.	Disinfication	Gas chromatography(GC)-High Pressure Liquid Chromatography (HPLC)

WERSC – Dr. Manar Fayyad.
3/10/03
Visited 3 labs
① drinking H2O lab analysis
② Wastewater lab analysis
③ Hydro lab

PHD + master students
Met a total of
4 or 5 people
working in the lab

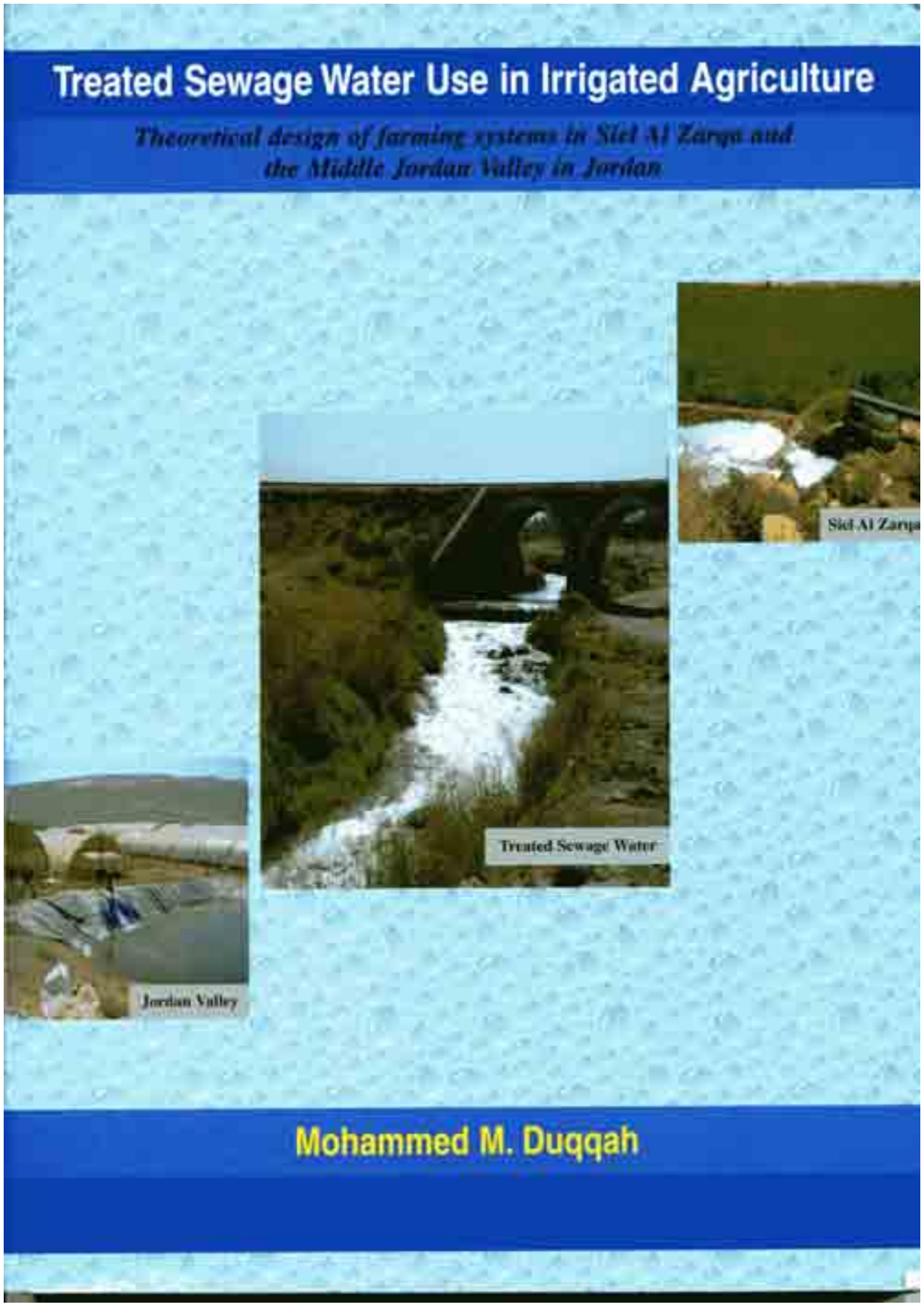
Appendix B II

Types of Biological tests performed at the WERSC.

No.	Test	Apparatus
1.	Total Coliform , Fecal Coliform	Tubes , Filtration unit , Autoclave, Incubator , Laminar flow
2.	Total Count	Petri dish , Autoclave, Incubator , Laminar flow
3.	Chlorophyll a	Spectrophotometer
4.	Algae Identification	Microscope
5.	Nematode	Centrifuge & microscope
6.	E.Coli	Colilert

(Analysis are performed according to Standard Methods for Examination of Water & Wastewater , 19th eddition , 1995)

PAMPHLETS COLLECTED AT SITES



The Hashemite Kingdom of Jordan

Ministry of Agriculture

National Center for Agricultural Research and Technology Transfer

(NCARTT)

January 2001

The Hashemite Kingdom of Jordan

MINISTRY OF AGRICULTURE

National Center for Agricultural Research and Technology Transfer (NCARTT)

3 INTEGRATED LIVESTOCK

Amman 1997

The Hashemite Kingdom of Jordan

MINISTRY OF AGRICULTURE

National Center for Agricultural Research and Technology Transfer (NCARTT)

4 Low Rainfall Areas

Amman 1997

The Hashemite Kingdom of Jordan

MINISTRY OF AGRICULTURE

National Center for Agricultural Research and Technology Transfer (NCARTT)

1 RAINFED AGRICULTURE

Amman 1997

The Hashemite Kingdom of Jordan

MINISTRY OF AGRICULTURE

National Center for Agricultural Research and Technology Transfer (NCARTT)

5 PLANT GENETIC RESOURCES

Amman 1997

The Hashemite Kingdom of Jordan

Ministry of Agriculture

PLANT GENETIC RESOURCES Unit

(NCARTT)

January 2001

The Hashemite Kingdom of Jordan

MINISTRY OF AGRICULTURE

National Center for Agricultural Research and Technology Transfer (NCARTT)

2 IRRIGATED AGRICULTURE

Amman 1997

The Hashemite Kingdom of Jordan

Ministry of Agriculture

RAINFED AGRICULTURE
Research Program

(NCARTT)

January 2001

Improve and enhance agricultural production
This is NCARTT
Research and Technology transfer For Agricultural Development

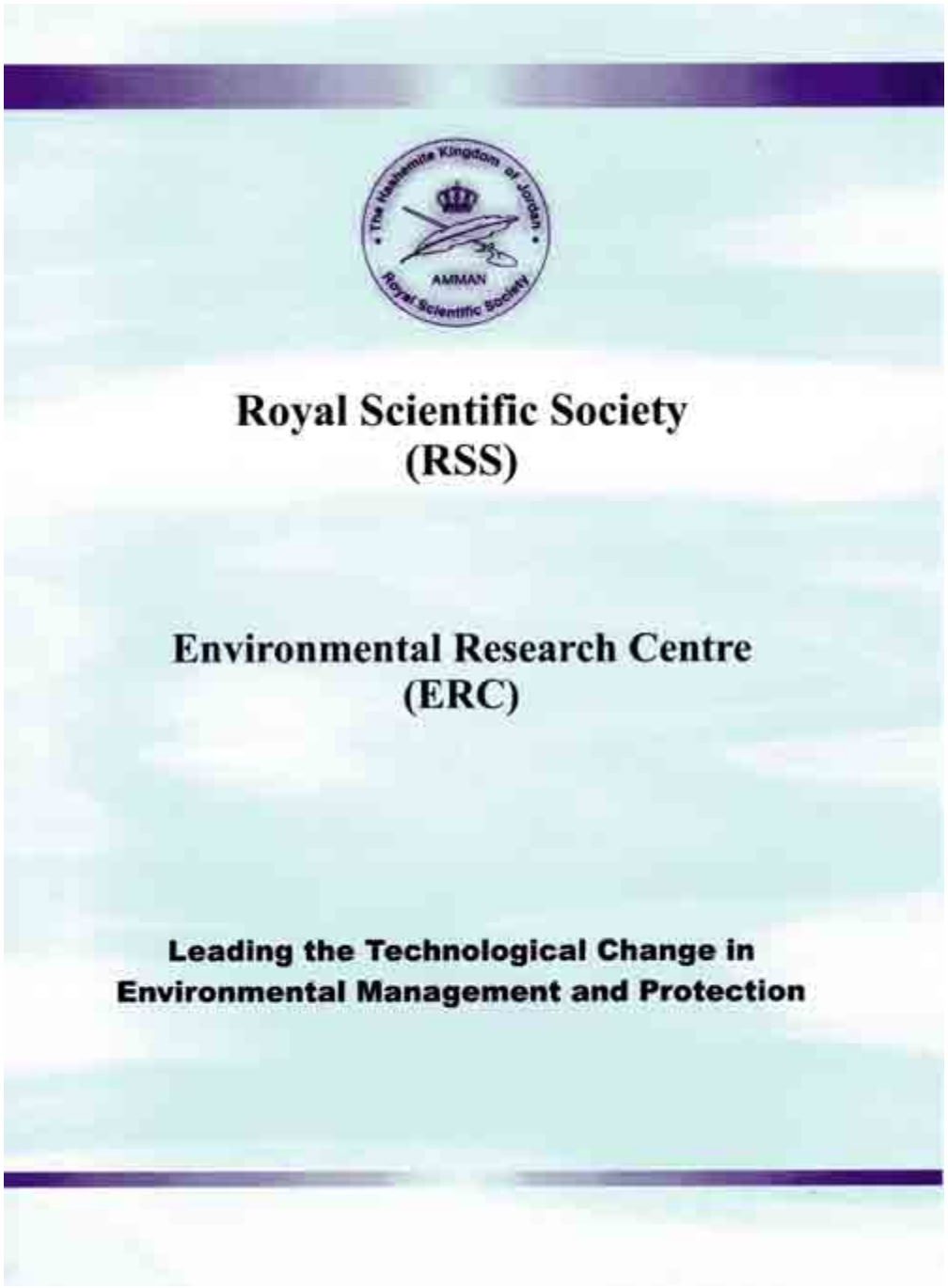
THE HASHEMITE KINGDOM OF JORDAN

Ministry of Agriculture

National Center for Agricultural Research and Technology Transfer (NCARTT)

5 Years, Work plan

2001 - 2005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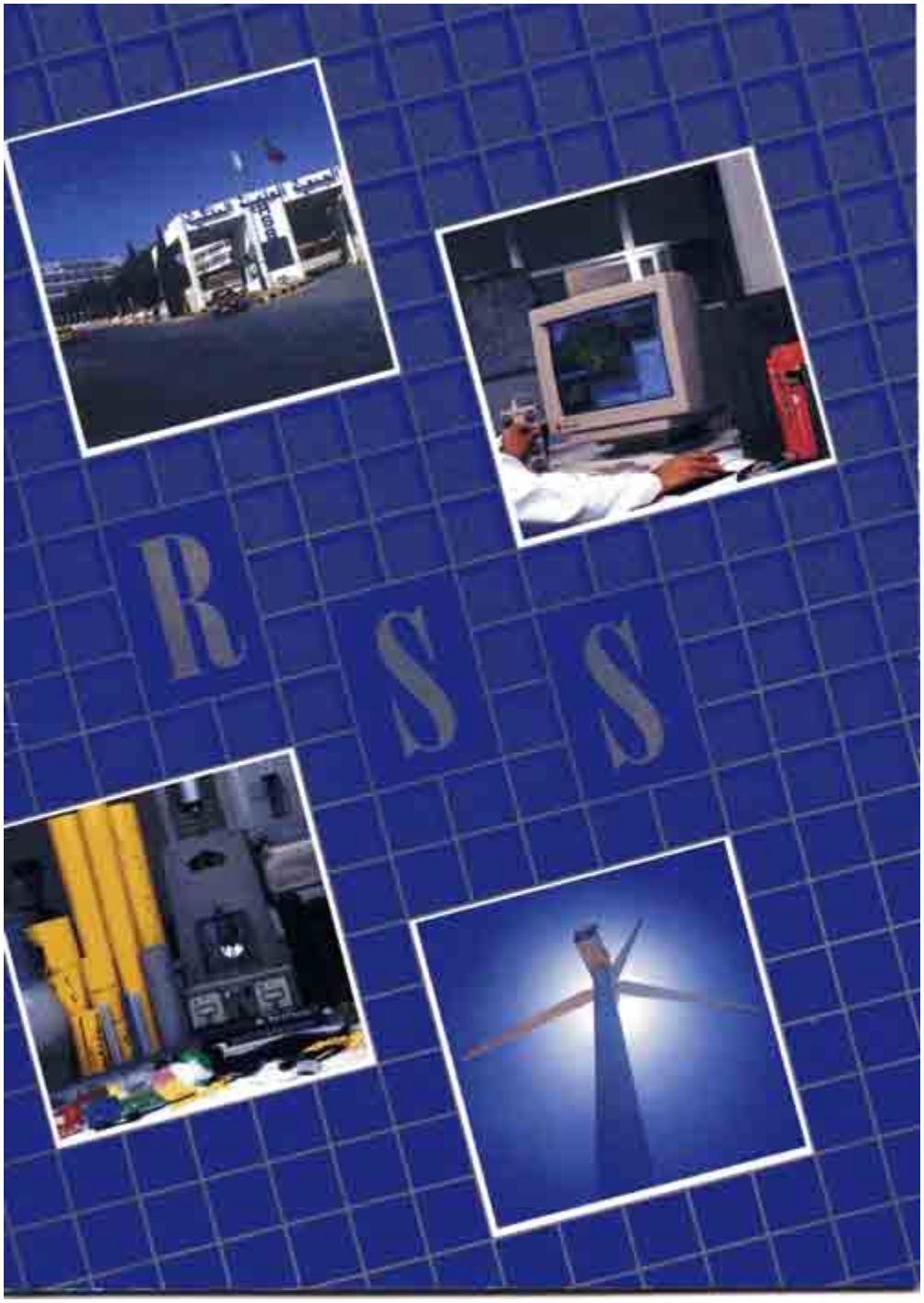
Royal Scientific Society
Royal Scientific Society
(RSS)
Environmental Research Centre
(ERC)
Leading the Technological Change in
Environmental Management and Protection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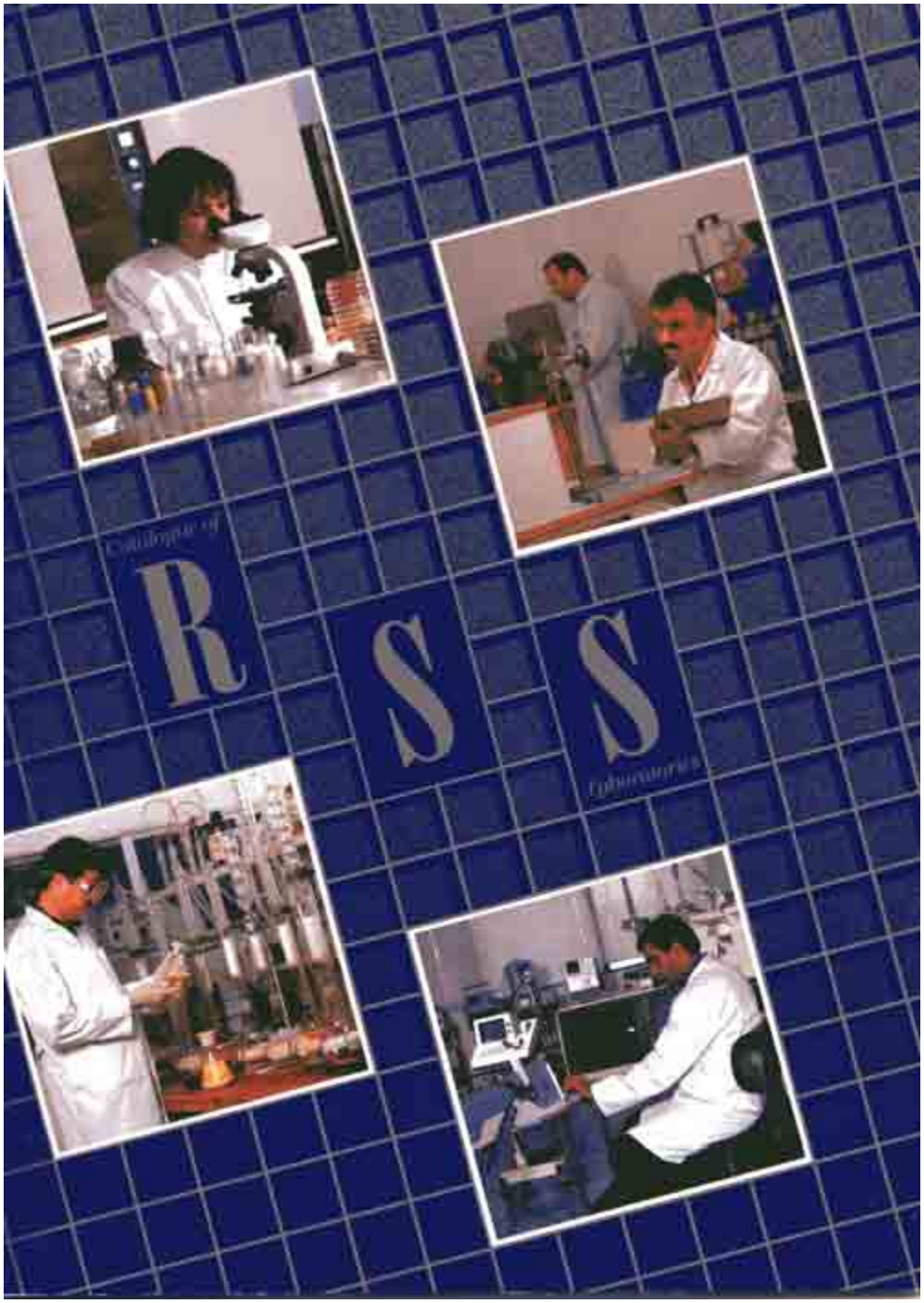
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Water and Environment Research and Study Center (WERSC)