JORDAN Pesticide Evaluation Report and Safe Use Action Plan (PERSUAP) in support of Initial Environmental Examinations for the RIAL and KAFA'A projects

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Acronyms used in the Jordan PERSUAP

ANE	Asia & Near East Bureau, USAID
ARS	Agricultural Research Service, USDA
ASEZA	Aqaba Special Economic Zone Authority
AZB	Amman-Zarqa Basin
BEO	Bureau Environmental Officer
CABI	Commonwealth Agricultural Bureau International, United Kingdom
CAS	Chemical Abstract Service
CDM	Camp, Dresser, McKee consulting firm
CFR	Code of Federal Regulations
COP	Chief of Party
CPC	Crop Protection Compendium, of CABI
DCHA	Democracy, Conflict, and Humanitarian Assistance (a USAID Bureau)
DCOP	Deputy Chief of Party
DF	Dry Flowable (pesticide formulation)
DPR	Department of Pesticide Regulation (California)
EA	Environmental Assessment
EC	Emulsifiable Concentrate (pesticide formulation)
ENCAP	ENvironmental Assessment CAPacity Building Program (Africa Bureau)
EPA	Environmental Protection Agency (USEPA)
EUROGAP	European Retailers Partnership-Good Agricultural Products
GAM	Greater Amman Municipality
GTZ	German Technical Assistance
GUP	General Use Pesticide (EPA designation)
IEE	Initial Environmental Examination
IPM	Integrated Pest Management
IR	Intermediate Result (USAID project designation)
JUST	Jordan University for Science and Technology
JVA	Jordan Valley Authority
KAFA'A	Knowledge and Action Fostering Advances in Agriculture
L	Liquid (pesticide formulation)
LC	Liquid Concentrate (pesticide formulation)
MEO	Mission Environmental Officer
MOA	Ministry of Agriculture
MOE	Ministry of Environment
MOP	Ministry of Planning
NCAART	National Center for Agricultural Research and Transfer of Technology
NGO	Non-Governmental Organization
OECD	Organization of Economic Cooperation and Development
OIRP	Office of International Research Programs, USDA/ARS
OP	Organophosphate (type of pesticide)
PEA	Programmatic Environmental Assessment
PER	Pesticide Evaluation Report
PERSUAP	Pesticide Evaluation Report and Safe Use Action Plan

PAN	Pesticide Action Network
PC	Pesticide Chemical (EPA code)
PMS	Pesticide Management Specialist
PIC	Prior Informed Consent (international agreement)
POP	Persistent Organic Pollutant (international agreement)
PPT	Powerpoint Presentation
PUC	Pesticide Use Checklist
PVO	Private Voluntary Organization
REO	Regional Environmental Officer
RIAL	Reuse for Industry, Agriculture and Landscaping
RUP	Restricted Use Pesticide (EPA designation)
SC	Sprayable Concentrate (pesticide formulation)
SEA	Supplemental Environmental Assessment
SL	Slurry (pesticide formulation)
SO	Strategic Objective (USAID project designation)
SUAP	Safe Use Action Plan
UNFAO	United Nations Food and Agriculture Organization
USAID	United States Agency for International Development
USEPA	United States Environmental Protection Agency
USDA	United States Department of Agriculture
WG	Water Dispersible Granules (pesticide formulation)
WHO	World Health Organization
WP	Wettable Powder (pesticide formulation)
WRE	Water Resources Management Program
WRIP	Water Reuse Implementation Program

JORDAN Pesticide Evaluation Report and Safe Use Action Plan (PERSUAP) in support of IEEs for the RIAL and KAFA'A projects

PROGRAM/ACTIVITY DATA:

Programs/Activity Numbers: Reuse for Industry, Agriculture and Landscaping (RIAL)
Task Order No. 816 Contract No. LAG-I-00-98-00034-00

Country/Region: Jordan

PERSUAP Preparer: Alan Schroeder, PhD, Consultant to Tellus Institute

Programs/Activity Titles: Knowledge and Action Fostering Advances in Agriculture (KAFA'A)
Contract No. 278-C-00-03-00222-00

1.0 BACKGROUND AND PROJECTS DESCRIPTIONS

As part of its strategic objective to improve water resources in Jordan, in the 1990s the United States Agency for International Development (USAID) initiated a series of development projects in Jordan to improve water sector institutions and policies on groundwater and treated wastewater use in agriculture, rehabilitate the water sector infrastructure of pipelines and treatment plants, and expand public awareness of conservation issues. The KAFA'A and RIAL projects are the latest in this series of investments to increase the efficiency of water use in the agricultural, industrial, and landscaping sectors. KAFA'A has pilot sites in the north, middle and south Jordan Valley, west of Amman and in the Amman-Zarqa Basin, north of Amman. RIAL has three wastewater pilot treatment sites in Aqaba, Wadi Musa, and Irbid (at the Jordan University of Science and Technology—JUST), and in the future will have a project to serve the Greater Amman Municipality—GAM.

Much of Jordan, outside of the Jordan Valley and Aqaba, is high plateau desert, with sandy and calcareous soils, 300-400 meters to the underground water table, and a high evaporation rate. Therefore, surface and sub-surface drip irrigation is being promted. Soil organic matter is very low everywhere in the country. There are relatively few pests in the highlands. The Jordan Valley, on the other hand, has been cultivated for millennia, and has a repertoire of pests.

The semi-arid climate in Jordan ensures the presence of relatively few pest problems. Naturally dry conditions and large expanses of desert between the green areas control the development and movement of many pests.

Much of the Jordan Valley is in greenhouse production. The Jordan Valley has a very shallow water table as much of it sits near or below sea level. Production on RIAL project sites in Wadi Musa and Aqaba is relatively new, and pests have not yet taken hold there.

KAFA'A

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KAFA'A

The acronym for KAFA'A in Arabic translates as "efficiency" in English. The project itself involves the transfer of knowledge, management skills, and tools to farmers in the Jordan Valley

and Amman-Zarqa Basin (AZB), creating incentives for changing water use practices through marketing connections, a loan program, and policy advocacy, and improving public and private sector technical support services.

The KAFA'A Project is designed to achieve its objectives through farmer and extension agent training, field demonstrations, community action programs, university curriculum reform, and media campaigns to enhance the awareness of the public and government decision makers to policy constraints. The ultimate goals of the project are to change farmer attitudes and behavior in the use of water resources in agriculture and improve the economic returns per unit irrigation water used. A secondary goal is to find economically viable ways to replace the use of fresh water in irrigation with treated wastewater.

RIAL

The Reuse for Industry, Agriculture and Landscaping (RIAL) Project was initiated in June 2004 and seeks to maintain and expand on existing agricultural reuse projects initiated under the Water Reuse Implementation Program (WRIP) and to develop new agricultural and landscaping projects utilizing reclaimed water. In addition the RIAL project will engage Jordanian industries in water conservation, recycling and wastewater reuse through implementation of pollution prevention opportunities in an environmental management system framework. The RIAL project seeks to support expanded and sustainable wastewater reuse in Jordan through activity implementation and identification and development of appropriate financial mechanisms and product markets.

Specific objectives of the RIAL Project are to: Help establish permanence of wastewater reuse in Jordan; Improve regulatory capability for monitoring and management of reuse activities; Improve acceptance of wastewater reuse. The RIAL project is organized in three major tasks: Implementation of Direct Water Reuse for Agriculture and Landscaping; Institutional Strengthening and Public Participation; Water Reuse, Conservation and Pollution Prevention in Industries.

1.1 SO2 Results Framework

The KAFA'A and RIAL projects are being implemented under USAID/Jordan's Strategic Objective #2 (SO2), "Improved Water Resources Management." KAFA'A and RIAL help to achieve two Intermediate Results (IR) packages under SO2: IR1, "Stronger Water Sector Institutions and IR2, "Increased Efficiency in Use of Water Resources."

1.2 Purpose and Scope of IEEs and PERSUAP

As required by USAID's Pesticide Procedures (22 CFR 216.3(b)(1)(i)), this PERSUAP will consider and mitigate the environmental and human health consequences of pesticide procurement and use, and technical assistance and training in pesticides, according to the "factors to consider," i.e., paragraphs a to l of the Pesticide Procedures. This PERSUAP is being submitted specifically to address use of the accepted pesticides, as listed below, on the two projects and in support of an IEE for each of them.

1.3 Pesticides Accepted for use in RIAL and KAFA'A

The following pesticides are evaluated for the two IEEs in this technical PERSUAP, listed by generic or accepted common name

Fungicides

RIAL	KAFA'A
copper hydroxide	copper sulfate
fenarimol	mancozeb
hymexazol	metalaxyl
tebuconazole	sulfur
trifloxystrobin	

Seed Treatments

RIAL
triadimenol

Insecticides

RIAL	KAFA'A
beta-cyfluthrin	beta-cypermethrin*
beta-cypermethrin*	chlorpyrifos
chlorpyrifos	cypermethrin
cyfluthrin	imidacloprid
cypermethrin	indoxicarb
deltamethrin	methidathion
dimethoate	spinosad
imidacloprid	thiamethoxam
lambda cyhalothirn	
malathion	
methidathion	
oxydemeton methyl	
thiachloprid	

Nematicides

RIAL
fenamiphos

Acaricides

RIAL	KAFA'A
dicofol	abamectin

1.4 Summary of the Pesticides being proposed for the KAFA'A Project

Fifty-two products (15 for KAFA'A, 35 for RIAL, and 2 for both projects) were evaluated to settle on the current list of 29 pesticides that meet the selection criteria. Potential replacements of nominated pesticides were also evaluated. A total of 29 pesticides are being proposed for use in the following categories:

Pesticide Types	No.
Fumigants	0
Fungicide seed treatments	1
Insecticide stored seed treatments	0
Nematicides	1
Herbicides	0
Bactericides	0
Fungicides	9
Insecticides	16
Acaricides	2

Following is a table of toxicity for each pesticide, based upon EPA's classification scheme.

USEPA Toxicity Class			
Class I highly toxic	**Class II moderately toxic**	**Class III slightly toxic**	**Class IV relatively non-toxic**
copper hydroxide	betacypermethrin \2	beta-cyfluthrin	abamectin
copper sulfate	chlorpyrifos	dicofol EC	mancozeb
cyfluthrin \1	cypermethrin \2	indoxycarb	sulfur
deltamethrin-decis	dimethoate	malathion	
dicofol WP	fenarimol \2	metalxyl	
fenamiphos	hymexazol	tebuconazole	
methidathion	imidacloprid \2	thiamethoxam	
oxydemeton-methyl \1	lambda-cyhalothrin	trifloxystrobin	
	thiacloprid		
	triadimenol \2		

\1 range I-II depending on concentration, \2 range II-III depending on concentration or formulation

Pesticides with no classification or signal word (likely not toxic): spinosad.
Note that different formulations (WP vs EC) of dicofol have different toxicities.

1.5 Restricted Versus General Use Pesticides

For the two projects, the following list shows EPA classification to be General Use Pesticides (GUP), generally safe enough for the untrained, and Restricted Use Pesticides (RUP)—here some of the insecticides and a nematicide—put in bold type, to be used only by those who will be required to receive specialized safety training, with follow-up monitoring for enforcement/compliance, and should be gradually phased out.

Restricted (RUP) versus General Use (GUP) Pesticides

Fungicides
copper hydroxide GUP
cuprofix GUP
fenarimol GUP
hymexazol-Anvil GUP
kumulus GUP
mancozeb GUP
metalaxyl GUP
tebuconazole GUP
trifloxystrobin GUP

Seed Treatments
triadimenol GUP

Insecticides
beta-cyfluthrin GUP
beta-cypermethrin GUP
chlorpyrifos GUP
cyfluthrin RUP
cypermethrin RUP
deltamethrin RUP
dimethoate GUP
imidacloprid GUP
indoxycarb GUP
lambda cyhalothirn RUP
malathion GUP
methidathion RUP
oxydemeton methyl RUP
spinosad GUP
thiachloprid GUP
thiamethoxam GUP

Nematicides
fenamiphos RUP

Acaricides
abamectin GUP
dicofol GUP

Key issue for Restricted (RUP) versus General (GUP) Use Pesticides

Restricted Use Pesticides are very toxic and should not be used by untrained personnel. The key IEE/PERSUAP issue will be to ensure that training is absolutely included in the two projects, especially where RUPs are intended for use, along with provision of safety equipment if farmers cannot/will not afford or buy it.

1.6 KAFA'A and RIAL activities involving pesticides

The KAFA'A project works to develop marketing and production practices for select crops that show potential for production and export expansion within and outside of Jordan. The RIAL project is primarily producing for markets in Jordan, and with emphasis, through the Aqaba Special Economic Zone Authority (ASEZA) Municipality-level initiative, on tourist and new agriculture development initiatives in Aqaba.

The projects address local (RIAL) and local/international (KAFA'A) farmer and market linkages, and they also integrate activities back into the supply side by providing technical assistance to increase production so there are sufficient volumes of marketable products of suitable quality. Due to very limited production area in Jordan, a major focus is in increasing output through increasing productivity, and saving water. Through RIAL, area under cultivation and irrigation will increase on land formerly not intensively cultivated. Increasing productivity necessitates the use of yield-enhancing technologies, including a combination of improved seeds, fertilizers and pesticides. Increasing area planted necessitates the availability of water, in addition to these other inputs. Inputs are bought by farmers from the private sector, with little or no subsidization, except for emergency pests. Some of the target crops may change as market and other conditions change, though most will likely remain the same.

1.7 Crops, forage and trees produced by KAFA'A and RIAL

Cropping pattern for KAFA'A Demonstration Sites

North Jordan Valley:
1. Citrus Management
2. Mango
3. Avocado

Middle Jordan Valley:
1. Hot Pepper
2. Sweet Pepper
3. Grapes
4. Pineapple

5. Cucumber (management)
6. Tomato (management)

South Jordan Valley:

1. Beans
2. Eggplants
3. Broccoli
4. Artichoke
5. Fine Beans
6. Potato
7. Cactus
8. Pineapple

Highlands Amman-Zarqa Basin (well water):

1. Pears
2. Peaches
3. Apricot
4. Onion

Highlands Amman-Zarqa Basin (well water):

1. Alfalfa
2. Clover
3. Sudan Grass
4. Rye Grass
5. Millet
6. Sorghum
7. Corn
8. Pistachio
9. Jojoba
10. Fruit Trees
11. Cactus

Cropping pattern for RIAL Demonstration Sites

1. Crops, like forage, winter cover and field crops (medium and large-scale pilot plots and farmers using secondary treated water in Aqaba and Wadi Musa):

grass for tourists projects/golf courses
alfalfa
sorghum
millet
barley
vetches
maize
Sudan grass

2. Higher value crops like greenhouse cut flowers, ornamentals and fruit trees (large- and medium-scale farmers and landscape in Aqaba, Wadi Musa, and the highlands). No vegetables pemitted yet with secondary-treated drip waste water:

cut flowers for hotels
ornamentals
olive
pistachio
almond
apricot
peach
palm
guava
lemon
papaya
walnut
fig
grapes

The diversity of crops necessitates the use of a diverse range of pesticides, both to manage for resistance and to address the wide range of crop types and situations.

2.0 The Pesticide Evaluation Report (PER)

As required by USAID's Pesticide Procedures (22 CFR 216.3(b) (1) (i)), this PERSUAP and associated IEEs will consider the environmental and human health consequences of pesticide use and procurement, and technical assistance and training in pesticides, according to the "factors to consider," i.e., paragraphs a to l of the Pesticide Procedures.

Pesticide Procedures Element a: USEPA registration status of the proposed RIAL and KAFA'A pesticides. Pesticides are registered in the U.S. as formulated products and also by the technical active ingredients. "Registration status" possibilities of the active ingredients and the formulated products include never registered, active registration, and cancelled registration.

USAID is effectively limited to using pesticide active ingredients registered in the U.S. by the U.S. Environmental Protection Agency for the same *or similar* uses. Emphasis is placed on *similar use* because many of the pests found overseas are not present in the USA, and therefore pesticides may not be registered for the exact same use, but often are registered for similar pests and pest situations. In addition, host country pesticide registration procedures must also be identified and followed.

Jordan has pesticide registration procedures and has produced codes for all accepted pesticides, and has pesticide regulations written in Arabic. In the past, almost all pesticides available world-wide received Jordan registration. Only in the last two years (2002-2004) has the government more tightly regulated what can and cannot be used.

For many if not most overseas technical folks, there is much confusion about EPA registration numbers. Therefore, a short EPA registration number tutorial is included here, below.

Numbers often confused with EPA registration numbers

The most common EPA 'numbers' are the EPA PC Codes, or the Pesticide Chemical (PC) codes to categorize or keep track of active ingredients only. The PC code is different from registration numbers. Registration numbers are given to individual specialized pesticide products formulated from active ingredients by the pesticide manufacturers. Registration numbers are also given to the technical active ingredients. So, for one active ingredient pesticide chemical (PC) code, there can be hundreds of registered products, each with their own unique registration number.

And, to make things more complicated, a particular pesticide product may have a registration number from *having been registered* in the past, but then the EPA may cancel the use of that specific product, and leave the registration number intact. So, even a registration number is not sufficient. One has to search beyond the registration number to see if it is still active (still registered for use in the USA) or cancelled (not able to be sold or used in the USA).

The best way to see this "cancelled versus active" registration data is to type in the name of the active ingredient into the site http://www.pesticideinfo.org/Search_Chemicals.jsp. One will receive a list containing that active ingredient and closely-related active ingredients. From that list, click on the active ingredient again to arrive at a webpage that shows "identification, toxicity, use, water pollution potential, ecological toxicity and regulatory information" for the chemical active ingredient that you are researching. Then, go down the page until you see the following (this is from the PAN database webpage for metalaxyl):

Products Containing This Chemical
Current and historic U.S. registered products

View US Products **o** All Products (64 Total) o Currently Registered Products (32 Total)

One can see that there are only 32 currently or actively registered metalaxyl products out of a total of 64 metalaxyl products (note that all 64 will have EPA registration numbers, but only 32 are active, which means that only those 32 can legally be purchased and used; the other 32 have been cancelled for use in the USA). One can either view all 64, or just the 32 that are actively registered by EPA for use in the USA.

Other numbers confused with EPA registration numbers

Other numbers that are found associated with pesticides and that are often confused with registration numbers are the Chemical Abstract Service (CAS) Registry Number and the California DPR Chemical Code (DPR).

The Chemical Abstract Service (CAS) Registry Number is a unique identifier assigned to each chemical and to some mixtures of chemicals by the Chemical Abstracts Service, a division of the American Chemical Society. This number is used worldwide. The CAS registry number includes up to 9 digits which are separated into 3 groups by hyphens (xxxxxx-xx-x). The first part of the number, starting from the left, has up to 6 digits; the second part has 2 digits. The final part consists of a single check digit or checksum that makes it easy to determine whether a CAS number is valid or not.

Due to the high amount of agriculture and stringent environmental controls, the USA state of California tightly controls pesticides used, and has its own code for tracking pesticides. The California Department of Pesticide Regulation (DPR) assigns a unique chemical code number to serve as an identifier for a particular pesticide active ingredient or mixture of active ingredients. These numbers are also often mistaken for EPA registration numbers, but they are not.

Pesticide companies operating or selling in Jordan

The pesticide companies that are most actively operating in Jordan include: Dow-USA, Dupont-USA, Syngenta-Switzerland, Bayer-Germany, BASF-Germany, Sankyo-Japan, and Vapco-Jordan, a local company.

The list below shows all of the pesticides proposed for use on the KAFA'A and RIAL projects that have active EPA registrations for same or similar use in the USA, and have therefore been approved for use by this PERSUAP.

Formulations and Manufacturers of RIAL and KAFA'A Projects Pesticides

Fungicides	**Product name, formulation, manufacturer**
copper hydroxide	(Coproxide 50 WP, Sankyo-Japan)
copper sulfate	(Cuprofix, Dow-USA, also Gowan-USA)
fenarimol	(Rubigan 4 EC, Dow-USA)
hymexazol	(Tachigaren 30 L, Sankyo-Japan)
mancozeb	(Dithane M45, Dow-USA)
metalaxyl (+ mancozeb mix)	(Ridomil Gold MZ 68 WP, Syngenta-Switzerland)
sulfur	(Kumulus 80 DF, BASF-German)
tebuconazole	(Folicur 25 WP, Bayer-German)
trifloxystrobin	(Flint 50 WG, Bayer-German)
Seed Treatments	
triadimenol	(Bayfidan 250 EC, Bayer-German)
Insecticides	
beta-cyfluthrin	(Bulldock 25 EC, Bayer-German)
beta-cypermethrin	(Betamethrate 5 EC, Vapco-Jordan)
chlorpyrifos	(Dursban 48 EC, Dow-USA)

cyfluthrin	(Baythroid 50 EC, Bayer-German)
cypermethrin	(Cyperkill 10 EC, Vapco-Jordan)
deltamethrin	(Decis 2.5 EC, Bayer-German)
dimethoate	(Dimethoate 40 EC, BASF-German)
imidacloprid	(Confidor 200 SL, Admire, Bayer-German)
indoxacarb	(Avaunt insecticide, DuPont-USA)
lambda-cyhalothirn	(Karate 5 EC, Syngenta-Switzerland)
malathion	(Malathion 57 EC, Vapco-Jordan)
methidathion	(Supracid 40 EC, Syngenta-Switzerland)
oxydemeton methyl	(Metasystox 25 EC, Bayer-German)
spinosad	(Spintor 2 SC, Dow-USA)
thiachloprid	(Calypso 480 SC, Bayer-German)
thiamethoxam	(Actara insecticide, Syngenta-Switzerland)

Nematicides

Fenamiphos	(Nemacur 10 EC, Bayer-German)

Acaricides

abamectin	(Vertimec 18 EC, Syngenta-Switzerland)
dicofol	(Kelthane 50 WP, Dow-USA)

EPA and Jordan Registration for RIAL and KAFA'A Projects Pesticides

Fungicides (10)	**EPA Registrations**	**Jordan Registration, #**
copper hydroxide	yes	yes, 2018
copper sulfate	yes	yes, 1536
fenarimol	yes	yes, 1119
hymexazol	yes	yes, 628
mancozeb	yes	yes, 136
metalaxyl	yes	yes, 1292
sulfur	yes	yes, 91
tebuconazole	yes	yes, 1620
trifloxystrobin	yes	yes, 1659
Seed Treatments		
triadimenol	yes	yes, 1069
Insecticides (16)	**EPA Registrations**	**Jordan Registration, #**
beta-cyfluthrin	yes	yes, 1304
beta-cypermethrin	yes	yes, 194
chlorpyrifos	yes	yes, 1781
cyfluthrin	yes	yes, 778
cypermethrin	yes	yes, 526
deltamethrin	yes	yes, 1725
dimethoate	yes	yes, 1450
imidacloprid	yes	yes, 1038
indoxacarb	yes	yes, 1694
lambda-cyhalothrin	yes	yes, 7403
malathion	yes	yes, 1035
methidathion	yes	yes, 37
oxydemeton-methyl	yes	yes, 653
spinosad	yes	yes, 1845
thiachloprid	yes	yes, 1840
thiamethoxam	yes	yes, 1781
Nematicides		
Fenamiphos	yes	yes, 1706
Acaricides		
abamectin	yes	yes, 912
dicofol	yes	yes, 1022

Below is a list of pesticides that have been considered for use, but have been disallowed from (not permitted for) use in Jordan, primarily because they have no active USAEPA registration status, due to high toxicity to humans or the environment.

Pesticides Disallowed—Not Permitted—for use on KAFA'A and RIAL in Jordan

Fungicides	EPA Registrations	Jordan Registration	Project
benomyl	No	yes	RIAL
captan (Cryptanol)	No	yes	RIAL
hexaconazole (Anvil 5 EC)	No*	yes	KAFA'A
methyl-bromide	Too toxic**	yes	RIAL
pyrazaphos (Afugan 30 EC)	No	yes	RIAL
spiroxamine (Impulse 500 EC)	No	yes	RIAL
toclofos-methyl (Rizolex)	No	yes	RIAL
zineb (+ copper hydroxide)	No	yes	RIAL

Insecticides	EPA Registrations	Jordan Registration	
alpha-cypermethrin (Astor)	No***	yes	Both
alpha-cypermethrin (Harvest Sypermethrin)	No***	yes	Both
azinphos-methyl (Gusathion 25 EC)	No****	yes	RIAL
carbofuran (Pilarfuran 10 %)	No	yes	RIAL
carbosulfan (Pilarsulfan)	No	yes	RIAL
chorbyrothomis	No	yes	RIAL
methiocarb (Mesurol 50 WP)	No	yes	RIAL
pirimicarb (Primor 50 EC)	No	yes	RIAL
thiocyclam (Eviscet)	No	yes	KAFA'A

Acaraicide	EPA Registrations	Jordan Registration	
dinocap (Karathane 35 LC)	No	yes	RIAL

Notes:

* Anvil 5 EC (hexaconazole) is only registered in the USA for use on mosquitoes, not on agricultural crops. Hexaconazole should not be used due to high toxicity.

** Methyl-bromide is too toxic for use in most countries, especially those with little or no training on safe pesticide use. Jordan is one of those countries.

*** Both projects wished to use these 2 products. The only cypermethrin formulations having active EPA registration status are cypermethrin and beta-cypermethrin. All formulations of alpha-, zeta-, and theta-cypermethrin have all been cancelled by EPA. These are very toxic.

**** Gusathion is not EPA-registered; however other formulations of azinphos-methyl are registered by EPA, and could be chosen by the projects to replace Gusathion.

In addition to the pesticides which have been disallowed for use, there are several pesticides which are actively registered by EPA, but they are also very toxic and should be quickly phased-out (6 months) of use by RIAL and KAFA'A. These are listed below.

Pesticides that should be rapidly phased-out of use on KAFA'A and RIAL in Jordan

cyfluthrin insecticide
deltamethrin insecticide
methidathion insecticide
oxydimeton-methyl insecticide
fenamiphos nematicide

For RIAL and KAFA'A to use these products in the short term, they will require immediate (before the next spraying season-March 2005) training in pesticide safe use and Integrated Pest Management (IPM).

EPA Registration Status Issues and Discussion

This PERSUAP recommends for use on RIAL and KAFA'A projects 9 fungicides, one seed treatment, 16 insecticides, one nematicide, and two acaricides. During the review process, eight fungicides, nine insecticides, and one acaricide were disallowed because there are no EPA-approved uses (no active registrations). These insecticides are also considered too dangerous to be used by general pesticide users.

Further, this PERSUAP recommends that six additional pesticides, listed just above, be rapidly phased out of use on RIAL and KAFA'A, due to very high toxicity, a restricted use category, and a general lack of safe pesticide use training of applicators in Jordan. In addition to these, lambda-cyhalothrin and cypermethrin are considered Restricted Use Pesticides (RUP), and should also be considered, at some point (12 months) for replacement by a less toxic alternative.

Recommendations Based Upon EPA Registration Status

* By six months time from the approval of this PERSUAP and IEEs, the following 5 pesticides should be phased out and replaced by less toxic alternatives:

cyfluthrin insecticide
deltamethrin insecticide
methidathion insecticide
oxydimeton-methyl insecticide
fenamiphos nematicide

* At the end of 3 years, or during the present phase of the projects, all RUP pesticides are replaced by less toxic alternative products.

Two of the remaining pesticides, alpha-cyhalothrin and cypermethrin are RUPs, and should be replaced with less toxic alternatives.

* Update the changes to the list of pesticides and communicate these changes to USAID

USAID Project Managers will need to report changes to less toxic products on the list of pesticides recommended for monitoring purposes.

* Immediate training in safe use of pesticides

RIAL and KAFA'A project participants, including staff, associated staff (from ASEZA), farmers, laborers, and extension agents involved in project implementation require train-the-trainer training in safe pesticide handling, calibration, use and disposal.

* Use of safe handling and use practices

Safe handling and use practices are outlined in another part of this PERSUAP.

* Produce a quick reference guide for all of the pesticides to be used on each project for each type of plant and anticipated pest

A quick reference guide will be useful for pesticide applicators to refer to as they make pesticide choice decisions.

----------End of Element a----------

Pesticide Procedures Element b: Basis for Selection of RIAL and KAFA'A Pesticides. This refers to the economic and environmental rationale for choosing a particular pesticide. In general, the least toxic pesticide that is effective is selected. Basis for selection factors are given in the table below.

Basis Factors: P=Price, A=Availability, E=Efficacy, S=Safety, N=Environment

Fungicides

RIAL	Basis	KAFA'A	Basis
copper hydroxide	PAE	copper sulfate	PAESN
fenarimol	PAES	mancozeb	PAESN
hymexazol	PAES	metalaxyl	PAESN
tebuconazole	PAES	sulfur	PAESN
trifloxystrobin	PAES		

Seed Treatments

RIAL	Basis
triadimenol	PAES

Insecticides

RIAL	Basis	KAFA'A	Basis
beta-cyfluthrin	PAES	beta-cypermethrin	PAE
beta-cypermethrin	PAE	chlorpyrifos	PAES
chlorpyrifos	PAES	imidacloprid	PAESN
cyfluthrin	PAE	indoxicarb	PAES
cypermethrin	PAE	methidathion	PAEN
deltamethrin	PAE	spinosad	PAESN
dimethoate	PAES	thiamethoxam	PAESN
imidacloprid	PAESN		
lambda cyhalothirn	PAE		
malathion	PAES		
methidathion	PAEN		
oxydemeton methyl	PAE		
thiachloprid	PAES		

Nematicides

RIAL	Basis
fenamiphos	PAE

Acaricides

RIAL	Basis	KAFA'A	Basis
dicofol	PAES	abamectin	PAESN

Basis for Selection of Pesticides Issues and Discussion

The primary issue with basis of selection of pesticides is that, for practical reasons, most pesticides in Jordan are chosen on the basis of price, availability and efficacy. Safety and environmental protection criteria are considered in cases where farms will export to European markets under strict EUROGAP environmental and human health standards, such as at some pilot KAFA'A farm project sites in the Jordan Valley. Pesticides chosen for these sites, and a few others, are therefore given an N designation for environment and an S for safety.

Relative safety to human health is an added benefit associated with the use of GUPs (General Use Pesticides) proposed by both projects. GUP pesticide use should be promoted, as all GUP pesticides are considered relatively safer, and an S for safety is granted as a selection criteria. Furthermore, safety consideration is not granted to pesticides considered in the USA to be RUP (Restricted Use Pesticides), or to those with a very high (EPA class I— highly toxic) toxicity rating.

Recommendations Based Upon Pesticide Selection Criteria

- Intend to use more biological and organic pesticides

The water use and reuse projects' agricultural/ornamental components compliance, driven in part by EUROGAP and other international import standards and treaties, like POPs and PIC, can serve as a local catalyst opportunity for the evolution toward the use of biological and organic compounds to drive specialized high-value and high- return organic and transitional agriculture for local, regional and international markets.

The list of pesticides shows only two products that are derived from natural sources: abamectin, which is a mixture of insecticidal and miticidal compounds called avermectins produced by fermentation from the soil bacterium *Streptomyces avermitilis*; and spinosad, a mix of new insecticidal compounds called spinosyns produced by fermentation of the soil actinomycete microorganism *Saccharopolyspora spinosa*.

Pyrethrum, a mix of natural chemicals called pyrethroids, can be extracted from chrysanthemum flowers, and provides good general pest control. Extracts from Neem trees are effective insecticides that are commercially available. Spore extracts from the bacterium *Bacillus thuringiensis* are effective against worm or caterpillar larvae of Lepidopteran (moth and butterfly) pests. A list of botanical products studied and registered by EPA is attached at the end of this report.

The projects should study and try additional natural products.

- Enhance understanding of and emphasis on Integrated Pest Management (IPM), with pesticide use as a last resort

IPM combines all tactics and tools available for pest management, and puts the focus on use of synthetic pesticides only as a last resort. Several non-pesticide methods are being used in Jordan. For example, many greenhouses in the Jordan Valley have fine mesh siding to exclude white flies and aphids. Soil sterilization using solar heating is practiced as a cheap alternative to the use of methyl bromide, even though it is not as effective but is much safer.

The projects should study and try to use more IPM tactics.

- Immediately start pesticide safe use and environmental protection training

Training on safe use for protecting human health and the environmental has not occurred much in Jordan. It is imperative that such training begin as soon as possible for program field staff as trainers and for farmers and laborers. Staff members from both water use/reuse projects have produced draft training guidelines and modules to be edited and used. Additional materials from USDA and USEPA can help enhance these efforts.

The projects should continue to collect and adapt good training materials, and make plans for training extension-type trainers, who can then train farmers.

- A three-year transition period to phase out the use of RUPs (Restricted Use Pesticides)

Seven of the EPA-registered products for the two projects are RUPs, with the synthetic pyrethroids making up the bulk (4) of these. Restricted use pesticides are approved by EPA for use only by well-trained and certified persons. No such training exists in Jordan, and when it is implemented it takes time to be accepted, enforced and to take hold. Unless there are absolutely no substitute pesticides available, RUP products should be phased out in favor of less toxic or damaging pesticides. There are several synthetic pyrethroids available as GUPs in the U.S. These can be investigated, over time, as alternatives.

----------End of Element b----------

Pesticide Procedures Element c: Extent to which the proposed pesticide use is, or could be, part of an IPM program. USAID policy promotes the development and use of integrated approaches to pest management whenever possible. This section discusses the extent to which the proposed pesticide use is incorporated into an overall IPM strategy, and if not, how it can be.

IPM Program Issues and Discussion

History of IPM in Jordan

There have been very few IPM courses or programs implemented in Jordan. GTZ, the German Technical Assistance group, has done some IPM courses in Jordan that have focused on specific issues or crops. From 1994 to 1996, GTZ ran a project on biological control of whiteflies and other pests.

Most of the IPM theoretical training and knowledge exists in Jordan through well-educated individuals in government, universities, and international projects. Most farmers and farm laborers have not had such formalized training; however some non-pesticide pest control tactics that make sense and are affordable have been adapted by them in the Jordan Valley. These include the use of screen mesh on greenhouses to exclude whiteflies and aphids, and the use of solar heat to sterilize soil.

Further, new technologies flow across both sides of the Jordan River and are being adopted and adapted, as they offer cost-savings and regional/international marketability advantages. But, many of these tactics are used more by immediate usefulness than by actual IPM planning, design and integration into an IPM program. General IPM tactics are summarized below.

IPM Tactics

IPM makes use of combinations of the following tactics: cultural (use of resistant varieties, crop rotation, variation in time of planting or harvesting, crop refuse destruction, pruning, planting trap crops), mechanical (hand destruction, exclusion by barriers, trapping), physical (heat, cold, humidity, traps, sound), and biological (introduction and/or protection of imported or indigenous natural enemies of pests, propagation and dissemination of microbial control agents).

IPM can also include use of: natural chemical methods (by using attractants, repellents, sterilants and growth inhibitors), genetic methods (propagation and release of sterile or genetically incompatible pests), and regulatory means (plant and animal quarantines, suppression and eradication programs) to the extent possible while permitting the safe integration of pesticides with farmers' traditional cropping and pest management systems.

Recommendations Based Upon Pesticide Selection Criteria

- IPM plans should be written for each of the crops to be protected

Table 1, in column 2, has IPM recommendations for practical ways to reduce the use of the pesticides accepted by this PERSUAP and approved by the Project IEEs.

The strongest selling points for IPM beyond the health and environmental benefits are:

- IPM is more effective then synthetic pesticides *in the long run*
- IPM is less damaging to essential soil health and nutrient cycling
- IPM generally requires less capital investment
- IPM can be used preventatively to eliminate or minimize the need for "responsive" controls (that is, applying pesticides after a pest outbreak occurs and much damage already has been done).

IPM Program Planning and Design

The design of an IPM program can be developed with all of the fundamental parts of any good management plan. The vital parts of a plan include a definition of the targeted primary (small or large-holder farmers) and secondary (marketers, processors, transporters, and consumers) beneficiaries, implementation partners (farmers, laborers, extension personnel, national, regional and international organizations), listed production constraints (problem identification) and IPM strategies for dealing with them.

Elements of IPM Program

Since IPM is not an active part of crop production in Jordan, and there are few lists of the pest species of Jordan, a basic understanding of the steps or elements needed in an IPM program is addressed below.

Step 1: Evaluate and use non-pesticide management options first.
Use both preventive and responsive/curative options that are available to manage pest problems. Farmers may prevent pests (and avoid requiring pesticides) by the way they select plants, prepare the site, plant and tend growing plants. Along with prevention, farmers may respond to or cure the problem via physical, mechanical or biochemical methods.

Preventive Interventions:

Plant selection
- choose pest-resistant strains
- choose proper locally-adapted plant varieties
- diversify plant varieties or inter-crop plants
- provide or leave habitat for natural enemies

Site preparation and planting
- choose pest-free or pest-avoidance planting dates (e.g., early planting in rainy season avoids stem borers in cereals)
- enhance/provide shade for shade-grown crops
- assign crop-free (fallow) periods and/or rotate crops
- install buffer zones of non-crop plants and/or physical barriers
- improve soil health
- use and appropriate planting density
- rotate crops
- low-till, no-till

Plant tending/cultivation practices
- fertilize and irrigate appropriately
- remove weeds while small and before sowing crop

Responsive/Curative Interventions:

Physical/mechanical control
- remove or destroy diseased plant or plant parts & pests
- weed
- install traps

Biochemical control
- pheromones (very effective, but not currently easily accessible or economical, however, they are becoming more so)
- homemade botanical pesticides
- repellents

Biological control
- release or augment predators
- release or augment parasites/parasitoids
- release or augment microbial pesticides

Step 2: Assess IPM Needs and Establish Priorities. In planning IPM projects consider crop protection needs, farmers' perceptions of pest problems, pesticide use history and trends,

availability of IPM technology, farming practices, access to sources of IPM expertise, support for IPM research and technical assistance, and training needs for farmers and project field extension workers.

Next, identify strategies and mechanisms for fostering the transfer of IPM technology under various institutional arrangements, mechanisms, and funding levels. Define what is available for immediate transfer and what may require rapid and inexpensive adaptation and validation research. During the planning stages of an IPM program, the inputs from experienced IPM specialists will be extremely useful. If possible, set up an initial planning workshop to help define and orient implementation activities, and begin to assign individual responsibilities.

Step 3: Learn and value farmers' indigenous IPM tactics, and link with and utilize all local resources/partners. Most farmers are already using their own forms of IPM, many of which are novel, self-created, adapted for local conditions, and many of which work well. These include: mechanical and physical exclusion; crop rotation, trap crops, cover crops, and green manures; local knowledge of strategic planting times; water, soil and fertilizer resource management; intensive intercropping; leaving refuge habitat for natural enemies; soil augmentation and care leading to healthy nutrient cycling; transplanting; and weeding.

Accurate assessments of these farmer technologies, as well as of actual losses due to different constraints in farmers' fields are a must, before designing a crop production and pest management program. Crop loss figures provided by small and large farmers alike, and thus projected and reported by international organizations, are often inaccurate, and thus overestimated.

Step 4: Identify key pests for each target crop. Although hundreds of species of organisms can be found in a crop at any one time, only a few of them may cause substantial crop losses, and be considered pests. Become familiar with the key pests of target crops, whether they are primary or secondary pests, how to positively identify them. Monitor their population size, the kind of damage that they cause, and their life cycle. These usually amount to a relatively small number of species on any one crop and can include any combination of insects, pathogens, weeds, diseases, and vertebrates. A few other species, known as secondary or occasional pests, attain damaging status from time to time; especially if over-spraying occurs and kills natural predators that naturally regulate their populations.

The vast majority of insect species found in any one crop are actually predators and parasites of the plant-feeding species. Many small-holder farmers are not aware of these distinctions and must be taught to correctly identify the more common beneficial species, as well as pests, found in their crops. Incorrect identification of beneficial insects, predators or neutral insect species, may lead to unnecessary pesticide applications. This diagnostic phase requires sampling and careful observation. Usually, most key pests are fairly well known by local farmers and government extension personnel. However, a few species may be poorly known or understood because they occur at night, are hidden, or small. These include soil-inhabiting species such as nematodes and insect larvae (wireworms, white grubs, cutworms), mites, and pathogens (viruses, bacteria, mycoplasma, fungi). In addition, farmers usually do not understand the role of some insects as vectors of plant diseases.

Step 5: Do effective activities and training to promote IPM. A number of activities are very effective in promoting IPM in developing countries:

Learning-by-doing/discovery training programs
The adoption of new techniques by small- and large-holder farmers occurs most readily when program participants acquire knowledge and skills through personal experience, observation, analysis, experimentation, decision-making and practice. First, frequent (usually weekly) sessions are conducted for 10–20 farmers during the cropping season in farmers' fields by trained instructors or extension agents. Because these IPM training sessions take place in the farmers' own environment, (1) they take advantage of the farmers' own knowledge; and (2) the farmers understand how IPM applies to their own farms.

Of these IPM training sessions, four or five analyze the agroecosystem. They identify and describe conditions such as soil type, fertility, and needs, weather, crop stage, each pest, their natural enemies, and relative numbers of both. Illustrations and drawings are provided, as necessary. Extensionists apply a Socratic method, guiding farmers with questions to discover important insights and supplying information only when absolutely necessary.

Farmers may also experiment with insect zoos where they can observe natural predators of their pests in action and the impact of pesticide on both. Knowledge and skills necessary for applying IPM are best learned and understood through practice and observation, understanding pest biology, parasitism, predation and alternate hosts; identifying plant disease symptoms; sampling population size; and preparing seed beds.

Recovering collective memory
Pest problems often emerge because traditional agricultural methods were changed in one way or another, or lost. These changes can sometimes be reversed. This approach uses group discussions to try to identify what changes might have prompted the current pest problem.

Smallholder support and discussion groups
Weekly meetings of smallholders, held during the cropping season, to discuss pest and related problems can be useful for sharing the success of various control methods. However, maintaining attendance is difficult except when there is a clear financial incentive (e.g., credit).

Demonstration projects
Subsidized experiments and field trials at selected farms can be very effective at promoting IPM within the local community. These pilots demonstrate IPM in action and allow comparison with traditional synthetic pesticide-supported cultivation.

Educational material
In many countries, basic written and photographic guides to pest identification and crop-specific management techniques are unavailable or out of date. Such material is essential. Videos featuring graphic pictures of the effects of acute and chronic pesticide exposure, and interviews

with poisoning victims can be particularly effective. A study in Nicaragua found videos to be the most important factor in motivating farmers to adopt IPM.

Youth education
Promoting and improving the quality of programs on IPM and the risks of synthetic pesticides has been effective at technical schools for rural youth. In addition to becoming future farmers, these students can bring informed views back to their communities.

Organic food market incentive
Promoting organic certification for access to the lucrative and rapidly growing organic food market can be a strong incentive to adopt IPM.

Step 6: Partner successfully with other IPM implementers. Many IPM projects consist of partnerships between two or more organization, e.g., donors, governments, PVOs and NGOs. If these partnerships are not forged with care, the entire project may be handicapped. The following design steps are considered essential.

Articulate the partnership's vision of IPM
Organizations may forge partnerships based on a common commitment to "IPM"—only to discover too late that that their visions of IPM differ considerably. It is important that partners articulate a common, detailed *vision* of IPM, centered on the crops and conditions the project will encounter.

Confirm partner institutions' commitment
Often, organizations make commitments they do not intend to (or are unable to) fulfill completely. The extent of commitment to IPM integration into project, design, and thus implementation depends strongly upon the following key variables:

- **IPM program integration into larger projects**. The IPM program is likely to be part of a larger "sustainable agriculture" project. The IPM program must fit into a partner's overall program. The extent of this integration should be clearly expressed in the proposed annual work plan.
- **Cost sharing**. The extent of funds (or in-kind resources) is a good measure of a genuine partner commitment.
- **Participation of key IPM personnel.** Large partner organizations should have staff with expertise in IPM who are assigned specifically to IPM work. In strong partnerships, these staff members are actively involved in the partnership.

Step 7: Monitor the fields regularly. The growth of pest populations usually is related closely to the stage of crop growth and weather conditions, but it is difficult to predict the severity of pest problems in advance. The crops must be inspected regularly to determine the levels of pests and natural enemies and crop damage. Current and forecast weather should be monitored. Farmers, survey personnel, and agricultural extension staff can assist with field inspections. They can train other farmers to be able to separate pests from non-pests and natural enemies, and to determine when crop protection measures, are necessary.

Step 8: Select an appropriate blend of IPM tools. A good IPM program draws from and integrates a variety of pest management techniques. IPM does not require predetermined numbers or combinations of techniques, nor is the inclusion or exclusion of any one technique required for IPM implementation. Flexibility to fit local needs is a key variable. Pesticides should be used only if no practical, effective, and economic non-chemical control methods are available. Once the pesticide has been carefully chosen for the pest, crop, and environment, it should be applied only to keep the pest population low. When dealing with crops that are already being treated with pesticides, IPM should aim first at reducing the number of pesticide applications through the introduction of appropriate *action thresholds*, while promoting appropriate pesticide management and use practices and shifting to less toxic and more selective products and non-chemical control methods. In most cases, NGOs/PVOs will probably need to deal with low to moderate levels of pesticide use. Either way, an IPM program should emphasize preventive measures and protect a crop, while interfering as little as possible with the production process.

Step 9: Develop education, training, and demonstration programs for extension workers. Implementation of IPM depends heavily on education, training, and demonstration to help farmers and extension workers develop and evaluate the IPM methods. Hands-on training conducted in farmers' fields (as opposed to a classroom) is a must. Special training for extension workers and educational programs for government officials and the public are also important.

Step 10: Monitor and Evaluate. First, develop data collection tools, and then collect baseline data at the beginning of the project to identify and determine the levels of all variables that will need to be tracked. These may include numbers and types of pests, predators, and soil microorganisms; relative numbers of all non-target animals (birds, lizards, mollusks) that may be negatively impacted if pesticides are used; soil and water samples to determine levels of pesticide residue; soil samples to learn dominant soil types and to predict soil nutrition, requirements, and fertilizer/pesticide activities; pesticides, application and safety equipment available; and, amounts and type of training received by target audiences.

Develop methods for measuring the effectiveness of each IPM tactic used, and of their sum in reducing pest damage and crop losses. Also, develop methods for monitoring environmental health (maintaining and encouraging high levels of predators and soil microorganisms) and human health if pesticides are used. Kits are available for determining the level of cholinesterase-inhibiting pesticides to which farmers and applicators have been exposed. Make checklists for farmers to use when applying pesticides that indicate the type of application and safety equipment used, and the rates at which pesticides were applied.

----------End of Element c----------

Pesticide procedures element d: Proposed method or methods of application, including the availability of application and safety equipment: This section examines in detail how the pesticide is to be applied and the measures to be taken to ensure its safe use.

On most pilot test sites for both projects, tanks with motorized sprayers are pulled through the field, thus limiting exposure to applicators. The pesticide application equipment is generally borrowed from local farmers and pesticides are purchased in relatively small quantities from local agricultural supply stores for immediate use. Most pesticides are not stored for later use and are not purchased in large quantities. Therefore, storage is not an issue, except perhaps in parts of the Jordan Valley. Pesticide evaporation is high due to high temperatures and relatively dry air. Residues are reduced due to the presence these conditions. Safety equipment will be provided by the projects.

At Wadi Musa, spraying is done by back-pack sprayer and wand. At urban sites like JUST and GAM, spraying will likely be done by backpack sprayers. In Jordan, calibration is generally done by fixed volume per liter, not area-hectares (or dunums) to be sprayed, as in most other countries. Pesticides are diluted into large, tractor-pulled tanks in Aqaba and the Jordan Valley.

Since drip irrigation is used extensively by both projects, some soil and systemic pesticides could be applied with the drip flow.

In the highlands, at Wadi Musa, and at Aqaba, neither of the projects expects to need to spray much since these are virgin areas for production of most crops. Therefore, pesticide use is expected to not be high.

Many of the farms in the Jordan Valley are adopting EUROGAP standards of production, which include a pesticide evaporation disposal pit, separate temporary storage sheds for fertilizer and pesticides, workers quarters, a shower for field laborers to rinse off after application, safety equipment, and maximum allowable pesticide residue levels. In addition, fourteen percent of all agriculture in the Jordan Valley is done in plastic greenhouses. These present opportunities for use of biological control agents.

The following are some general measures that can be used to ensure safe pesticide use.

Mitigating potential pesticide dangers; measures to ensure safe use

If there are no feasible alternatives to pesticides, take the following measures to mitigate and reduce their risks to human health and the environment. Note that risk is a function of both toxicity and exposure. Reducing risk means (1) selecting less toxic pesticides and (2) selecting pesticides that will lead to the least human exposure before, during and after use. Also, for more detailed information on pesticides and use, refer to the chapter on Safer Pesticide Use, contained in these guidelines.

Reduce exposure time or the degree of exposure
Before using
Transport:

- separate pesticides from other materials being transported

Packaging:

- follow international and national norms and guidelines
- use packaging (small containers) adapted to local needs
- eliminate re-use of packaging materials

Storing:

- develop strict guidelines for village-level storage
- ensure permanent, well-marked labeling
- follow and respect national norms
- use appropriate language and approved pictograms

Formulating:

- use appropriate type and concentration

During use

Training:

- should be continuous
- should identify level and audiences (distributors, farmers, transporters)

Use application equipment:

- should be adapted to user needs and possibilities
- should assure maintenance and availability of parts and service

Use protective equipment and clothing:

- should be adapted to local climatic conditions
- should be adapted to user needs and resource possibilities
- should eliminate exposure rather than just reduce it, if at all possible

Focus on "buffer zones" around the following:

- housing
- environment: water, sensitive areas

After using

- know, enforce, respect exclusion periods after application
- assure proper cleaning and rinsing off of:
  - applicators' preparation and application equipment
  - applicators' clothing
  - storage containers
- develop a workable monitoring and evaluation system for:
  - adherence to national and international policies regarding pest management and pesticides
  - health effects on applicators, the local population, and domestic animals
  - efficacy on target pests

- impacts on environment: water, soils, air
- elimination of pesticide leftovers and containers

Application and Safety Equipment Issues and Discussion

Spraying is quite straightforward, with few issues on these pilot project sites. If spraying will be done by non-project staff, for example for emergency response to a locust plague or other epidemic, they need to use safety equipment on pilot project sites. There are outside groups, like the Ministry of Agriculture (MOA), the Aqaba Special Economic Zone Authority (ASEZA), and the Jordan Valley Authority (JVA) who may spray the pilot sites under such emergencies. They should be required to use safety equipment on project sites, for safety and liability issues.

Recommendations Based Upon Application and Safety Equipment

* Immediate (before the next season) training in safe handling and use

Project staff who will use of oversee the use of pesticides require training in safe handling and use of insecticides. Very little of this training has been provided in the past in Jordan.

* The production of safe use training materials and posters

One way to remind applicators of safety issues is through the production and use of high quality training materials and safe use posters. These should be adapted or borrowed from other Arabic-speaking countries for use in Jordan.

* Administer the Pesticide Use Checklist (PUC) for NGOs/PVOs

Translate into Arabic and administer during training the PUC to all project participants to gather baseline data on their understanding of safe pesticide issues.

* Procurement and use of protective clothing and safety equipment

Protective clothing and safety equipment needs to be provided for all pesticide handlers, users, applicators, and others present while application occurs. Both projects will need to have safety equipment on hand for use during application.

----------End of Element d----------

Pesticide procedures element e: Any acute and long-term toxicological hazards, either human or environmental, associated with the proposed use, and measures available to minimize such hazards: This section of the PERSUAP examines the acute and chronic toxicological data associated with the proposed pesticide. In addition to hazards, this section also discusses measures designed to mitigate any identified toxicological hazards, such as training of applicators, use of protective clothing, and proper storage.

The acute and chronic human and environmental toxicological hazards are listed for each pesticide in Table 1. Primary and Special Concerns are also outlined for each pesticide. Use precautions outlined in Table 1 for each pesticide. There are several ways to mitigate exposure to humans. Some of the best examples are outlined below.

Mitigation of Human Toxicological Exposures

Most pesticide poisonings result from careless handling practices or from a lack of knowledge regarding the safer handling of pesticides. The time spent learning about safer procedures and how to use them is an investment in the health and safety of oneself, one's family, and others. Pesticides can enter the body in four major ways: through the skin, the mouth, the nose, and the eyes. A checklist is given below to help avoid these various routes of overexposure to pesticides.

To avoid dermal (skin) exposure

- Check the label for special instructions or warnings regarding dermal exposure
- Use recommended protective clothing and other equipment as listed on the label
- Do not re-enter the area until deposit has dried or re-entry interval is past

To avoid oral (mouth) exposure

- Check the label for special instructions or warnings regarding oral exposure
- Never eat, drink, or smoke, chew tobacco while working with any pesticide
- Wash thoroughly with soap and water before eating, drinking, smoking, or chewing tobacco
- Do not touch lips to contaminated objects (such as nozzles)
- Do not wipe mouth with contaminated hands or clothing
- Do not expose food, beverages, drinking vessels, or cigarettes to pesticides
- Wear a face shield when handling concentrated pesticides

To avoid respiratory (lungs) exposure

- Read the label to find out if respiratory protection is required
- If respiratory protection is required, use only an approved respiratory device
- Stay upwind during application

To avoid eye exposure

- Read the label to find out if eye protection is required
- If eye protection is required use goggles to protect eyes or a face shield to protect eyes and face
- Keep pesticide container below eye level when pouring

In addition to these common sense measures, there is a way to ensure protection against exposure to pesticides by the type of clothing required for different classifications of pesticides (the classification of each pesticide by EPA toxicity class I, II, III, or IV, and signal word DANGER, WARNING, CAUTION). Toxicity class and signal word is provided for each RIAL and KAFA'A pesticide in Table 1. Good protection is achieved by following the protective clothing and equipment guide.

Protective Clothing and Equipment Guide

	Label Signal Words		
Formulations	Caution	Warning	Danger
Dry	Long-legged trousers and long - sleeved shirt; shoes and socks.	Long-legged trousers and long-sleeved shirt; shoes and socks; wide-brimmed hat; gloves.	Long-legged trousers and long-sleeved shirt; shoes and socks; wide-brimmed hat; gloves; cartridge or canister respirator if dusts in air or if label precautionary statement says: □Poisonous or fatal if inhaled.
Liquid	Long-legged trousers and long-sleeved shirt; shoes and socks; wide-brimmed hat.	Long-legged trousers and long-sleeved shirt; shoes and socks; wide-brimmed hat; rubber gloves. Goggles if required by label precautionary statement. Cartridge or canister respirator if label precautionary statement says: □Do not breathe vapors or spray mists.□ or □Poisonous if inhaled.□	Long-legged trousers and long-sleeved shirt; rubber boots, wide-brimmed hat; rubber gloves, goggles or face shield. Canister respirator if label precautionary statement says: □Do not breathe vapors or spray mists, □ or □Poisonous if inhaled.□
Liquid (when mixing)	Long-legged trousers; long-sleeved shirt; shoes and socks; wide-brimmed hat; gloves;	Long-legged trousers and long-sleeved shirt; shoes and socks; wide-brimmed hat; rubber	Long-legged trousers and long-sleeved shirt, rubber boots, wide-brimmed hat, rubber gloves,

	rubber apron.	gloves; goggles; or face shield; rubber apron. Respirator if label precautionary statement says: □Do not breathe vapors or spray mist □, or □Poisonous (or fatal or harmful) if inhaled.□	goggles or face shield. Canister respirator if label precautionary statement says: □Do not breathe vapors or spray mists□, or □Poisonous if inhaled.□
Liquid (when mixing the most toxic concentrates)	Long-legged trousers; long-sleeved shirt; boots, rubber gloves, water proof wide-brimmed hat.	Water repellant, long-legged trousers and long-sleeved shirt, rubber boots; rubber gloves; rubber apron; water-proof wide-brimmed hat, face shield, cartridge or canister respirator	Water-proof suit, rubber gloves, water-proof hood or wide-brimmed hat.

Long-legged trousers and long-sleeved shirt, rubber boots, wide-brimmed hat, rubber gloves, goggles or face shield. Canister respirator if label precautionary statement says: 'Do not breathe vapors or spray mists', or 'Poisonous if inhaled'. Check Label Signal Word (Pesticide Signal Words also found in Table 1).

Mitigating Toxicological Hazards Issues and Discussion

Very little pesticide use has been required at most pilot sites outside of the Jordan Valley, because there have been very few pests present in any numbers. In the highland basin, north of Amman, few pests exist. At Aqaba, so far, only desert locusts have presented a spray target. There is no safety equipment present at this site. At Wadi Musa, photographs show a person applying pesticides with a backpack sprayer, with all appropriate spray equipment (gloves, hat, overalls, mask, and boots).

Recommendations Based Upon Toxicological Hazards

* Avoid damage to environment through training to avoid non-target ecosystems

IPM and safe use training should components or training modules on how to mitigate exposure of non-target organisms to pesticides.

* Get training in proper use of protective equipment and safe use of pesticides

All project personnel who handle, supervise, or spray pesticides will require safe use training.

* Develop or adapt posters on use of safety equipment

For many projects using pesticides, posters exist to remind users of safety concerns and equipment. Such posters, in Arabic, should be ordered and posted where pesticide workers can see and review them. This can be done as part of a training program.

----------End of Element e----------

Pesticide procedures element f: Effectiveness of the requested pesticide for the proposed use: This section of the PERSUAP requires information similar to that provided in item b, but more specific to the actual conditions of application. This section also considers the potential for the development of pest resistance to the proposed insecticide.

All of the pesticides chosen for the project were selected based upon effectiveness as one of the primary criteria, from farmer experience. As little pest infestation and little pesticide use is expected on these pilot projects, resistance will likely not be an issue. The only place that will be an exception to this is in the Jordan Valley, where many farmers are spraying regularly.

Pesticides Effectiveness Issues and Discussion

Effectiveness will likely not be an issue for these pilot projects.

Recommendations Based Upon Pesticide Effectiveness

* Rotate pesticides to reduce the build-up of resistance

Each project has chosen several pesticide products for each type of pests, in able to rotate pesticides are reduce the occurrence of resistance.

* Monitor resistance by noting reduction in efficacy of each pesticide product

Project staff, especially in the Jordan Valley, can monitor the kill rate of the pesticides for any reduction in efficacy, communicate with neighboring farmers and extension agents, to determine when pesticide rotation is called for.

----------End of Element f----------

Pesticide procedures element g: Compatibility of the proposed pesticide use with target and non-target ecosystems: This section examines the potential effect of the pesticide on organisms other than the target pest (for example, the effect on bee colonies in the spray area). Non-target species of concern also include birds, fish, aquatic organisms, and beneficial insects. The potential for negative impact on non-target species should be assessed and appropriate steps should be identified to mitigate adverse impacts.

The effect of each insecticide on non-target ecosystems will depend on how long it stays in the environment, or rather its rate of break-down, or half-life. Half-life is defined as the time (in days, weeks or years) required for half of the pesticide present after an application to break down into degradation products. The rate of pesticide breakdown depends on a variety of factors including temperature, soil pH, soil microbe content and whether or not the pesticide is exposed to light, water and oxygen.

Many pesticide breakdown products are themselves toxic, and each may also have a significant half-life. Since pesticides break down in soil, light and water, there are half-lives for exposure to each of these factors. In the soil, types and numbers of microbes present, water, oxygen, temperature, pH, and soil type (sand, clay, loam) all affect the rate of breakdown. Most pesticides also break down, or photo-degrade, with exposure to light. Lastly, pesticides can be broken down, or hydrolyzed, with exposure to water.

Table 1 addresses the potential impact of each pesticide on aquatic organisms, fish, birds, bees, beneficial insects, and ground water contamination. Please refer to this table to see the impacts and suggestions for mitigating these impacts.

Non-target Organisms Issues and Discussion

Since pests and pesticide use will likely be low on the project pilot sites, there should be little impact to non-target organisms. However, since water and groundwater are a very limited resource in Jordan, all attempts must be made to reduce contamination. And, botanical and biological pesticides should be promoted on these pilot projects.

Recommendations Based Upon Non-target Organisms

* Investigate the use of botanical and biological controls, especially in greenhouses

The geography (islands of green crop in a sea of sand and desert) and cropping methods (plastic house production in the Jordan Valley) in Jordan are very amenable to the use of biological controls. The projects could investigate their use.

----------End of Element g----------

Pesticide procedures element h: Conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils: This section examines issues such as the potential for contamination of surface and groundwater sources.

Each pesticide has physical characteristics, such as solubility in water, ability to bind to soil particles and be held (adsorbed) by soil so they do not enter the soil water layers and the ground water table, and their natural breakdown rate in nature. This data can be found for the pesticides proposed for use on the two projects by checking each pesticide on the PAN website:

http://www.pesticideinfo.org. The water solubility, soil adsorption and natural breakdown rates, if available, are included at the bottom of the webpage for each parent chemical.

In general, pesticides with water solubility greater than 3 mg/liter have the *potential* to contaminate groundwater; and pesticides with an adsorption coefficient of less than 1,900 have the potential to contaminate groundwater. And, pesticides with an aerobic soil half-life greater than 690 days or an anaerobic soil half-life greater than 9 days have the potential to contaminate groundwater. Pesticides with a hydrolysis half-life greater than 14 days have potential to contaminate groundwater.

The detailed environmental, hydrological, and soil conditions at the projects' pilot sites are included in the official Project Papers for RIAL and KAFA'A. Look at these documents to find details. Further, potential for surface and ground water contamination for each pesticide are addressed in Table 1. Look to this table to determine contamination potential and use with care.

Groundwater Contamination Issues and Discussion

Most of the proposed pesticides are not potential ground water contaminants. Further, the arid conditions under which the pesticides will be used indicate that they will be rapidly evaporated upon application. In the highlands east of the Jordan Valley, the distance to ground water tables is great, and many of the soils contain a highly impermeable calcium layer. There is much closer proximity to surface water via rivers and canals in the Jordan Valley. Do not apply pesticides near or in water.

Recommendations Based Upon Groundwater and Environmental Contamination

* Continue to utilize pesticides with low ground water contamination potential

As one of the criteria for selection of pesticides, determine the potential for risk of surface and ground water contamination at each site, and choose pesticides based upon little contamination potential.

* Investigate and promote the use of biological pesticides to replace synthetic pesticides

Lists of botanical and biological pesticides are included in this report. Investigate their usefulness and availability in Jordan.

----------End of Element h----------

Pesticide procedures element i: Availability of other pesticides or non-chemical control methods: This section identifies other options for control of pests and their relative advantages and disadvantages.

Only two products being used on project sites, Spinosad and Abamectin, are derived from microbial organisms. There are no other biological or botanical products being anticipated by either of the projects. There are international and local companies that can provide this type of support to RIAL and KAFA'A, should they so choose. And, these companies specialize in many, if not most of the pests encountered in Jordan.

Biological pesticides are available commercially from two large international companies, Koppert of Holland and Biobest of Belgium, and one regional company called BioBee right next door in Israel. The Dutch company Koppert provides many biological controls against spider mites, beetles, leaf miners, mealy bugs, thrips, aphids, whiteflies, and moth and butterfly larvae. Koppert also provides the Koppert Side Effects List, a list of the side effects of pesticides on biological organisms. Their website is: http://www.koppert.com.

Biobest of Belgium provides many of the same or similar biological controls as Koppert, and includes a control against leaf hoppers. Their website is: http://www.biobest.be.

The Israeli company, BioBee (a local/regional subsidiary of Koppert), provides biological controls for aphids, spider mites, thrips, leaf miners, mealy bugs, and white flies. Their website is: http://www.bio-bee.com/english/welcome.html. They are right across the Jordan River.

Also, attached to this report is a list of botanical products that can be tried for pest control.

Non-Chemical Control Methods Issues and Discussion

Clearly, biological pesticides do exist for control of many of the pests anticipated to infest or infesting RIAL and KAFA'A pilot sites. And, Jordan provides an incredible opportunity for these to work, with its virtual 'islands' of green crops in a vast brown desert—and ideal situation for the use of biologicals, and with pest control opportunities in greenhouses. Many of these control agents work exceptionally well in a greenhouse (plastic house) setting.

Project staff can look into procuring these biologicals and do cost comparisons with synthetic pesticides. These biological pesticides may prove valuable for organic produce and exporting regionally and to Europe.

Recommendations Based Upon Non-Chemical Control Methods

* Research and try more biological pesticides

All the resources are provided in this PERSUAP to do this. The websites given provide direct links to companies producing biological 'pesticides'.

----------End of Element i----------

Pesticide procedures element j: Host country's ability to regulate or control the distribution, storage, use, and disposal of the requested pesticide: This section examines the

host country's existing infrastructure and human resources for managing the use of the proposed pesticides. If the host country's ability to regulate pesticides is inadequate, the proposed action could result in greater harm to the environment.

Jordan is a developing and rapidly evolving peaceful country in the Middle East, with evolving pesticide regulations. These are available only in Arabic. So far, Jordan has evolved from a stance of admitting almost all pesticides produced globally to a more limited list of 942 products at present, each with an internal registration control number.

Jordan recently approved and signed a Plan of Action for U.S.—Jordan Joint Forum on Environmental Technical Cooperation. This Plan includes agreements to undertake consultations on cooperation on technical environmental issues, and harnessing market forces to protect the environment. In 2002, a new Ministry of Environment (MOE) was formed out of the powerful Ministry of Planning.

One goal of this agreement is to ensure compliance with environmental standards. As this compliance improves, Jordan's ability to regulate or control the distribution, storage, use, and disposal of pesticides will improve.

Regulatory Issues and Discussion

The country of Jordan is at an historic crossroads, with a new MOE formed, and assistance from USAID, to lead environmental management in the region. As it evolves, implementation and compliance will improve during the length of the RIAL and KAFA'A projects. The projects can take advantage of and contribute to this progress with the use of progressive pest control tactics and safe use of pesticides.

Recommendations Based Upon Regulations and Compliance

* Continue to work with the new MOE as they implement environmental compliance

RIAL and KAFA'A staff should continue to work closely with the MOE to stay abreast of developments in the regulation and registration of pesticides.

----------End of Element j----------

Pesticide procedures element k: Provision for training of users and applicators: USAID recognizes that safety training is an essential component in programs involving the use of pesticides. The need for thorough training is particularly acute in developing countries, where the level of education of applicators may typically be lower than in developed countries.

or different pesticide. This will be reported to USAID, as a small section, along other reporting requirements.

----------End of Element 1----------

Table 1. Synoptic Summary of the Proposed Pesticides to be Promoted in the KAFA'A and RIAL projects, by categories, including registration in the US and Jordan, target pests, summaries of IPM measures, toxicological and environmental hazards, and special concerns.

Generic name of Pesticide (or accepted common name)/EPA and Jordan ACB Status	IPM program	Toxicological and Environmental Hazards	Primary concerns
1. Fungicides			
Copper hydroxide; Registered-USEPA. Toxicity Class I Highly Toxic DANGER-Poison; Registered in Jordan. Soil treatment for *Fusarium* and damping off diseases.	Monitoring to detect onset of disease; field counting or other detection methods. Correct target disease ID, treating only at disease threshold level.	Easily absorbed through skin. Corrosive to mucous membranes and cornea. Irritates eyes, skin, and respiratory tract. Causes stomach pain, nausea, and vomiting. Kills aquatic crustaceans and mollusks. Persistent chemical; not broken down in environment.	Potential impacts to humans. **Special concern:** Careful when using near surface water; kills crustaceans and mollusks. Be careful around endangered crustacean and mollusk species.
Copper sulfate; Registered-USEPA. Toxicity Class I Highly Toxic DANGER-Poison; Registered in Jordan. Late and early blight on tomato, potato, cucumber. Angular leaf spot on cucumber.	Crop monitoring to detect angular leaf spot; action thresholds established for disease; crop rotation; use of certified seed; high seeding rates; avoid sprinkler irrigation.	Deadly acute toxicity if ingested. Injury to brain, liver, kidneys, stomach and intestinal lining. Easily absorbed through skin. Corrosive to mucous membranes and cornea. Irritates eyes, skin, and respiratory tract. Causes stomach pain, nausea, diarrhea, and vomiting. Chronic exposure leads to liver disease. Kills fish, mollusks, crustaceans, amphibians, nematodes, flatworms, and zooplankton. Nontoxic to birds. Persistent chemical; not broken down in environment.	Potential impacts to humans, fish, aquatic invertebrates, bees, earthworms, and livestock. **Special concern:** Careful when using near surface water; kills fish, crustaceans, mollusks, amphibians, nematodes, flatworms and zooplankton. Be careful with endangered species.
Fenarimol; Registered-USEPA. Toxicity Class II WARNING or III	Constant monitoring by	Mild eye irritant, and non-irritating to skin. Can affect kidneys and liver. Not mutagenic, non-	Potential impacts to humans.

CAUTION (depending on formulation); Registered in Jordan. Powdery mildew on grapes, eggplant, potato, pear, peach, apricot.	trained scouts to detect presence of powdery mildew. Minimum effective dose of fungicide used; fungicides rotated on a regular basis to prevent resistance.	carcinogenic. No birth defects, but has been shown to produce other fetal effects. On list of pesticides that potentially cause hormone disruption. Highly toxic to aquatic invertebrates. Moderately toxic to fish and green algae. Relatively non-toxic to birds, bees, earthworms, and domestic and wild mammals. Not likely to be toxic to beneficial arthropods. Potential ground water contaminant.	**Special concern:** reproductive effects, and toxicity to fish, aquatic invertebrates, and algae.
Hymexazole; Registered-USEPA. Toxicity Class II WARNING; Registered in Jordan Soil treatment for fungi *Fusarium* wilt and damping off diseases.	Crop monitoring for fungal diseases; Use as a seed treatment should be considered. Other IPM practices include crop rotation, certified seed, and high seeding rates.	Deadly at high doses. PAN Bad Actor chemical. Possible skin irritation and serious eye damage. No reproductive effect, not mutagenic, not teratogenic, not an endocrine disruptor. No sign that it is a carcinogen. Kills fish, amphibians, crustaceans and zooplankton. Low levels of bioaccumulation in organisms. Potential ground water pollutant.	Potential impacts to humans, fish, and other aquatic organisms. **Special concern**: toxicity to fish and other aquatic organisms.
Mancozeb; Registered-USEPA. Toxicity Class IV CAUTION; Registered in Jordan. Early and Late Blight diseases of tomato, potato, cucumber, onion.	Crop monitoring for fungal diseases and action thresholds established. Treat only in greenhouse where disease is detected. Non-chemical control measures are used such as crop	May cause irritation of nose, throat, eyes, and skin. Ingestion causes nausea, diarrhea, vomiting. Can affect thyroid gland. Is considered PAN Bad Actor chemical. USEPA listing as probable human carcinogen. On list of pesticides that are potentially hormone disruptors. Unlikely to produce reproductive effects; non-teratogenic; inconclusive mutagenicity but data suggest non-mutagenic or weakly mutagenic.	Potential impacts to humans, fish, aquatic invertebrates, and grazing animals. **Special concern**: toxicity to fish and aquatic invertebrates, and grazing animals; and potential carcinogenic action in humans.

	rotation, use of certified seed, good sanitation, and hand removal of diseased leaves. Fungicide is rotated to prevent resistance.	Kills amphibians, fish and zooplankton. Moderately to highly toxic to aquatic invertebrates. Not toxic to bees or beneficial arthropods. Moderately toxic to aquatic plants. Domestic/wild mammals not to be grazed in treated areas. Relatively non-toxic to birds.	
Metalaxyl; Registered-USEPA. Toxicity Class III CAUTION; Registered in Jordan. Downey mildew on cucumber and onion.	Constant monitoring by trained scouts to detect presence of insect pests. Minimum effective dosages of pesticides used. Insecticide rotated on a regular basis to prevent resistance.	May irritate eyes and skin. Slightly toxic orally, relatively non-toxic via inhalation. Unlikely to cause reproductive effects in humans at normal exposure levels. Teratogenic effects unlikely; non-mutagenic; unlikely carcinogen. Not an endocrine disruptor. Slightly toxic to fish and toxic to aquatic invertebrates. Practically non-toxic to bees. Not highly toxic to domestic/wild mammals. Relatively non-toxic to birds. Potential ground water contaminant.	Potential impacts to some aquatic invertebrates. **Special concern:** some aquatic invertebrates.
Sulfur; Registered-USEPA. Toxicity Class III CAUTION; Registered in Jordan. Powdery mildew on peppers, grapes, eggplant, potato, pear, peach, apricot.	Crop monitoring is practiced and action thresholds are established. Non-chemical measures used such as crop rotation, use of certified seed, and high seeding rates. Fungicides are	Skin, eye, and mucous membrane irritant. Low toxicity and poses minimal risk to human and animal health. May affect pulmonary function. No reproductive effects; non-mutagenic; non-teratogenic; non-carcinogenic; not a hormone disruptor. Toxic to beneficial predatory mites. Poses minimal threat to non-target organisms. Essentially non-toxic to birds, fish, aquatic invertebrates, bees, livestock, and mammals.	Potential impacts are minimal. **Special concern:** people with chronic respiratory problems should not have chronic exposure to sulfur products. Toxicity to beneficial mites.

	rotated to prevent resistance.		
Tebuconazole; Registered-USEPA. Toxicity Class II WARNING or III depending on formulation; Registered in Jordan. Fusarium, downey mildew, powdery mildew on grapes and all tree fruits; damping off disease; and *Botrytus* on grapes.	Constant monitoring by trained scouts to detect powdery mildew. Minimum effective dosage used. Rotated with other fungicides to prevent resistance.	Eye and skin irritant. Moderately toxic via inhalation. May affect spleen, liver, adrenals, and lens of eye. Possible reproductive affects at high doses. Non-mutagenic, non-teratogenic, non-carcinogenic. Not a hormone disruptor. Harmful to fish, aquatic invertebrates, aquatic plants. Relatively non-toxic to birds. Non-toxic to bees and beneficial arthropods. Slightly toxic to earthworms. Minimal hazard to domestic/wild mammals under normal usage. Potential ground water contaminant.	Potential impacts to humans, fish, aquatic invertebrates, aquatic plants, earthworms. **Special concern:** fish, aquatic invertebrates, aquatic plants.
Trifloxystrobin; Registered-USEPA. Toxicity Class III CAUTION; Registered in Jordan. Powdery mildew	Constant monitoring by trained scouts to detect disease. Minimum effective dosage used. Fungicides rotated regularly to prevent resistance.	Skin and eye irritant. Some reproductive and teratogenic effects noted in test animals. Non-mutagenic; non-carcinogenic; not an endocrine disruptor. Highly toxic to aquatic invertebrates, earthworms, and aquatic plants. Moderately toxic to fish. Non-toxic to birds, bees, beneficial arthropods, and domestic/wild mammals.	Potential impacts to humans, fish, aquatic invertebrates, aquatic plants, and earthworms. **Special concern**: aquatic invertebrates, earthworms, aquatic plants.
2. Seed Treatments			
Triadimenol; Registered-USEPA. Toxicity Classes II WARNING and III CAUTION; Registered in Jordan Powdery mildew (PM).	Use disease-free seed from reputable companies. Rotate with other fungicides to prevent resistance	Possible carcinogen. Suspected endocrine disruptor. Kills fish. Harms plankton.	Potential impacts to humans. **Special concern:** fish, aquatic invertebrates, aquatic plants.

	buildup. Monitoring to detect powdery mildew. Rotate to crops not affected by PM.		
3. Insecticides			
For all insecticides	IPM: For niche market vegetables, where < 50 ha are grown a year nationwide, insecticide application is frequent, even though used as a last resort. Pesticide levels are checked by importers. Insect pest problems tolerated to a degree. Economic thresholds are used to determine when to spray. Insecticides are rotated to prevent resistance. Trained scouts take insect counts at least weekly and no insecticide is applied on a calendar basis. Spraying at night only to avoid contact with foraging bees.		
Beta-cyfluthrin; Registered-USEPA. Toxicity Class III CAUTION; Registered in Jordan Whiteflies on grapes; fruit flies on all tree fruits; bugs, aphids on all fruit and nut trees; cutworms and leaf-hoppers on all grasses.	Constant monitoring by trained scouts to detect insect pests. Minimum effective dosages used. Insecticides rotated regularly to prevent resistance.	Slight irritant to eyes and skin. Headache, dizziness, nausea, vomiting, diarrhea, fatigue and excessive salivation. Non-mutagenic; non-teratogenic; non-carcinogenic; and not on the list of endocrine disruptors.	Potential impacts to humans, beneficial arthropods, wild/domestic mammals, aquatic invertebrates.
Beta-cypermethrin; Registered-USEPA. Toxicity Class II WARNING and Class III CAUTION; Registered in Jordan White flies on citrus, avocado, mango, cactus, pineapple, broccoli, cucumber, tomato, grapes, peppers; cutworms on all grasses; thrips on	Insecticide sprays used as last resort and based on pest densities rather than calendar-based. Threshold densities of pests should be used to determine whether	Possible carcinogen. Irritant to eyes and skin. Headache, dizziness, nausea, vomiting, diarrhea, fatigue and excessive salivation. Seizure, muscle twitching. Suspected endocrine disruptor. Highly toxic to bees. Kills crustaceans, fish, and aquatic invertebrates. Harms earthworms and soil fauna. Practically non-toxic to birds.	Potential impacts to bees, humans, fish, aquatic invertebrates, earthworms, and soil dwelling beneficial arthropods. **Special concern is all the above.**

CAUTION; Registered in Jordan White flies on citrus, avocado, mango, cactus, pineapple, broccoli, cucumber, tomato, grapes, peppers; cutworms on all grasses; aphids on grapes, tomatoes, cucumbers, eggplant, broccoli, artichoke, potato, cactus and fruit trees.	determine whether to apply and the dosage. Rotate insecticides to avoid buildup of resistance.	twitching. Suspected endocrine disruptor. Highly toxic to bees. Kills crustaceans, fish, earthworms, mollusks, zooplankton, and aquatic invertebrates. Harms amphibians and soil fauna. Practically non-toxic to birds.	and soil dwelling beneficial arthropods. **Special concern:** impacts to birds, bees, and all aquatic organisms. Use care around water.
Deltamethrin; Registered-USEPA. Toxicity Class I DANGER-Poison, Highly Toxic; registered in Jordan Cutworms on all grasses, leafhoppers, desert locust outbreaks.	Insecticide sprays used as last resort and based on pest densities rather than calendar-based. Decision thresholds for target pests follow IPM principles. Trained scouting crews regularly monitor for pests.	Eye and skin irritant. Salivation, seizure, convulsions, diarrhea, headache, paralysis, tremors, vomiting, death. Kills honey bees, predatory mites, amphibians, crustaceans, mollusks, and zooplankton. Relatively not toxic to birds. Harms aquatic plants, earthworms, phytoplankton and nematodes. Not likely groundwater contaminant.	Potential impacts to humans, honey bees, aquatic organisms, and beneficial arthropods. **Special concern:** Risks to honey bees, and beneficial arthropods.
Dimethoate; Registered by USEPA Toxicity Class II WARNING; Registered in Jordan. Aphids on all fruit and nut trees, ornamentals, cut flowers.	Insecticide sprays used as last resort and based on pest densities rather than calendar based. Decision thresholds for target pests follow IPM principles. Trained scouting crews regularly	Eye and skin irritant. Moderately toxic by ingestion, inhalation, and dermal absorption. People with respiratory ailments, liver malfunction etc, may be at increased risk. High environmental temperatures increase toxicity. Prolonged exposure to vapors can damage liver and kidneys. Target organs: testes, kidneys, liver, and spleen. Dietary risk from eating treated foods or drinking contaminated water is low. Impaired reproductive function in humans is low. Not likely teratogenic in humans. USEPA classified as potential mutagen and potential carcinogen.	Potential impacts to humans, birds, bees, fish, aquatic invertebrates, domestic and wild mammals, and beneficial arthropods. **Special concern:** Risks to handlers is high; also birds, bees, and beneficial arthropods.

	monitor for pests.	Potential endocrine disruptor. Highly toxic to honey bees. Moderately to highly toxic to birds. Moderately toxic to fish, aquatic invertebrates, and domestic/wild mammals. Potential high risk for beneficial arthropods. Slightly toxic to aquatic plants. Unknown affect in earthworms.	*Considered a pesticide of Special Concern by USEPA (see section 4.1.a)*
Imidacloprid; Registered-USEPA. Toxicity Class III CAUTION; Registered in Jordan. Flies, cutworm on all grasses, wood-boring *Capnodis* and powder beetles on all fruit and nut trees; aphids; thrips on onion, bean, peppers; white flies on citrus, avocado, mango, cactus, pineapple, broccoli, cucumber, tomato, grapes, peppers; aphids on grapes, tomato, cucumber, eggplant, broccoli, artichoke, potato, cactus, pear, peach, apricot, pistachio.	Constant monitoring by trained scouts to detect insect pests. Minimum effective dosages used. Insecticides rotated regularly to prevent resistance.	Mildly toxic orally and dermally. May affect the nervous system. Probably does not have reproductive effects; non-mutagenic; non-teratogenic; non-carcinogenic; not an endocrine disruptor. Highly toxic to birds. Relatively non-toxic to fish. Slightly toxic to aquatic invertebrates and aquatic plants. Moderately toxic to beneficial arthropods and livestock and wild mammals. Harmful to bees only by direct contact. Earthworms unknown.	Potential impacts to humans, birds, domestic/wild mammals, beneficial arthropods, bees. **Special concern:** birds For bees, should not be sprayed onto flowering crop. OK to use as seed treatment, if desired.
Indoxycarb/Indoxacarb: Registered-USEPA. Toxicity Class III CAUTION; Registered in Jordan. Caterpillars, armyworm, thrips on onion, bean, peppers, aphids. Alfalfa, clover, Sudan grass, Rye grass, millet, sorghum, corn, beans,	Insecticide sprays used as last resort and based on pest densities rather than calendar-based. Decision thresholds for target pests follow IPM principles. Regularly monitor	Moderate eye irritation. Can be absorbed through skin. Harmful if inhaled. No teratogenic, reproductive, or carcinogenic effects. Highly toxic to bees. Can kills mammals, birds, fish and aquatic invertebrates.	Potential impacts to humans, birds, bees, fish, aquatic invertebrates, and domestic and wild mammals. **Special concern**: impacts to birds, bees, and all aquatic organisms. Use care around water.

pistachio.	for pests.		
Lambda-cyhalothrin: Registered-USEPA. Toxicity Class II WARNING; Registered in Jordan. Bugs, aphids and spider mites on all fruit and nut trees; and cutworm on all grasses.	Constant monitoring by trained scouts to detect insect pests. Minimum effective dosages used. Insecticides rotated regularly to prevent resistance.	Strong irritant to eyes and skin. Convulsions, cough, labored breath/shortness of breath, abdominal pain. Suspected endocrine disruptor. Contact with skin causes tingling, numbness, tremors, and paralysis. Kills fish, aquatic insects and zooplankton. Higly toxic to honey bees. Harms amphibians, earthworms, crustaceans, mollusks, nematodes and phytoplankton. Slightly to non-toxic to birds.	Potential impacts to humans, fish, many aquatic organisms, beneficial arthropods. **Special concern:** Do not use near water. Harm to pesticide handlers, aquatic invertebrates, tadpoles, earthworms, honeybees, beneficial arthropods.
Malathion; Registered-USEPA. Toxicity Class II WARNING; Registered in Jordan. Flies, cutworms on all grasses, leafhoppers, and locust outbreaks on all crops.	Constant monitoring by trained scouts to detect insect pests. Minimum effective dosage of pesticide is used. Rotated on a regular basis to prevent resistance.	Slightly toxic dermally, relatively non-toxic via inhalation. May affect the central nervous system, immune system, adrenal glands, kidneys, liver, and blood. Unlikely to cause reproductive effects in humans at normal use levels. Probably non-teratogenic; possibly mutagenic, currently unknown. Inconclusive data on carcinogenicity, most likely non-carcinogenic. Highly toxic to aquatic invertebrates, tadpoles, earthworms, and honeybees. Not toxic except at high dosages to domestic/wild mammals. Harmful to many beneficial arthropods. Slightly to moderately toxic to birds. Slightly toxic to fish, depending on species.	Potential impacts to humans, birds, aquatic invertebrates, tadpoles, earthworms, honeybees, and beneficial arthropods. **Special concern:** Pesticide handlers, aquatic invertebrates, tadpoles, earthworms, honeybees, beneficial arthropods.
Spinosad; Registered-USEPA.	Crop monitoring	Not toxic orally or dermally, or via inhalation. No	Potential impacts to

Toxicity Class IV CAUTION; Registered in Jordan. White flies on citrus, avocado, mango, cactus, pineapple, broccoli, cucumber, tomato, grapes, peppers; thrips on onion, bean, peppers; aphids on grapes, tomato, cucumber, eggplant, broccoli, artichoke, potato, cactus, pear, peach, apricot, pistachio.	for fungal diseases and action thresholds established. Treat only in greenhouse where disease is detected. Non-chemical control measures are used such as crop rotation, use of certified seed, and good sanitation. Fungicide is rotated to prevent resistance.	body organs affected. No reproductive effects; non-mutagenic; non-teratogenic; non-carcinogenic; not a known endocrine disruptor. Highly toxic to bees. Moderately to slightly toxic to fish. Slightly to highly toxic to aquatic invertebrates. Non-toxic to birds, livestock/domestic mammals, aquatic plants, beneficial arthropods. No data on earthworms.	humans, bees, fish, aquatic invertebrates. **Special concern**: bees, aquatic invertebrates.
Methidathion: Registered-USEPA. Toxicity Class I DANGER-Poison, Highly Toxic; registered in Jordan Spider mites, leaf miners, aphids, and scales on all fruit and nut trees. Citrus, avocado, mango, pear, peach, apricot, pistachio, sweet pepper, hot pepper, pineapple, tomato, cucumber, eggplant, broccoli, artichoke.	Insecticide sprays used as last resort and based on pest densities rather than calendar-based. Decision thresholds for target pests follow IPM principles. Regularly monitor for pests.	Death from cholinesterase inhibition. Tight chest, difficulty breathing, sweating, salivation, muscle twitch, tremor, seizure, loss of consciousness, nausea, vomiting, diarrhea, blurred vision. PAN Bad Actor Chemical. Possible carcinogen. Kills birds, crustaceans, fish, aquatic insects, mollusks, and zooplankton. Slightly toxic to bees. Potential ground water contaminant.	Potential death to humans, fish, most aquatic organisms, birds, aquatic invertebrates, honeybees, and beneficial arthropods. **Special concern:** very highly toxic to humans and others. Use care around water. **Phase out within 6 months. Begin to find an alternative chemical.**
Oxydemeton-methyl: Registered-USEPA. Toxicity Class I	Threshold densities of pests	Death from cholinesterase inhibition. Tight chest, difficulty breathing, sweating, salivation, muscle	Potential death to humans, fish, most aquatic

DANGER-Poison, Highly Toxic; registered in Jordan Aphids, scales on all fruit and nut trees.	should be used to determine whether to apply and the dosage. Rotate insecticides to avoid buildup of resistance.	twitch, tremor, seizure, loss of consciousness, nausea, vomiting, diarrhea, blurred vision. PAN Bad Actor Chemical. Development/reproductive toxin. Kills birds, crustaceans, fish, aquatic insects, and zooplankton. Harms mollusks. Potential ground water contaminant.	organisms, birds, aquatic invertebrates, honeybees, and beneficial arthropods. **Special concern:** very highly toxic to humans and others. Use care around water. **Phase out within 6 months. Begin to find an alternative chemical.**
Thiacloprid; Registered-USEPA. Toxicity Class II WARNING; Registered in Jordan Mixed pests on all grasses, ornamentals, flowers, fruit and nut trees.	Constant monitoring by trained scouts to detect insect pests. Threshold densities of pests should be used to determine whether to apply and the dosage. Minimum effective dosage of pesticide is used. Rotate pesticides on a regular basis to prevent resistance.	New chloronicotinyl pesticide. Harmful if swallowed or inhaled. Apathetic state, depressed muscular tone, respiratory disturbances and trembling. Muscular cramps are also possible in severe cases of poisoning. Risk of cancer. No skin or eye irritation. Thiacloprid was not mutagenic, did not cause developmental effects, and was not neurotoxic in animal studies. Very highly toxic to marine and estuarine invertebrates. Moderately toxic to earthworms. Slightly toxic to algae. No significant effect on bees, aquatic organisms, or birds. Harms some beneficial insects and arthropods such as green lacewings, ladybird beetles, parasitic wasps, and spiders. Potential ground water contaminant.	Potential impacts to humans, marine and estuarine invertebrates, and some beneficial insects and spiders. **Special concern:** Do not use near marine or estuary environments, or where beneficial insects are conserved.
Thiamethoxam; Registered-USEPA. Toxicity Class III CAUTION; Registered in Jordan	Rotate pesticides on a regular basis to prevent	Carcinogen. Low acute oral, dermal and inhalational toxicity. It is not a skin irritant and is not allergic to skin.	Potential impacts to honey bees, and some beneficial insects.

Armyworm. Alfalfa, clover, Sudan grass, Rye grass, millet, sorghum, corn, beans, pistachio.	resistance. Minimum effective dosage of pesticide is used. Constant monitoring by trained scouts to detect insect pests.	Highly toxic to honey bees. Toxic to predatory bugs and parasitic wasps. Slightly toxic to fish and birds. Nontoxic to earthworms.	**Special concerns:** bees and non-target organisms.
4. Neamaticides			
Fenamiphos; Registered-USEPA. Toxicity Class I DANGER-Poison, Highly Toxic; registered in Jordan General soil treatment against nematodes.	Threshold densities for nematodes used to determine whether to apply and the dosage. Nematodes are sampled twice a year on roses, and before each planting season for zucchini. Samples are analyzed to determine if soil should be treated with a nematicide. Organic amendments such	Deadly organophosphorous compound. Tight chest, difficulty breathing, sweating, salivation, constricted eye pupils, muscle twitch, tremor, seizure, loss of consciousness, nausea, vomiting, diarrhea, blurred vision, death. PAN Bad Actor Chemical. Kills birds, crustaceans, fish, aquatic insects, and zooplankton. Harms mollusks. Not too toxic to honey bees. Potential ground water contaminant, but breaks down quickly in water.	Potential death to humans, fish, most aquatic organisms, birds, aquatic invertebrates, and beneficial arthropods. **Special concern:** very highly toxic to humans and others. Use care around water. **Phase out within 6 months. Begin to find an alternative chemical.**

	as compost are used to encourage natural enemies of nematodes to become established. Marigolds used as field crops preceding other plantings. Row application of nematicide so that dosage can be minimized by targeting the root zone. Alternative to methyl bromide.		

5. Acaricides (Miticides)			
Abamectin: Registered-USEPA. Toxicity Class IV CAUTION; Registered in Jordan. Spider mites, leaf miners. Citrus, avocado, mango, pear, peach, apricot, pistachio, sweet pepper, hot pepper, pineapple, tomato, cucumber, eggplant, broccoli, artichoke.	Constant monitoring of crops by trained scouts to detect presence of spider mites. Minimum effective dosages used. By selecting pesticides that are not toxic to beneficial arthropods,	A mix of natural avermectins (derived from a soil bacterium). EC concentrations may cause eye and skin irritation. Pupil dilation, vomiting, convulsions, tremors, coma. Not readily absorbed through skin. Possible teratogenic and reproductive effects. Kills fish, crustaceans, and aquatic invertebrates. Highly toxic to bees. Harms mollusks, aquatic plants and zooplankton.	Potential impacts to bees, fish, aquatic invertebrates, and aquatic plants. **Special concern:** fish, bees, aquatic invertebrates, and aquatic plants.

	farmers avoid killing arthropods that help control spider mites.		
Dicofol; Registered-USEPA. Toxicity Class II WARNING or III CAUTION depending on formulation; Registered in Jordan. Spider mites on all fruit and nut trees.	Monitoring by trained scouts to detect spider mites. Use minimum effective dosages. Alternate acaricides that have different modes of action to avoid build up of resistance. Treat only infested portions of plants.	Chronic exposure can damage kidneys, liver, and heart. Can cause moderate skin irritation. Reproductive effects at very high levels of exposure. Non-teratogenic; non-mutagenic; probably non-carcinogenic; and not a known endocrine disruptor. Highly toxic to fish, aquatic invertebrates, and aquatic plants. Slightly toxic to birds. Non-toxic to earthworms, bees, beneficial arthropods, domestic/wild mammals.	Potential impacts to humans, fish, aquatic invertebrates, and aquatic plants. **Special concern:** fish, aquatic invertebrates, and aquatic plants.

3.0 Safe Use Action Plan (SUAP)

For each of the 12 elements of the PER, and for each pesticide listed in Table 1, there are recommended mitigation procedures or actions that will need to be completed in order to increase the safety of pesticide use to both the environment and all its organisms (non-targets), water resources, and human health. What follows is a plan, including the recommendations, with timeline, for doing all of these.

Immediately,

* *Produce a quick reference guide for all of the pesticides to be used on each project for each type of plant and anticipated pest*

A quick reference guide with toxicity, safety equipment required, safe use, and environmental cautions, will be useful for pesticide supervisors and applicators to refer to as they make pesticide choice decisions. Begin to compile lists of pest species (by species and genus name) present in Jordan (use pest species and genus lists from neighboring countries as a start).

* *Begin to investigate the potential use of more biological and organic pesticides*

For many of the pests in Jordan, there are biological control agents that can be used immediately for control without pesticide concerns or residues. For red spider mite, the predatory mite *Phytoseilus persimilia* is very effective in greenhouses. For thrips, *Orius* parasite species are very effective on peppers. For aphids, the parasite *Aphidius colemani* is very effective. And, for leaf miners, the parasite *Diglyphus ipeae* is very effective. These have been tested in Jordan.

For biological control products, see company websites:

Koppert http://www.koppert.com
Biobest http://www.biobest.be
Bio-Bee http://www.bio-bee.com/english/welcome.html

Bacterial products such as spore extracts from the bacterium *Bacillus thuringiensis* are effective against worm or caterpillar larvae of Lepidopteran (moth and butterfly) pests, like cutworm. Botanical extracts such as pyrethrum, a mix of natural chemicals called pyrethroids, can be extracted from chrysanthemum flowers, and provide good general pest control. Extracts from Neem trees are effective insecticides that are commercially available. A list of botanical products studied and registered by EPA is attached at the end of this report.

* *Begin to write simple IPM plans for each of the crops to be protected*

For each pesticide proposed, Table 1, in column 2, has IPM recommendations for practical ways to reduce the use of the pesticides. For each crop and pest, fold these

recommendations, as appropriate, into simple IPM plans with timelines. Consult Table 1. As pilot demonstration sites, both projects have the opportunity to serve as a model for further water-use and reuse cropping initiatives, and IPM should be a part of a rational approach to reducing pesticide use while protecting crops and expanding markets. A detailed IPM plan outline is included in the PER discussion of element c.

* *Produce simple safe use training materials and posters*

One way to remind applicators of safety issues is through the production and use of high quality training materials and safe use posters. These should be adapted or borrowed from other Arabic-speaking countries for use in Jordan.

* *Procure protective clothing and safety equipment*

Protective clothing and safety equipment needs to be provided for all pesticide handlers, users, applicators, and others present while application occurs. Both projects will need to have safety equipment on hand for use during application beginning in March 2005.

Continuously,

* *Rotate pesticides to reduce the build-up of resistance*

Each project has chosen several pesticide products for each type of pests, in able to rotate pesticides are reduce the occurrence of resistance.

* *Monitor resistance by noting reduction in efficacy of each pesticide product*

Project staff, especially in the Jordan Valley, can monitor the kill rate of the pesticides for any reduction in efficacy; communicate with neighboring farmers and extension agents, to determine when pesticide rotation is called for. Site managers will be responsible for drawing up simple monitoring plans, to collect data on reduction in efficacy and any other known environmental impacts leading to a change to a new or different pesticide. This will be reported to USAID, as a small section, along other reporting requirements.

* *Monitor the health of laborers using organophosphorous compounds*

Organophosphorous (OP) poisoning can be severe and there are chronic effects. Monitor the health and blood cholinesterase levels of any worker extensively (more than 2 hours) using an OP product, or who accidentally receives a large dose exposure (spill on skin, ingestion).

* *Continue to work with the new MOE as they implement environmental compliance*

RIAL and KAFA'A staff should continue to work closely with the Ministry of Environment (MOE) to stay abreast of developments in the local regulation and registration of pesticides.

By March 1, 2005,

* *Training in safe use of pesticides, IPM, and environmental protection*

RIAL and KAFA'A project participants, including staff, associated staff (from ASEZA or JVA), farmers, laborers, and extension agents involved in project implementation require train-the-trainer training in environmental protection and safe pesticide clothing, handling, calibration, use and disposal.

Training can occur via a train-the-trainer format, whereby supervisors are trained for 2-3 days, followed by training for actual applicator and laborer staff for the following 2-3 days.

* *During training, administer the Pesticide Use Checklist (PUC) for NGOs/PVOs*

Translate into Arabic and administer during training the PUC to all project participants to gather baseline data on their understanding of pesticide safety issues.

By December 1, 2005,

* *Update changes to pesticides lists and communicate these changes to USAID*

For monitoring purposes, USAID Project Managers will need to report changes to less toxic products on the list of pesticides recommended. Also, the RIAL and KAFA'A IEEs and this PERSUAP will be amended by USAID to reflect these changes.

By December 1, 2006,

* *Update changes to pesticides lists and communicate these changes to USAID*

USAID Project Managers will need to report changes to less toxic products on the list of pesticides recommended for monitoring purposes. Also, the RIAL and KAFA'A IEEs and this PERSUAP will be amended by USAID to reflect these changes.

* *Phase out the use of the following Restricted Use Pesticides (RUPs) in 6 months*

The following pesticides are actively registered for use in the USA, but only as Restricted Use Pesticides (RUPs).

cyfluthrin insecticide
deltamethrin insecticide
methidathion insecticide
oxydimeton-methyl insecticide
fenamiphos nematicide

For individuals to be able to use these products in the USA, they must submit to rigorous training on safe use, reduction of water contamination, and environmental protection. Such training does not yet exist in Jordan and most people using pesticides in Jordan, especially the laborers who are in the most contact with pesticides, have received minimal or no training. Therefore, RUP pesticides should be rapidly phased out in favor of less toxic alternatives.

By End of Projects, 2007,

* *At the end of 3 years, or during the current phase of the projects, all remaining Restricted Use Pesticides (RUPs) are replaced by less toxic alternative products*

Two of the remaining pesticides, alpha-cyhalothrin and cypermethrin are RUPs, and should be replaced with less toxic alternatives.

----------End of SUAP----------

Jordan PERSUAP Attachment 1:

USAID/AFR guidance: Preparing PERSUAPs for pesticide programs in Africa

Overview of review requirements

All USAID activities are subject to evaluation via, at minimum, an Initial Environmental Examination (IEE). And because of risk concerns presented by pesticides, the USAID environmental regulations require that at least the 12 factors outlined in the Pesticide Procedures described in 22 CFR 216.3 (b)(1)(i) (a through l) be addressed in the IEE for any program that includes assistance for the procurement or use of pesticides. The Africa Bureau asks that these factors be examined in a particular type of document, termed a "Pesticide Evaluation Report and Safer Use Action Plan" (PERSUAP), which is submitted as an attachment to the IEE. (Note: the IEE itself can be very brief, with the analytical work contained in the attached PERSUAP.) The PERSUAP focuses on the particular circumstances of the program in question, the risk management choices available, and how a risk management plan would be implemented in the field. Further details about what to include in a PERSUAP are given below.

Why is a local-level assessment such as a PERSUAP needed for USAID pesticide programs? To help in understanding the utility, consider the U.S. system for promoting pesticide safety. When the USEPA registers pesticides for use in the United States, it specifies the manner in which the product can be "safely" used (i.e., with an acceptably small risk), including safety equipment needed when applying the pesticide, how to apply it, and the allowed uses. But the context in which EPA makes these registration decisions is important to note. An extensive system of capabilities and resources exist in this country that help give EPA confidence these specifications will be followed and the product will be used appropriately. These include a 97% literacy rate meaning most of the population can read labels; close control by EPA over the content of the label; training requirements and programs for those pesticide products that require applicator certification; worker protection requirements; occupational safety regulations; and relatively effective federal, state and local enforcement mechanisms. In allowing the use of certain pesticides in its African programs, USAID cannot rely on the same societal capabilities and resources that the USEPA does to assure appropriate use of the product. The preparation of a PERSUAP gives a program manager the opportunity to consider practical actions by which to reduce the risks of using pesticide products in a program, taking into consideration the context in which the products will be used, the particular elements of the program, and the different capacities of the partners involved.

Who prepares a PERSUAP?

Program managers are generally responsible for assuring that environmental review requirements for their programs are met, including PERSUAPs. As for all environmental reviews, guidance and assistance for PERSUAPs is available from the appropriate

Mission Environmental Officer (MEO), Regional Environmental Officer (REO), the Africa Bureau Environmental Officer (BEO), or the BEO/DCHA if Title II (PL 480) funds are involved.. Considerable reference materials, as well as examples of other PERSUAPs, are available through these contacts, or directly from the Africa Bureau's ENCAP program website, www.encapafrica.org.

Components of an activity-level PERSUAP

A PERSUAP basically consists of two parts, a "PER" and a "SUAP." The Pesticide Evaluation Report (PER) section addresses the 12 informational elements required in the Agency's Pesticide Procedures. The Safer Use Action Plan (SUAP) puts the conclusions reached in the PER into a plan of action, including assignment of responsibility to appropriate parties connected with the pesticide program.

Below is table which further elaborates the content needed in a PERSUAP:

1. Detailed guidance for developing a Pesticide Evaluation Report: provides detailed guidance on the information that should be provided in the Pesticide Evaluation Report, following the 12 informational elements required by the Pesticide Procedures section of USAID's environmental regulations.

3. "A Practical Guide To Reducing Pesticide Risks in Development Projects": This brief guide was prepared by staff of the UNFAO, and provides a useful list of problems to watch for as well as practical responses. USAID programs using pesticides would do well to use this guide as a checklist to look for problems and as a source of inspiration for ways to deal with those problems.

Table: Detailed guidance for the development of a Pesticide Evaluation Report

USAID "Pesticide Procedures" Element and Description (from USAID Pest Management Guidelines, 1991)	Specific Guidance for Pesticide PERSUAP
a. **USEPA registration status of the proposed pesticide.** Pesticides are registered in the U.S. by active ingredient and by formulation. "Registration status" possibilities of the active ingredients and the formulated products include registered, never registered, and cancelled.	In the PERSUAP: *Identify the registration status in the U.S. and in the host country. Identify the formulated pesticide product to be used.* USAID is effectively limited to using pesticide active ingredients registered in the U.S. by the U.S. Environmental Protection Agency for the same or similar uses. Other pesticides not registered in the U.S. may be authorized, but only if the USAID program can show that no alternatives are available, as required under USAID Pest Management Guidelines for the use on non-U.S. registered pesticides. Host country pesticide registration procedures must also be identified and followed.
b. **Basis for selection of the pesticide**: This refers to the economic and environmental rationale for choosing a particular pesticide. In general, the least toxic pesticide that is effective is selected.	In the PERSUAP: *Explain the basis for selection of the pesticide product to be used, including active ingredient and formulation.* Pesticide product selection may be driven by a number of factors, including efficacy, price, availability, safety. All things being equal, a program should choose the pesticide active ingredient and formulation that presents the least overall risk. Formulation is a key determinant of toxicity, and should be considered in selecting a particular pesticide product. Formulation can also have an impact on exposure; for example, solid formulations can eliminate the potential for poisoning through accidental exposure to concentrated liquid product. Packaging can have a significant impact on exposure potential. Large containers necessarily introduce hazardous product transfer steps, as well as the possibility that the product will end up in a smaller, poorly labeled container. Smaller containers are generally better for use in USAID programs.

c. **Extent to which the proposed pesticide use is, or could be, part of an IPM program**: USAID policy promotes the development and use of integrated approaches to pest management whenever possible. This section discusses the extent to which the proposed pesticide use is incorporated into an overall IPM strategy.	In the PERSUAP: *Describe the extent to which the proposed product(s) is/are or could be a part of an IPM program. Describe the connection between the USAID activity and regional, national and local control programs (as appropriate).* Integrated pest management, and its public health counterpart, integrated vector management, is USAID policy because it is the most effective, economical, and safest approach to pest control. "Integrated pest management attempts to control pests in an economically and environmentally rational manner; it emphasizes non-chemical tactics which cause minimal disruption to the ecosystem."[1] USAID programs should assure that the choice of pesticides was made after consideration of other pest management options available, and that this is the most effective and environmentally sound option available.
d. **Proposed method or methods of application, including the availability of application and safety equipment**: This section examines in detail how the pesticide is to be applied and the measures to be taken to ensure its safe use.	In the PERSUAP: *As stated, describe in detail how the pesticide is to be applied and the measures to be taken to ensure its safe use.*
e. **Any acute and long-term toxicological hazards, either human or environmental, associated with the proposed use, and measures available to minimize such hazards**: This section of the IEE examines the acute and chronic toxicological data associated with the proposed pesticide. In addition to hazards, this section of the IEE also discusses measures designed to mitigate any identified toxicological hazards, such as training of applicators, use of protective clothing, and proper storage.	In the PERSUAP: *Describe measures the program will take to reduce the potential for exposing humans or nontarget organisms to selected pesticides. Also describe monitoring measures that will allow the program to identify problems with users applying other pesticides.* **It is recommended that this be the key section of the PERSUAP, in which the majority, or perhaps all, of the planned mitigation measures are described.** To address this element, the PERSUAP should summarize the toxicity to humans and other non-target organisms of the pesticide products chosen for the program in question, the potential exposure opportunities presented by those products, and the risk reduction actions the program will take to minimize such exposure opportunities. The risk reduction actions should be described in sufficient detail to show that they are indeed workable solutions. If protective clothing is recommended, for example, assurance should be provided that a sustainable source of such protective clothing has been identified, a schedule for its replacement, training in its use.

[1] USAID. 1990. Integrated Pest Management: A.I.D Policy and Implementation.

f.	**Effectiveness of the requested pesticide for the proposed use**: This section of the PERSUAP requires information similar to that provided in item b, but more specific to the actual conditions of application. This section also considers the potential for the development of pest resistance to the proposed insecticide.	In the PERSUAP: *Explain what recommendations or evidence suggests that the ITM products proposed are effective in the program area.*
g.	**Compatibility of the proposed pesticide use with target and non-target ecosystems**: This section examines the potential effect of the pesticide on organisms other than the target pest (for example, the effect on bee colonies kept in the area). Non-target species of concern also include birds and fish. The potential for negative impact on non-target species should be assessed and appropriate steps should be identified to mitigate adverse impacts.	In the PERSUAP: *Describe efforts that are being made to minimize environmental exposure to pesticide products.* This section should address the toxicity of the products and the environmental risk mitigation measures that the program will take. The key options for environmental risk mitigation are product choice and exposure reduction. In this section, therefore, describe the relative environmental risk of the product chosen versus the other options. Also describe efforts the program will make to reduce exposure of the environment, through choice of pesticide product and packaging, preparation of educational materials, training. This question might also be covered in response to question (e), and if so, simply reference that section without repeating it.
h.	**Conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils**: This section examines issues such as the potential for contamination of surface and groundwater sources.	In the PERSUAP: *Describe the environmental conditions under which the pesticide is to be used, identifying any environmental factors that might be particularly sensitive or subject to contamination from re-treatment operations.* This item refers to particular environmental factors that might accentuate the effects of exposure to pesticides, and the potential need for measures to reduce those risks. Examples of special conditions that need to be noted here include sensitive ecosystems in the project area and superficial groundwater tables.

i. **Availability of other pesticides or non-chemical control methods**: This section identifies other options for control of pests and their relative advantages and disadvantages.	In the PERSUAP: *Describe other pest management options being pursued in the geographic area of the activity, either as part of the USAID activity or otherwise, and explain why this particular vector control method was chosen over other available options.*
j. **Host country's ability to regulate or control the distribution, storage, use, and disposal of the requested pesticide**: This section examines the host country's existing infrastructure and human resources for managing the use of the proposed pesticide. If the host country's ability to regulate pesticides is inadequate, the proposed action could result in greater harm to the environment.	In the PERSUAP: *Summarize the host country's capacity and structure for the regulation of public health and agricultural pesticides. Identify the approval/registration status of the pesticide product in the host country.* The host country's capacity and structure for the regulation of public health and agricultural pesticides should be summarized. A critical issue for a pesticide activity supported by the Agency is the extent to which the host country's regulatory oversight will help to control distribution, storage, use and disposal of the pesticide products in question. USAID activities should always be in compliance with local environmental and public laws and regulations, but that is not necessarily enough. If host country regulatory systems and institutions are not sufficient to give a reasonable expectation that environmentally sound practices will be enforced, USAID still bears responsibility for assuring environmental protection at each of these steps in the pesticide life cycle. Government oversight over pesticides is important for controlling the quality of products as well as their environmentally-sound use and disposal. USAID programs of substantial size should generally include an element of capacity-building work with host country institutions that govern public health pesticide use. These measures should be identified in this chapter of the PERSUAP.
k. **Provision for training of users and applicators**: USAID recognizes that safety training is an essential component in programs involving the use of pesticides. The need for thorough training is particularly acute in developing countries, where the level of education of applicators may typically be lower than in developed countries.	In the PERSUAP: *Describe the provisions made to train and educate those who will be using the pesticides.*

1. **Provision made for monitoring the use and effectiveness of this pesticide**: Evaluating the risks and benefits of pesticide use should be an ongoing, dynamic process.	In the PERSUAP: *Describe monitoring and evaluation programs for pesticide use activities, and the health and environmental safety-related information that is collected via this M and E capacity.* Monitoring programs should actively investigate, to the extent possible, the following issues: • Effectiveness of Information, Education and Communication materials and activities in promoting safe handling, use and disposal of pesticide products. • Adverse health and environmental effects and the frequency and severity with which they occur. • Quality control of pesticide products. • Effectiveness of the chosen products and their alternatives, including whether or not resistance is developing. • Safe and effective pesticide use and handling practices by program staff and end users.

Jordan PERSUAP Attachment 2:

Representative Elements for Pesticide Safer Use Action Plan

A pesticide safe use action plan should:

- **Be programmatically linked to national pesticide registration and pest management programs**

- **Ensure formal national registration of pesticides**
  - Establish pesticide quality standards and control procedures
  - Provide for enforcement
  - Require good packaging and clear and adequate labeling

- **Define and assure safe use practices**
  - Identify pesticides appropriate for use, selecting the least toxic insecticides and formulations possible, and considering non-pesticide alternatives.
  - Define appropriate methods of pesticide handling, storage, transport, use and disposal.

- **Assure accessibility of protective clothing and equipment needed.**
  - Training, development and distribution of appropriate information, education and communication
  - Specific IEC messages, along with sale and treatment, regarding the proper handling, use, disposal of pesticides, and related waste, at the distribution, storage, handling, use, disposal stages, at all levels, but especially at the village and household levels.

- **Emphasize operational research & monitoring & evaluation**: Roles of key actors
  - Quality control of insecticide(s)
  - Research on alternative insecticides and effectiveness under local conditions
  - Mosquito susceptibility to insecticide(s) of choice
  - Safe and effective use of insecticide by parties at all levels

- **Identify Roles and Responsibilities**:
  - Public Sector: coordination, regulatory oversight and management, defining environmental responsibilities, and others
  - Commercial Private Sector
  - Non-profit private sector, PVOs, NGOs

- **Integrate Mitigation Measures**, for example:
  - Choice of USEPA-recommended pesticides
  - Avoid disposal of treatment solution in bodies of water
  - Avoid washing application equipment where the residues would impinge on bodies of water
  - For bulk pesticides, provisions for spill prevention and clean-up

- **Disposal provisions for used pesticide containers**

Jordan PERSUAP Attachment 3:

A Practical Guide to Reducing Pesticide Risks in Development Projects[1]

Basic principle of risk reduction: risk must be evaluated in the local conditions of the project or activity.

1) **Some common errors**
   - Pesticide not registered in the host country
   - Pesticide not evaluated/registered in the country of origin (OECD)
   - Pesticide not efficacious for the planned use
   - Formulation is not stable in tropical conditions
   - Formulation not adapted for the available application equipment
   - Quantities exceed the real need
   - Pesticide is too dangerous for the users
   - No label / in a foreign language
   - Packaging of an inappropriate volume
   - Packaging not strong enough

2) **Basic principles**
   - Promote IPM as the preferred approach for pest control
   - Reinforce the management of pesticides by the host country
   - Use good practices in the provision of pesticides

3) **Constraints to IPM -- pesticides**
   - Aggressive marketing of pesticides
   - Policies of government/donors
   - Governmental policies / donors promote the use of pesticides
   - Economic/financial
   - Institutional
   - Centralized decision-making in favor of pesticides

4) **Possible responses**
   - Put in place a project/program for plant protection/vector control
   - Put in place IPM/IVM projects/programs
   - Donation/purchase of pesticides

[1] Translated from Oct. 2000 presentation at IPM workshop by H. van der Walk, UNFAO Sahel Regional Program, Bamako, Mali.

5) **Use of pesticides in development projects -- some recommendations if one is obliged to use pesticides.**

Stage 1 – phytosanitary problem analysis

- Is the pest biology known?
- Is the environment and are the farmer practices known?
- Is the pest impact known (financial loss)?

Stage 2 – analysis of management options.

- Has the pesticide efficacy been evaluated for the crop/pest and locality in question?
- Are agronomic/cultural measures known and applied?
- Is biological control possible?
- Has an IPM system been developed?

Stage 3 – risk reduction

- Risk = toxicity x exposure
- Minimize the risk of the pesticides used by:
- Reducing toxicity of choices
- Reducing the duration of exposure
- Reducing the degree of exposure

6) **Risk reduction measures:**

Avoid use

- Avoid pesticide use, if possible.
- Avoid pesticide use as the only control option, if possible.
- Integrate pesticide use into an IPM system -- minimize the frequency and dose of applications
- Use pesticides as a last resort

Toxicity reduction

- Use the least toxic commercial products available – basic principles:
- Products authorized? -- regulation.
- Products efficacious? -- regulation / research
- Products acceptables to users? -- extension / farmers' groups
- WHO acute toxicity classes:
  - Ia Extremely hazardous
  - Ib Highly hazardous
  - II Moderately hazardous
  - III Slightly hazardous
  - U Unlikely to present any acute hazard in normal use
- Lists of concern :
  - Products in WHO toxicity classes Ia, Ib (and II)
  - Products not registered in OECD countries
  - « PIC » or « POP » chemicals

(FAO will not use Ia/Ib in development projects. World Bank/OECD will not finance Ia/Ib/(II) if use is directly by or accessible to small farmers or in countries without good regulatory programs.)

Exposure reduction

- Prior to use
  - Transport, Packaging, Storage
- During use (« safer use »)
  - Training
  - Formulation
  - Equipment
  - Protective material
  - Buffer zones
- After use
  - Waiting period
  - Cleaning / bathing
  - Storage
  - Disposal
  - Monitoring

Jordan PERSUAP Attachment 4:

Table: Botanical Pesticides, Repellents, and Baits Regulated by EPA, as listed by EPA

Name	Other Names	Use	Toxicity	EPA Tracking Number
Allium sativum	Garlic	Repels insects	Low	128827
Allyl isothiocyanate	Oil of Mustard	Kills & repels insects	Questionable	004901
Anise Oil		Repels vertibrates	Low	004301
4-allyl anisole	Estragole	Kills beetles	Low	062150
Azadirachtin	*Azadirachta indica* Neem tree extract	Kills & repels insects	Low, IV	121701
Bergamot		Repels vertibrates		129029
Canola Oil	*Brassica Napus B. Campestris*	Kills many insects	Low	011332
Capsaicin	*Capsicum frutescans*	Repels vertibrates	Low, III	070701
Castor Oil		Repels vertibrates	Low	031608
Cedarwood Oil		Repels moth larvae	Low	040505
Cinnamaldehyde	*Ceylon and Chinese* cinnamon oils	Kills insects, fungi & repels vertibrates*	Low	040506
Citronella Oil		Repels insects & vertibrates	Low	021901
Cloves, Crushed			Low	128895
Dihydroazadirachtin	Neem tree extract *Azadirachta indica*	Kills & repels insects	III-IV	121702
Eucalyptus Oil		Repels insects, mites fleas & mosquitoes	Low	040503
Eugenol	Oil of cloves	Kills insects**	Low	102701
Geraniol	Oil of rose isomeric w/ linalool	Repels vertibrates**	Low	597501
Geranium Oil			Low	597500
Indole	from all plants	Trap bait: corn root-worm beetles	Low	25000-
Jasmine Oil			Low	040501
Jojoba Oil		Kills & repels whitefly kils powdery mildew	Low	067200

Lavandin Oil		Repels clothes moth	Low	040500
Lemongrass		Repels vertibrates	Low	040502
Linalool	Oil of Ceylon isomeric w/ geraniol	Repels insects, ticks, mites & spiders	Low	128838
Maple lactone		Roach trap bait	Low	004049
Methyl salicylate	Oil of wintergreen	Repels moths, beetle & vertibrates	May be Toxic in large quantity	76601-
Mint	Herb	Kills aphids	Low	128892
Mint Oil		Kills aphids	Low	128800
Mustard Oil		Repels insects, spiders & vertibrates	Low	004901
Neem Oil		Kills whitefly, aphids	Low	025006
1-Octen-3-ol	From clover, alfalfa	Trap bait: mosquitoes	Low	69037-
Orange		Repels vertibrates	Low	040517
p-Methane-3,8 diol	*Eucalyptus sp.*	Repels biting flies, mosquitoes	Low	
2-Phenylethyl-propionate	From peanuts	Kills insects, ticks, mites & spiders	Low	102601
Pyrethrum	*Chrysanthemum sp.*	Stored products use	III	
Red pepper	Chilli	Repels insects	Low	070703
Rosemary	Herb		Low	128893
Rotenone	*Derris sp., Tephrosia*	Controls ticks	III	
Ryania	*Ryania speciosa*	Kills thrips, coddling moth, corn borers		
Sabadilla	*Schoenocaulon sp.*		III	
Sesame Oil	*Sesamum indicum*	Pyrethroid synergist	Low	
Soybean Oil	Soja	Kills insects, mites	Low	031605
Thyme	Herb	Controls aphids	Low	128894
1,2,4 Trimethoxy-benzene	From squash	Trap bait: cornrootwo-rm, cucumber beetles	Low	40515-
Verbenone	From pine trees	Repels bark beetles	Low	128986

1. This table does not necessarily describe all plant oil active ingredients.
2. There is more detailed information available for most of the oils:
http://www.epa.gov/pesticides/reregistration/status.htm
3. Natural Source: Only one or a few sources are listed. Most of these chemicals are found in many different plants.
* attracts corn rootworm beetles, ** attracts Japanese beetles

Jordan PERSUAP Attachment 5:

Pesticide Disposal

Most pesticides will have storage and disposal information on their label. Read and follow label instructions.

Container Disposal

All empty pesticide containers must be destroyed, and never re-used. It is extremely dangerous to use them for anything else. Consult the pesticide label, the manufacturer, or the manufacturer's representative for specific recommendations regarding container cleanup and disposal. The following are general guidelines. There are two basic methods for cleaning pesticide containers prior to disposal. Both require that the container be turned upside down and allowed to drain into the spray tank for at least 30 seconds, followed by adding water to the container and rotating it well to wet all surfaces, then draining it again into the spray tank as an additional dilutent.

Triple Rinse Method: Add a measured amount of water or other specified dilutent so that the container is one-fifth to one-fourth full. Rinse container thoroughly, pour into a tank, and allow to drain for 30 seconds. Repeat three times. The water rinsate can be used to mix with or dilute more of the same pesticides or it can be sprayed on the target crop.
Pesticide Neutralization Method: Empty organophosphate and carbamate containers can be neutralized by adding alkaline substances. The following procedure is recommended for 200-liter barrels. Use proportionally less material for smaller containers.

1. Add 20 liters of water, 250 milliliters of detergent, and one kilogram of flake lye or sodium hydroxide.
2. Close the barrel and rotate to wet all surfaces.
3. Let stand for 15 minutes.
4. Drain completely and rinse twice with water. The rinsate should be drained into a shallow pit in the ground located far away from wells, surface water, or inhabited areas.

Containers cleaned by any of the above methods are still not safe to use for any other purpose. Glass containers should be broken and plastic or metal containers punctured or crushed. Containers can then be buried in an isolated area at least 50 cm below ground surface.

Jordan PERSUAP Attachment 6:

Basic First Aid for Pesticide Overexposure

Get medical advice quickly if you or any of your fellow workers have unusual or unexplained symptoms during work or later the same day. Do not let yourself or anyone else get dangerously sick before calling a physician or going to a hospital. It is better to be too cautious than too late.

First aid is the initial effort to help a victim while medical help is on the way. If you are alone with the victim, make sure the victim is breathing and is not being further exposed to the poison before you call for emergency help. Apply artificial respiration if the victim is not breathing.

Read the first aid instructions on the pesticide label, if possible, and follow them. Do not become exposed to poisoning yourself while you are trying to help. Take the pesticide container (or the label) to the physician. Do not carry the pesticide container in the passenger space of a car or truck.

Poison on skin

- Act quickly
- Remove contaminated clothing and drench skin with water
- Cleanse skin and hair thoroughly with detergent and water
- Dry victim and wrap in blanket.

Chemical burn on skin

- Wash with large quantities of running water
- Remove contaminated clothing
- Cover burned area immediately with loose, clean, soft cloth
- Do not apply ointments, greases, powders, or other drugs in first aid treatment of burns

Poison in eye

- Wash eye quickly but gently
- Hold eyelid open and wash with gentle stream of clean running water
- Wash for 15 minutes or more
- Do not use chemicals or drugs in the wash water; they may increase the extent of injury

Inhaled poison

- Carry victim to fresh air immediately
- Open all doors and windows so no one else will be poisoned
- Loosen tight clothing
- Apply artificial respiration if breathing has stopped or if the victim's skin is blue. If patient is in an enclosed area, do not enter without proper protective clothing and equipment. If proper protection is not available, call for emergency equipment from your fire department

Poison in mouth or swallowed

- Rinse mouth with plenty of water
- Give victim large amounts (up to 1 quart) of milk or water to drink
- Induce vomiting only if instructions to do so are on the label

Procedure for inducing vomiting

- Position victim face down or kneeling forward, Do not allow victim to lie on his back, because the vomit could enter the lungs and do additional damage
- Put finger or the blunt end of a spoon at the back of victim's throat or give syrup of ipecac
- Collect some of the vomit for the physician if you do not know what the poison is
- Do not use salt solutions to induce vomiting

When *not* to induce vomiting

- If the victim is unconscious or is having convulsions
- If the victim has swallowed a corrosive poison. A corrosive poison is a strong acid or alkali. It will burn the throat and mouth as severely coming up as it did going down. It may get into the lungs and burn there also
- If the victim has swallowed an emulsifiable concentrate or oil solution. Emulsifiable concentrates and oil solutions may cause severe damage to the lungs if inhaled during vomiting

Jordan PERSUAP Attachment 7

Primary Websites for Pesticide Searches:

http://www.pesticideinfo.org (PAN most complete pesticides database)
http://extoxnet.orst.edu/pips/ghindex.html (Extoxnet Oregon State database)
http://www.epa.gov/ecotox/ (EPA Ecotox Database)
http://cfpub.epa.gov/oppref/rereg/status.cfm?show=rereg (EPA Registr.Eligib.Decisions)
http://www.epa.gov/pesticides/biopesticides/ai/all_ais.htm (EPA regulated biopesticides)
http://www.epa.gov/opppmsd1/RestProd/rupjun02.htm (EPA restricted use pesticides)
http://www.epa.gov/pesticides/health/tox_categories.htm (EPA Toxicity Classifications)
http://www.epa.gov/opppmsd1/PPISdata/index.html (EPA pesticide product information)
http://www.chemfinder.camsoft.com (chemical database & internet search, free & fee)
http://www.hclrss.demon.co.uk/index.html (compendium of pesticide common names)

CABI Site for Crop Protection Compendium (CPC)
http://www.cabi.org/compendia/cpc/index.htm to enter CABI CPC for crop/pest reccs.

Pesticide Toxicity to Honey Bees
http://www.entm.purdue.edu/Entomology/ext/targets/e-series/EseriesPDF/E-53.pdf
http://www.ohioline.osu.edu/hyg-fact/2000/2161.html (Ohio State Extension site)

Pesticide Toxicity to Natural Enemies (Beneficials)
http://www.ipm.ucdavis.edu/PMG/r108900111.html

Biological Pesticides List
http://www.koppert.com (a Dutch biologicals company doing business internationally)
http://www.biobest.be (a Belgian biologicals company doing business internationally)
http://www.epa.gov/pesticides/biopesticides/ai/all_ais.htm (EPA's biopesticide list)
http://www.bio-bee.com/english/welcome.html (a biopesticide company in Israel)

PERSUAPs Sites
http://www.encapafrica.org/sectors/pestmgmt.htm (PERSUAPS guidance)
http://www.afr-sd.org/documents/iee/docs/31Uganda1_IDEA_Amend.doc (Uganda PERSUAP)
http://www.dec.org/pdf_docs/PNACX490.pdf (Colombia PERSUAP)
http://www.wateriqc.com/millenium_conference/Proceedings/powerpoint_presentations/Day_4/1030rossier.pps#285,10,Critical Pesticide Management Issues (EA History PPT)

International Conventions
http://www.pops.int/ (POPs website)
http://www.pops.int/documents/convtext/convtext_en.pdf (POPs Convention text)
http://www.chem.unep.ch/pops/pdf/redelipops/redelipops.pdf (reduce & eliminate POPs)

Note: The 1951 International Plant Protection Convention. The objective is to maintain and increase cooperation in controlling pests and diseases of plants and plant products, and in

preventing their introduction and spread across national boundaries. Jordan became a signatory on April 24, 1970.

methyl-bromide site
http://www.epa.gov/ozone/mbr/harmoniz.html

Jordan-Specific sites
http://www.usaidjordan.org/jordan.cfm (links to Jordan ministries)
http://www.eppo.org/STANDARDS/biocontrol/hymenoptera1.htm (use of parasitoids)
http://www.avocadosource.com/WAC3/WAC3_p419.htm (avocado pests)
http://web.idrc.ca/en/ev-5324-201-1-DO_TOPIC.html (urban agriculture in Jordan)
http://www.gtz.de/dokumente/AKZ/eng/AKZ_2002_Rio_plus_10/Jordanien_E.pdf (solar to replace MeBr)

Jordan PERSUAP Attachment 8: SOW for IEEs and PERSUAP

SCOPE OF WORK

For two Initial Environmental Examinations (IEEs), including a Pesticide Evaluation Report and Safe Use Action Plans (PERSUAP), supporting USAID activities in the Hashemite Kingdom of Jordan

(Draft October 24, 2004)

I. Purpose

This Scope of Work (SOW) describes the services requested for one Pesticide Management Specialist (PMS) who will perform services for the USAID Mission to the Hashemite Kingdom of Jordan on the following projects: Reclaimed Water Reuse for Industry Agriculture and Landscaping (RIAL) Project Request; and the KAFA'A Education and Information Program to Improve Irrigation Water Use Pesticides Project Request. The services described herein will enable the above-mentioned projects to respond to and comply with the requirements of USAID Regulation 22CFR 216.3(b), USAID's pesticide procedures. These services will make it possible for the two projects to comprehensively contribute to safe demonstration projects and development in Jordan.

The PMS will be responsible for finalizing one IEE and conducting another IEE, with the addition of a *Pesticide Evaluation Report and Safe Use Action Plan* (**PERSUAP**)—described below—for the production of high value crops and ornamental trees at demonstration sites around Jordan:

a. Ensure compliance with the Agency's pesticide procedures;
b. Ensure compliance with the Government of Jordan's pesticide importation, testing, storage, use, disposal and registration regulations, laws, policies and procedures;
c. Identify and recommend appropriate mitigative actions for incorporation into the projects' activities;
d. Identify and recommend alternative actions and/or pesticides, as appropriate;
e. Facilitate use of Integrated Pest Management (IPM) with a view of avoiding or reducing unnecessary pesticide risk; and
f. Identify and address key pesticide use issues in Jordan, particularly those that impact on pesticide utilization by small-scale producers, farm laborers, and ornamentals applicators.

The SOW requires that the RIAL and KAFA'A IEEs and PERSUAP produce:

- Documentation on the specific uses of pesticides that will comply with 22 CFR 216.3(b)(1)(i)(a through l) for each activity concerned with procurement or use of pesticides, including promoting the adoption of particular pesticides and pesticide use technologies supported by USAID;
- Mechanisms for capacity building of the various partners. This should specifically include design of the Safe Use Action Plan part of the PERSUAP, including mitigation and training to ensure that procedures required under 22 CFR 216.3 (b)(1) are disseminated and understood by all partners.

II. Background

The USAID/Jordan Water Resources Strategic Objective Agreement (278-0288), which includes KAFA'A and RIAL, activities are intended to initiate long-term programs of water-use efficiency in agriculture and landscaping. This includes increasing knowledge about the issues facing irrigated agriculture and landscape, and the changes required in the decision-making environment as well as initiating changes in on-farm practices, especially practices that involve irrigation water efficiency. The aim of these changes is to establish a profitable but less water intensive agricultural sector in Jordan that produces fruits and vegetables of appropriate quality for export.

The KAFA'A project works with the private and public sectors to encourage farmers to switch to high value, less water intensive crops, as well as establish a viable agricultural extension system based on a social marketing, multi-dimensional communications model in the country. This newly established extension service must have the capacity to plan and implement high quality research-based social marketing extension programs on a sustainable basis in the future.

The RIAL project works with industry, agriculture and landscaping to encourage use of high-value crops and dual-use ornamental trees at Wadi Mousa, Aqaba, Jordan University for Science and Technology (JUST), and Greater Amman Municipality (GAM), using similar extension methodologies to the KAFA'A project.

As part of its efforts to help improve water resources management in Jordan, USAID plans to support a new nation-wide program focused on improving on-farm water use efficiency. This program will build upon previous work done in this field in Jordan.

Based on results of the Irrigation Advisory Services Pilot effort, agricultural demand for water can be reduced without decreasing the irrigated area or the value of agricultural production. Proper water usage along with proper crop selection, IPM and pesticide selection and use, along with effective international marketing, may increase farmer's income and agriculture's contribution to the economy.

USAID/Jordan's overriding interventions will be focused on the following activities:

1. Advise decision-makers of present unsustainable practices in the water/agricultural sectors and the policies and regulations promoting these practices.

2. Inform the public of the water situation as it pertains to the agricultural and landscaping/ornamentals sectors, as well as policies adopted by the government of Jordan to deal with them. The ultimate aim of these activities is to promote behavioral change among Jordanian farmers and landscapers and give more decision authority to individual farmers and landscapers. Multiple efforts and campaigns will be needed to encourage the development of new attitudes and behavioral patterns as well as a stronger role for market incentives in crop selection, agricultural chemical selection, and water allocation. All work involving local organizations should contribute to their development and ability to carry out similar activities in the future.

3. Improve the technical capacity of extension workers and their access to information, in all relevant institutions and inform farmers and landscapers about the following:
   a) on-farm water management techniques that improve irrigation efficiency,
   b) crop and landscape water requirement,
   c) drought resistant crops and ornamentals,
   d) cash crops and dual-use ornamentals,
   e) crops and trees suitable for irrigation with reclaimed/brackish water,
   f) water harvesting, and
   g) marketing channels.

The two projects are designed to increase farm crop and landscape tree production through conservation farming and landscaping practices in order to ensure sustainable utilization of land in an environment which has seen depletion of soil fertility due to indiscriminate inorganic fertilizer applications and mismanagement. The projects also facilitate production and marketing of crops and dual-use trees that have higher investment returns to land and labor than the extensively grown maize crops or mono-use ornamentals.

The KAFA'A project is promoting a conservation-farming package that includes the use of Dursban for weed control. In addition, it proposes a list of 9 pesticides, including insecticides, fungicides, and acaricides, for various machine spraying and hand soil applications, depending upon formulations and intended uses. Further, the project also follows a production package for paprika as determined by the Jordan Out-Grower institutions. This package specifically entails the use of chemicals such as Uthane, copper oxy chloride, Karate and inorganic fertilizers. In all, 13 pesticides will be reviewed as well as any alternatives identified by the review process.

The RIAL project proposes a list of 28 pesticides, including insecticides, fungicides, and acaricides, for various machine spraying and hand soil applications, depending upon formulations and intended uses. The RIAL project will implement such pesticide use in Wadi Mousa, Aquaba, JUST, and GAM. In addition, alternative pesticides may be identified by this process as being appropriate.

The SO would like the two projects to remain in compliance of the regulation 22 CFR 216.3 (b) while at the same time enabling rural farmers and landscapers to increase their incomes. It is therefore desirable to expedite production of IEEs, and an environmental review of the programs of the PERSUAP-scale, and not a full EA for use (note that USAID interprets "use" broadly).

The rationale for a PERSUAP – type of environmental review (as opposed to a full-scale Environmental Assessment) is that the two projects will be reviewed and Initial Environmental Examinations approved for all other activities in the programs. The other rationale is that the pesticides are used under tight management, with well laid conservation practices, guided by trained and experienced KAFA'A and RIAL project members of staff.

II. Background, Scope and Application of PERSUAP

A. Background

Overview of review requirements

All USAID activities are subject to evaluation via, at minimum, an Initial Environmental Examination (IEE). And because of risk concerns presented by pesticides, the USAID environmental regulations require that at least the 12 factors outlined in the Pesticide Procedures described in 22 CFR 216.3 (b)(1)(i) (a through l) be addressed in the IEE for any program that includes assistance for the procurement or use of pesticides. For several years, the Africa Bureau has asked that these factors be examined in a particular type of document, termed a "Pesticide Evaluation Report and Safer Use Action Plan" (PERSUAP), which is submitted as an attachment to the IEE. (Note: the IEE itself can be very brief, with the analytical work contained in the attached PERSUAP.) Now, other bureaus, including Asia & Near East (ANE) will enjoy the utility of these documents.

The PERSUAP focuses on the particular circumstances of the program in question, the risk management choices available, and how a risk management plan would be implemented in the field. Further details about what to include in a PERSUAP are given below.

Why is a local-level assessment such as a PERSUAP needed for USAID pesticide programs? To help in understanding the utility, consider the U.S. system for promoting pesticide safety. When the USEPA registers pesticides for use in the United States, it specifies the manner in which the product can be "safely" used (i.e., with an acceptably small risk), including safety equipment needed when applying the pesticide, how to apply it, and the allowed uses. But the context in which EPA makes these registration decisions is important to note. An extensive system of capabilities and resources exist in this country that help give EPA confidence these specifications will be followed and the product will be used appropriately. These include a 97% literacy rate meaning most of the population can read pesticide labels; close control by EPA over the content of the label; training requirements and programs for those pesticide products that require applicator certification; worker protection requirements; occupational safety regulations; and relatively effective federal, state and local enforcement mechanisms. In allowing the use of certain pesticides in its overseas programs, USAID cannot rely on the same societal capabilities and resources that the USEPA does to assure appropriate use of the product. The preparation of a PERSUAP gives a program manager the opportunity to consider practical actions by which to reduce the risks of using pesticide products in a program, taking into consideration the context in which the products will be used, the particular elements of the program, and the different capacities of the partners involved.

Who prepares a PERSUAP?

Program managers are generally responsible for assuring that environmental review requirements for their programs are met, including the drafting of PERSUAPs. As for all environmental reviews, guidance and assistance for PERSUAPs is available from the appropriate Mission Environmental Officer (MEO), Regional Environmental Officer (REO), the ANE Bureau Environmental Officer (BEO), or the BEO/DCHA if Title II (PL 480) funds are involved. Considerable reference materials, as well as examples of other PERSUAPs, are available through these contacts, or directly from the Africa Bureau's ENCAP program website, www.encapafrica.org. PERSUAPs may be drafted by consultants with AFR experience dealing with PERSUAPs, in addition to experience with Regulation 216, Environmental Assessments (EAs), Programmatic EAs (PEAs), and Supplemental EAs (SEAs).

Components of an activity-level PERSUAP

A PERSUAP basically consists of two parts, a "PER" and a "SUAP." The Pesticide Evaluation Report (PER) section addresses the 12 informational elements required in the Agency's Pesticide Procedures. The Safer Use Action Plan (SUAP) puts the conclusions reached in the PER into a plan of action, including assignment of responsibility to appropriate parties connected with the pesticide program.

Below are three annexes which further elaborate the content needed in a PERSUAP:

1. Detailed guidance for developing a Pesticide Evaluation Report: provides detailed guidance on the information that should be provided in the Pesticide Evaluation Report, following the 12 informational elements required by the Pesticide Procedures section of USAID's environmental regulations.

2. *Representative Elements for a Safer Use Action Plan*: Describes the elements needed in a plan that takes action to assure issues resolved in the Pesticide Evaluation Report are resolved in the implementation of the development program being reviewed.

3. "A Practical Guide to Reducing Pesticide Risks in Development Projects": This brief guide was prepared by staff of the UNFAO, and provides a useful list of problems to watch for as well as practical responses. USAID programs using pesticides would do well to use this guide as a checklist to look for problems and as a source of inspiration for ways to deal with those problems.

B. Scope

Pesticides are synthetic or natural product-derived chemical products intended to kill, control, and repel insects, plant diseases, weeds, and other pest organisms. Plant-derived insecticides and those restricted, cancelled, or suspended by the USEPA are listed in two chapters, *Integrated Pest Management* (Schroeder, 2004, Tellus Institute) and *Safer Pesticide Use* (Schroeder, 2004,

Tellus Institute) in Africa Bureau's *"Environmental Guidelines for Small-Scale Activities"* . The analysis will cover those pesticides proposed for use by KAFA'A and RIAL projects that are:

- Registered by USEPA for the same or similar uses without restrictions;
- Also registered by the government of Jordan; and
- Available in Jordan

The study will cover activities under the two projects, which may involve assistance for the procurement or use of pesticides. Under this SOW, assistance for the procurement or use of pesticides is defined broadly (see above reference to learn the definition of small-scale) and includes recommending the procurement or use of the pesticides and conduct of training programs in pesticide handling/use.

C. Application of study

The IEEs to be written shall include appendices evaluating the economic, social, and environmental risks and benefits of the planned pesticide use to determine whether the use may result in significant environmental impact. If the PERSUAP determines that a specific pesticide use will significantly affect the environment, an environmental Assessment (EA) will normally be conducted; however this is not anticipated due to strong programmatic links with national pesticide registration and IPM plans, and strict guidance by project implementers.

The SUAP will also:
1. Assure accessibility of protective clothing and equipment needed;
2. Emphasize operational research & monitoring & evaluation: Roles of key actors;
3. Identify Roles and Responsibilities for Public Sector, Commercial Private Sector, and Non-profit private sector, PVOs, NGOs
4. Integrate Mitigation Measures
5. Disposal provisions for used pesticide containers

III. Roles

a) USAID/Jordan

USAID/Jordan through its SO Team Leader and the MEO will take an active role in working with the PMS in the conduct of the study. The MEO will provide specific technical guidance and direction, review progress and other draft materials produced by the PMS and perform liaison functions, as needed, with the ANE/BEO and USAID/Amman. The Regional Environmental Officer (REO), as appropriate, may also collaborate with the PMS at the initiation of the study to provide information and perspective and links to USEPA, as might be necessary.

b) KAFA'A and RIAL:

Each project will assign a contact person or persons to work with the PMS. The contact person will assist the PMS in developing the study by providing information

about uses and conditions of use for all pesticides, types of activity implementation, roles and responsibilities of implementing farmers, landscapers, and extension officers with the purpose of ensuring that all relevant pesticides are covered and to help the PMS design training for those in the field. Each project, through the contact person will be responsible for reviewing and providing comments on the study.

c) PMS

As a consultant, the PMS will be responsible for: 1) acquiring and synthesizing information on Jordan's ability to regulate or control the acquisition, distribution, usage, storage and disposal of pesticides; 2) restrictions on use of pesticides (e.g. information from the Jordan Ministry of Environment); 3) examining, by site visits, the conditions under which various pesticides will be used (climate, flora, fauna, geography, hydrology, soils, near water bodies etc); and 4) acquiring from the projects information on the extent to which the pesticide use is part of an integrated pest management program.

IV. PMS Tasks and Responsibilities

- Review list of potential pesticides to be procured/used under the programs, and review US EPA status of the pesticides.
- Contact Mission MEO, appropriate Jordan Ministries and ANE to review compliance requirements and pest management options and develop an agreed upon definition of "assistance for procurement or use of" pesticides.
- Assess the overall capabilities and limitations of the KAFA'A and RIAL pesticide management relative to the more common pesticide use problems affecting the targeted farmers and landscapers.
- Provide KAFA'A and RIAL projects with an algorithm for comparing and contrasting the economics of use of the various alternative pesticides;
- Recommen/outline a training program, including a plan to train participants who will be implementing the recommendations of the study.
- Following a description of the proposed usage and expected benefit of the requested pesticides, address each of the following factors listed under 22 CFR 216.3(b)(1)(i):

    - The USEPA and Jordan registration status of the requested pesticides
    - Extent to which the proposed pesticide is part of the integrated pest management
    - The proposed method of application, including availability of appropriate application and safety equipment;
    - Any acute or long term toxicological hazards, either human or environmental, associated with the proposed use, and measures available to minimize such hazard;
    - The effectiveness of the pesticide for the proposed use;
    - Compatibility of the proposed pesticide with target and non- target ecosystems;
    - The availability and effectiveness of other pesticides or non chemical control methods;

- Provisions made for monitoring the use and effectiveness of the pesticide;
- Jordan's ability to regulate or control the distribution, storage, use, and disposal of the pesticide; and
- Provisions made for training of users and applicators, and outline a training plan for participants and extension officers

- Draft preliminary IEEs and PERSUAP; respond to comments from MEO, REO, ANE BEO, and the KAFA'A/RIAL contact persons.

V. Deliverables

Final Reports: Two IEEs and one PERSUAP.

VI. Period of performance

Three to Four weeks starting November 2004

Jordan PERSUAP Attachment 9:

Jordan IEE and PERSUAP contacts:

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APPROVAL OF ENVIRONMENTAL ACTION RECOMMENDED:

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John O. Wilson
Bureau Environmental Officer
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CLEARANCE:
General Counsel (ANE Bureau)
Date

ADDITIONAL CLEARANCES:

Amal Hijazi
Mission Environmental Officer
Date

James Franckiewicz
Director, WRE
Date