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JOHN OGONOWSKI AND DOUG BEREUTER FARMER-TO-FARMER PROGRAM (FY2024-28)

PESTICIDE EVALUATION REPORT AND SAFER USE ACTION PLAN

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The following mitigation measures shall be implemented by F2F volunteers to minimize or avoid any potential irreversible long-term adverse effects on human health and the environment, as identified in the Programmatic Pesticide Evaluation Report (factors a to i).

The mitigation measures below apply to all F2F volunteers.

- **Type 1 volunteers are required to implement all measures.**
- **Type 2 volunteers should review and be familiar with the measures.**
- **Type 3 volunteers** should not involve pesticides in any way and do not therefore need to be familiar with the measures but are required to **read the Brochure pg. 64-65**
- **Type 4 volunteers** should refer to the applicable Type 1, 2, or 3 assignment.

12.17 MITIGATION MEASURES TO BE IMPLEMENTED BY F2F VOLUNTEERS

The following mitigation measures shall be implemented by F2F volunteers to minimize or avoid any potential irreversible long-term adverse effects on human health and the environment, as identified in the Programmatic Pesticide Evaluation Report (factors a to i).

The mitigation measures below apply to all F2F volunteers. Type 1 volunteers are required to implement all measures and Type 2 volunteers should review and be familiar with the measures. Type 3 volunteers should not involve pesticides in any way and do not therefore need to be familiar with the measures. However, it is the responsibility of IPs to ensure that Type 3 volunteers' assignments do not involve the "use" of pesticides in any way. Type 4 volunteers should refer to the applicable Type 1, 2, or 3 assignment.

No volunteers will be involved in procuring pesticides, although a volunteer's recommendations about a pesticide may lead to procurement. This PERSUAP and the following recommendations cover F2F volunteer technical assistance and the associated administrative, consultant, training, and technical assistance under the F2F Program. This includes core country F2F projects, flexible assignments, and technical assistance, training, and volunteer services under Associate Awards, and other mechanisms whereby Missions or other offices fund F2F programs.

1. *F2F volunteers shall provide assistance for the use or procurement of pesticides containing only those pesticide active ingredients listed in Annex 1, Table 1*, all of which are US EPA registered and WHO toxicity class II and above. (Type 4 volunteers may use a project/sector/mission PERSUAP list of approved pesticides instead of the F2F PERSUAP list.) New pesticides may be added to this approved list only by being added through an amendment to the PERSUAP approved by the USAID/REFS BEO.
2. *F2F volunteers shall provide assistance for the use or procurement of pesticide products/trade names/brands made up of only those pesticide AIs in Annex 1, Table 1*, which are also General Use Pesticides (GUPs) or the equivalent (if the product is not registered by US EPA) and US EPA toxicity level 2 and above (or the equivalent). F2F volunteers shall strongly discourage the use of Restricted Use Pesticides or the equivalent (for non-US EPA registered products). RUPs are only permitted to be used in USAID-supported projects if an Environmental Assessment has been prepared and approved by the USAID Bureau Environmental Officer.
3. *F2F volunteers shall provide assistance for the use or procurement of the pesticide AIs in Annex 1, Table 1, only within the context of an IPM approach*. They should promote an understanding of how knowledge of the pest can help effective pest control. For volunteers' reference, Annex 3 includes general recommendations on IPM. F2F country offices are required to retain a list of IPM practices that were submitted as supporting documentation. Volunteers, whose assignments will include advice/recommendations on specific pesticides (Type 1 Assignments) should obtain a copy of these IPM practices. Volunteers with specific knowledge in IPM should build on and strengthen these practices and shall provide documentation in this regard to the F2F country office.
4. *Volunteers shall provide advice on the potential health and environmental hazards* of using pesticides and how to mitigate these. They should be aware of the sometimes low level of existing understanding of these and take account of education and literacy levels of the people they work with. They should seek to educate and instill best practice in pesticide use to minimize adverse effects on health and the environment.
5. *F2F volunteers shall provide advice and recommendations on the pesticide AIs in Annex 1, Table 1, only in conjunction with recommendations for appropriate protective gear, and other safety precautions to mitigate pesticide impacts to human health* (Section 8, Health Context and Annex 4, Elements of pesticide safer use training). Volunteers should be aware of the limited accessibility to protective gear in many cases and should

be prepared to identify measures to access protective gear if unavailable. F2F volunteers should also be aware of the lack of intact (completely missing, missing some information, or counterfeit) labeling in some F2F countries. Given that pesticide labels may be unreliable in many F2F countries, volunteers should be prepared to provide alternative advice on protective gear and on other safety precautions to minimize impacts to human health (see Section 8, Health Context). For Type 1 assignments, Annex 1 provides toxicity information for active ingredients such as acute toxicity, carcinogenic potential, endocrine disruptor, etc. Where these concerns are noted, F2F volunteers should recommend least toxic pesticides and the appropriate safety precautions.

6. *Volunteers shall provide advice on good application practice* including selection, use and maintenance of suitable application equipment. Before recommending the use of any pesticide they should ensure that appropriate application equipment is available to apply It safely and effectively and that it can be stored and transported safely.

7. *F2F volunteers shall provide advice and recommendations for the specific pesticide AIs in Annex 1, Table 1, only in conjunction with recommendations to mitigate impacts on the environment detailed in Section 9.* For Type 1 assignments, volunteers should refer to Annex 1, Table 1, for chemicals with the potential to contaminate groundwater, and should tailor recommendations and environmental safeguards accordingly (Section 9 contains guidance for this). In addition, the assessment of Factor g, Section, 12.10, offers best practices to mitigate environmental harm; these should be referred to, and recommended, as appropriate, by Types 1 and 2 volunteers.

8. *F2F volunteers shall recommend the use only of pesticides in Annex 1, Table 1, that are also approved by the host country government.* Volunteers whose assignments will require providing advice/recommendations on the use of specific pesticides (Type 1 assignments) should obtain the list of host country registered pesticides from the F2F Country Office (or in the case of flex assignments, from the F2F Home Office). F2F is required to retain lists of approved/registered pesticides for each country.

9. *F2F Type 1 volunteers whose assignments will involve providing recommendations and advice on specific pesticide active ingredients and products shall obtain the relevant SDSs for AIs and products that they plan to recommend (see http://www.cdms.net).* SDSs should be distributed, as practical, and should be used to provide recommendations on best practices (recommended uses, restrictions, hazards, first aid, PPE, etc.). (F2F IPs may decide to translate SDSs into local languages where necessary and cost effective.)

10. *F2F volunteers shall provide training in and shall leave host country partners with tools (see Annex 4) they will need once the volunteer departs the country.* Tools to monitor various parameters of pesticide use and pest and disease infestation such as scouting protocols, IPM monitoring forms, and measures to monitor the efficacy of pesticides will be useful, once a volunteer departs, to help ensure that the volunteer's recommendations on safe use and IPM will continue to be implemented. Volunteers who prepare pest monitoring plans and forms shall submit them to the F2F Country Office so that future volunteers can build on them and so that F2F Country Offices can report in semi-annual reports, on their preparation and updating.

11. *F2F Type 1 volunteers shall evaluate how the PERSUAP-approved AIs correspond to the pesticides actually available to the farmer in local agriculture supply shops*. This information should be included in F2F end-of-trip reports and used to update relevant country-specific documentation and should include and take account of any available information on the availability of illegal, fake or adulterated pesticides that the volunteer is aware of.

12. *Where volunteers have evidence that PERSUAP approved AIs are ineffective or are responsible for adverse health or environmental effects* this information should be included in F2F end-of-trip reports and used to update relevant guidance and reports. Where relevant volunteers should advise on Pesticide Resistance occurrence and management.

ANNEX 1 APPROVED AND REJECTED AIS

A1.1 APPROVED AIS

Table 1 below presents the AIs recommended for approval by this PERSUAP. This list is compiled from the list of Approved AIs in the previous PERSUAP with updated information. No new AIs have been added, several have been removed due to EPA restrictions. The list includes an indication of their approved uses in the US, both Type of pesticide and the Crops and Situations they are approved for use in.

Information has been taken from the following sources:

- EPA Pesticide Product and Label System (contains the registered labels for all US EPA approved pesticides): https://ordspub.epa.gov/ords/pesticides/f?p=PPLS:1. For each AI, a range of labels have been checked to determine the range of crops and situations the product is approved for use on, the EPA signal words and any specific restrictions, such as ground water contamination warnings.
- The Pesticide Action Network database of Active Ingredients https://www.pesticideinfo.org
- The University of Hertfordshire Pesticide Properties Database (http://sitem.herts.ac.uk/aeru/ppdb/en/atoz.htm) and Bio-Pesticides database (http://sitem.herts.ac.uk/aeru/bpdb/atoz.htm)
- The Resistance Action Committees for
    - Fungicides - https://www.frac.info
    - Insecticides - https://irac-online.org/
    - Herbicides - https://hracglobal.com/
    - Rodenticides - https://rrac.info/

Where available, for each AI the EPA and WHO toxicity ratings are given. Details of the WHO and EPA toxicity ratings are below.

The WHO system is based on the acute toxicity of active ingredient. It does not take account of long term or chronic hazards to health.

WHO Toxicity classification system

Class		LD50 for Rats Mg/Kg body weight	
		Oral	**Dermal**
Ia	Extremely hazardous	< 5	< 50
Ib	Highly hazardous	5-50	50-200
II	Moderately hazardous	50-2000	200-2000
III	Slightly hazardous	Over 2000	Over 2000
U	Unlikely to present acute hazard	5000 or higher	

The system used by the US EPA is based on an evaluation of the formulated product and takes account of a wider range of acute factors. The EPA ratings presented here are largely taken from the signal words used on product labels. Some AIs have multiple ratings as depending factors such as on the formulation and use.

US EPA Toxicity Classification Guide

Toxicity Categories	Category I	Category II	Category III	Category IV
Acute Oral	Up to and including 50 mg/kg	> 50 thru 500 mg/kg	> 500 thru 5000 mg/kg	> 5000 mg/kg
Acute Dermal	Up to and including 200 mg/kg	> 200 thru 2000 mg/kg	> 2000 thru 5000 mg/kg	> 5000 mg/kg
Acute Inhalation	Up to and including 0.05 mg/liter	> 0.05 thru 0.5 mg/liter	> 0.5 thru 2 mg/liter	> 2 mg/liter
Eye Irritation	Corrosive (irreversible destruction of ocular tissue) or corneal involvement or irritation persisting for more than 21 days	Corneal involvement or other eye irritation clearing in 8-21 days	Corneal involvement or other eye irritation clearing in 7 days or less	Minimal effects clearing in less than 24 hours
Primary Skin Irritation	Corrosive (tissue destruction into the dermis and/or scarring)	Severe irritation at 72 hours (severe erythema or edema)	Moderate irritation at 72 hours (moderate erythema)	Mild or slight irritation at 72 hours (no irritation
Signal Word	DANGER	WARNING	CAUTION	None Required

Additionally, a General Hazard classification with advice on PPE is given. This is taken from a peer reviewed paper published in The Lancet: Planetary Health[6]. This gives an overall risk categorization taking account of acute, chronic and environmental effects. It also details specific risks areas for pesticides.

WHO and General categorization ratings are not available for all pesticides. AIs indicated † are therefore based on similar chemicals and those indicated * are the authors extrapolations from chemicals with similar toxicity ratings.

The MOA groups indicate the pesticide group and categorization of an AI by the relevant Resistance Action Committee. Chemical groups in brackets differ from those recognized by the RAC (usually because for insecticides where a MOA group contains only a single AI, IRAC uses the AI name rather than a group).

PAN BAD ACTORS

Table 1 identifies pesticide AIs classified by PAN North America as Bad Actors. These are a set of "most toxic" pesticides. These pesticides are at least one of the following:

- Known or probable carcinogens, as designated by the International Agency for Research on Cancer (IARC), Globally Harmonized System of Classification and Labelling of Chemicals, U.S. National Toxicology Program, EPA Toxic Release Inventory cancer list, or the state of California's Proposition 65 list.
- Reproductive or developmental toxicants, as designated by Globally Harmonized System of Classification and Labelling of Chemicals, EPA Toxic Release Inventory reproductive and developmental toxicant lists, and the state of California's Proposition 65 list.
- Neurotoxic cholinesterase inhibitors, as designated by the California Office of Environmental Health Hazard Assessment, EPA, and/or PRI expert evaluation of chemical structure (for organophosphorus compounds).

[6] Paul C Jepson, Katie Murray, Oliver Bach, Maria A Bonilla, Lars Neumeister, 2020, Selection of pesticides to reduce human and environmental health risks: a global guideline and minimum pesticides list, The Lancet: Planetary Health. https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196(19)30266-9/fulltext

- Known groundwater contaminants, as designated by the state of California (for actively registered pesticides) or from historic groundwater monitoring records (for banned pesticides).
- Pesticides with high acute toxicity, as designated by the WHO, the Globally Harmonized System of Classification and Labelling of Chemicals, or U.S. EPA.

Note that because the acute toxicity of a product is dependent on the concentration of the active ingredient, the acute toxicity rating (i.e., the U.S. EPA Acute Hazard Warning Label) of the *product* (not the pure active ingredient) is used to determine PAN Bad Actor Product status in the Acute Toxicity category. For all other categories, the Bad Actor properties of the individual chemicals are applied to the product.

While many pesticides on this list remain authorised for use, volunteers should be aware that there is public pressure to ban them and alternative AIs may be perceived as better.

A1.2 Restricted Use Pesticides (RUPs)

Some AIs approved in the previous PERSUAP are RUPs for some or all uses. RUPs must only be recommended for use in exceptional circumstances and following the completion of a full EIA considering the need and hazard posed by the use, approved by the BEO. Pesticide hazard is a function of a range of factors such as concentration, formulation and the environmental risk posed by a particular use. Some AIs are therefore included in both RUP and GUP products.

This PERSUAP annex identifies AIs that were included in the previous PERSUAP but are RUP for any or all uses. Any AIs that have no ***agricultural*** GUP uses are excluded from Table 1 and included in a separate list, Table 2. Note that this includes the pyrethroid insecticides that are RUP in the US for agricultural uses, due to the risk they pose to aquatic organisms, but are available in GUP products for small scale use in domestic gardens.

A1.3 Deleted products

Table 3 lists AIs that were approved in the previous PERSUAP but are no longer approved by the EPA. Products containing these AIs must therefore not be supported for use. ***IPs must ensure that any existing lists of products are updated to remove products containing these AIs.***

Table 1 - AIs Approved by the PERSUAP.

Active Ingredient	Type	Crops/Situation	Toxicity EPA, WHO	General categorization	MOA group	Notes
2,4-D	Herbicide	Cereals, grass and amenity use	EPA: I Danger WHO: II Moderately hazardous	Low risk, Full PPE required	Phenoxy-carboxylates HRAC: 4	Available in various chemical forms, such as amines and esters, which vary in toxicity. Not all forms approved by EPA. Often co-formulated with other herbicide AIs
2,4-D Dimethylamine salt	Herbicide	Cereals, grass, vines, hops and amenity use	EPA: I Danger WHO: II Moderately hazardous (2,4-D†)	Low risk, Full PPE required	Phenoxy-carboxylates HRAC: 4	Also known as 2,4-D Amine
Abamectin	Insecticide / Acaricide / Nematicide	Wide variety of crops Anti-parasitic drug in livestock Residential and Industrial uses	EPA: II/III Caution/Warning WHO: IB Extremely hazardous	Medium Risk Use only by trained personnel Risk to aquatic systems Risk to Bees (Avermectin†)	Avermectin IRAC: 6	**Most EPA registered products for crop use are RUP** (exceptions are for non-food crops)
Acephate	Insecticide	Variety of crops	EPA: III Caution WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to wildlife Risk to Bees PAN Bad actor	Organophosphate IRAC: 1B	Organophosphate, Cholinesterase inhibitor
Acetamiprid	Insecticide	Wide variety of Crops, Residential and Industrial uses	EPA: III Caution WHO: II Moderately hazardous	Medium Risk Risk to aquatic systems Potential groundwater contaminant	Neonicotinoid IRAC: 4A	Neonicotinoid. May pose a lower risk to bees than other active substances of this group
Acetochlor	Herbicide	Pre-emergence/ planting for Grass weed control in a wide variety of crops	EPA: III Caution WHO: III Slightly hazardous	Use only by trained personnel* Potential groundwater contaminant PAN Bad actor	α-Chloroacetamide HRAC: 15	Probable Carcinogen
Acibenzolar-s-methyl	Fungicide	Preventative use on a wide variety of crops	EPA: III Caution WHO: Not Listed	Low risk, Basic PPE required	Benzothiadiazole FRAC: P 01	Has no direct effect on target organisms but activates plants natural defenses. May be co-formulated with other fungicides AIs

Table 1 - AIs Approved by the PERSUAP.

Active Ingredient	Type	Crops/Situation	Toxicity EPA, WHO	General categorization	MOA group	Notes
Amitraz	Insecticide	Limited veterinary and apiary use only	EPA: I-III depending on use Caution, Warning, Danger WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to Bystanders PAN Bad actor	(Formamidine) IRAC: 19	Only approved by EPA for apiary use to control varroa mites and in tick collars to use on dogs
Asulam – Sodium Salt	Herbicide	Sugar cane, ornamentals and non-crop uses	EPA: III Caution WHO: III Slightly hazardous (Asulam†)	PPE Required* Potential groundwater contaminant	Carbamate HRAC: 18	
Azadirachtin	Insecticide / Nematicide	Wide variety of crops.	EPA: III Caution WHO: Not Listed	Low risk, Basic PPE required	Azadirachtin IRAC: UN	Also known as neem, it is extracted from the neem tree, and a component of artisanal insecticides. A potent botanical insecticide active against a wide range of insect pests. It also has some fungicidal properties
Azoxystrobin	Fungicide	Wide variety of crops	EPA: III Caution WHO: U Unlikely to present acute hazard	Medium Risk Risk to aquatic systems Potential groundwater contaminant	QoI FRAC: C3	Broad spectrum strobilurin fungicide
Bacillus sphaericus	Insecticide	Aquatic sites to control mosquitos	EPA: III Caution WHO: Not Listed	Low risk, Basic PPE required	Microbial disruptors of insect midgut membranes IRAC: 11B	Bacillus sphaericus 2362, Serotype H5a5b, Strains ABTS 1743 and AML 614 are EPA registered
Bacillus thuringiensis	Insecticide	Wide range of crops	EPA: III Caution WHO: Not Listed	Low risk, Basic PPE required	Bacillus thuringiensis IRAC: 11A	Several different subspecies (aizawai, israelensis & kurstaki) and strains are registered. Care should be taken to ensure that any strains recommended are EPA approved See www.pesticideinfo.org. Some isolates of Bt produce a beta-exotoxin that is toxic to humans

Table 1 - AIs Approved by the PERSUAP.

Active Ingredient	Type	Crops/Situation	Toxicity EPA, WHO	General categorization	MOA group	Notes
Beauveria bassiana	Insecticide		EPA: III Caution WHO: Not Listed	Low risk, Basic PPE required	B*eauveria bassiana* IRAC: 11B	Several strains registered by EPA, HF23, GHA, ANT-03, PPRI 5339
Bensulfuron methyl	Herbicide	Rice	EPA: II Warning WHO: Not Listed	Low Risk PPE with eye protection required* Potential groundwater contaminant	Sulfonylurea HRAC: 2	Only used in Rice in US. Most other crops are sensitive to Bensulfuron methyl and will be damaged. Care needed to avoid drift. Thorough tank washing required of sprayers before use on other crops
Bentazon, sodium salt	Herbicide	Post emergence in a variety of crops	EPA: III Caution WHO: Not Listed	Medium Risk Use only by trained personnel Risk to wildlife Risk to Bystanders Known groundwater contaminant	Benzothiazinone HRAC: 6	
Bifenazate	Acaricide	Wide range of crops	EPA: III Caution WHO: U Unlikely to present acute hazard	Low risk, Basic PPE required	Bifenazate IRAC: 20D	
Bifenthrin	Insecticide / Acaricide	Wide range of crops	EPA: II Warning WHO: II Moderately hazardous	Medium Risk Risk to aquatic systems Risk to Bees PAN Bad actor	Pyrethroid IRAC: 3A	Limited shelf life, keep cool
Bispyribac-sodium	Herbicide	Turf and aquatic situations	EPA: III Caution WHO: Not Listed	Low risk, Basic PPE required* Potential groundwater contaminant	Pyrimidinyl benzoate HRAC: 2	Mainly used for aquatic weed control. Limited shelf life, keep cool
Boscalid	Insecticide	Wide range of crops	EPA: III Caution WHO: U Unlikely to present acute hazard	Low risk, Basic PPE required	SDHI FRAC: C2	Often co-formulated with pyraclostrobin Limited shelf life

Table 1 - AIs Approved by the PERSUAP.

Active Ingredient	Type	Crops/Situation	Toxicity EPA, WHO	General categorization	MOA group	Notes
Bromacil	Herbicide	Soil acting pre-emergence herbicide mainly used in tree fruit and non-crop areas	EPA: II Warning WHO: U Unlikely to present acute hazard	Medium Risk Use only by trained personnel Risk to aquatic systems Known groundwater contaminant PAN Bad actor	Uracil HRAC: 5	
Buprofezin	Insecticide	Insect growth regulator controlling whitefly and other insects on a range of crops	EPA: II Warning WHO: III Slightly hazardous	Low risk, Full PPE required	Bubrofezin IRAC: 16	Use on vegetables, fruit and some field crops
Capsaicin (*Capsicum oleoresin*)	Animal and insect repellent		EPA: II Warning WHO: Not Listed	Low risk, Basic PPE required	Botanical essence IRAC: UNE	Extract of chilli pepper
Captan	Fungicide	Mainly used in fruit production or as a seed treatment in field crops	EPA: II Warning WHO: U Unlikely to present acute hazard	Medium Risk Use only by trained personnel Risk to Bees PAN Bad actor	Phthalimide FRAC: M	
Carbaryl	Insecticide	Wide range of crops	EPA: III Caution WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to aquatic systems Risk to wildlife Risk to Bees PAN Bad actor	Carbamate HRAC: 18	Also used for fruit thinning
Carbendazim	Fungicide	Only approved for tree injection and as an industrial microbicide	EPA: III Caution WHO: U Unlikely to present acute hazard	Highly Hazardous Mutagenic Reproductive toxicity PAN Bad actor	MBC FRAC: B1	Used as an additive in building adhesives, cements, grouts etc
Carboxin	Fungicide	Only approved for use as a seed treatment	EPA: III Caution WHO: III Slightly hazardous	Low risk, Basic PPE required PAN Bad actor	SDHI FRAC: C2	Often co-formulated with other seed treatment AIs
Chitin	Plant growth regulator, nematicide, Fungicide	Wide range of crops	EPA: III Caution WHO: Not Listed	Low risk, Basic PPE required	Botanical essence IRAC: UNE	Also known as Chitosan Acts by inducing resistance in plants Animal derived pesticide

Table 1 - AIs Approved by the PERSUAP.

Active Ingredient	Type	Crops/Situation	Toxicity EPA, WHO	General categorization	MOA group	Notes
Chlorantraniliprole	Insecticide	Wide range of crops	EPA: II Warning WHO: U Unlikely to present acute hazard	Low risk, Basic PPE required Potential groundwater contaminant	Diamide IRAC: 28	Used for both foliar applications and as a seed treatment
Chlorfenapyr	Insecticide	Glasshouse vegetables and ornamental crops Residential and industrial use	EPA: III Caution WHO: II Moderately hazardous	Risk to Bees*	Pyrrole IRAC: 13	US crop approvals limited to glasshouse uses
Chlorothalonil	Fungicide	Wide range of crops	EPA: II Warning WHO: U Unlikely to present acute hazard	Highly Hazardous Carcinogen PAN Bad actor	Chloronitrile FRAC: M	
Chlorsulfuron	Herbicide	Cereals, pasture, turf and bare ground use	EPA: III Caution WHO: U Unlikely to present acute hazard	Low risk, Basic PPE required Known groundwater contaminant PAN Bad actor	Sulfonylurea HRAC: 2	Broadleaf herbicide
Cinnamaldehyde	Multi action	Wide range of crops	EPA: Minimum Risk chemical, exempt from FIFRA registration WHO: Not Listed	Low risk, Basic PPE required	Botanical essence IRAC: UNE	Exempt from USEPA registration Cinnamon oil Controls Downy and powdery mildew and Botrytis Wide range of insect pests Also acts as a mammalian repellent
Citronellol	Multi action		EPA: Minimum Risk chemical, exempt from FIFRA registration WHO: Not Listed	Low risk, Basic PPE required	Botanical essence IRAC: UNE	Exempt from USEPA registration Citronella oil A natural plant extract which exhibits fungicidal, insecticidal and herbicidal activity acts as an insect repellent
Clethodim	Herbicide	Grassweed herbicide for use in broadleaf crops	EPA: III Caution WHO: Not Listed	Low risk, Basic PPE required	DIM HRAC: 1	Cereal and other grass crops are highly sensitive to damage from Clethodim
Clodinafop-propargyl	Herbicide	Grassweed control in wheat	EPA: III Caution WHO: Not Listed	Low risk, Basic PPE required	FOP HRAC: 1	Currently only approved for use on wheat and durum wheat in US

Table 1 - AIs Approved by the PERSUAP.

Active Ingredient	Type	Crops/Situation	Toxicity EPA, WHO	General categorization	MOA group	Notes
Clofentezine	Acaricide	Fruit and ornamental crops	EPA: III Caution WHO: III Slightly hazardous	Low risk, Basic PPE required	(Tetrazine) IRAC: 10	
Clopyralid	Herbicide	A selective post emergence herbicide mainly used in cereals, turf and non-cropped land	EPA: III Caution WHO: III Slightly hazardous	Low risk, Full PPE required Known groundwater contaminant PAN Bad actor	Pyridine carboyxlate HRAC: 4	Can persist in soil. Important to respect planting intervals to avoid damage to following crops
Clove oil / Eugenol	Multi action	A plant-based oil which has fungicidal, herbicidal and insecticidal activity	EPA: Minimum Risk chemical, exempt from FIFRA registration WHO: Not Listed	Low risk, Basic PPE required	Botanical essence IRAC: UNE	Exempt from USEPA registration Highly phytotoxic
Copper ammonium acetate (metallic copper)	Fungicide	Wide range of crops	EPA: III Caution WHO: Not Listed	Low risk, Full PPE required	Inorganic FRAC: M	EPA registration as Copper Ammonium Complex
Copper hydroxide	Fungicide	Wide range of crops	EPA: II/III Caution/Warning WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to wildlife	Inorganic FRAC: M	
Copper oxychloride	Fungicide	Wide range of crops	EPA: II/III Caution/Warning WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to wildlife Risk to Bees	Inorganic FRAC: M	
Copper sulfate (basic)	Fungicide	Wide range of crops	EPA: II Warning WHO: Not Listed	Low risk, Full PPE required	Inorganic FRAC: M	
Copper sulfate (Pentahydrate)	Fungicide/Algaecide/Molluscicide	Wide range of crops, water treatment	EPA: III Caution WHO: II Moderately hazardous (Copper sulfate[†])	Medium Risk Use only by trained personnel Risk to aquatic systems Risk to wildlife Risk to Bees	Inorganic FRAC: M	

Table 1 - AIs Approved by the PERSUAP.

Active Ingredient	Type	Crops/Situation	Toxicity EPA, WHO	General categorization	MOA group	Notes
Cottonseed oil (cotton oil)	Multi action	Wide range of crops	EPA: Minimum Risk chemical, exempt from FIFRA registration Min Risk WHO: Not Listed	Low risk, Basic PPE required*	Non-specific mechanical and physical disruptors IRAC: UNM	Exempt from US EPA registration Cinnamon oil Controls downy and powdery mildew and Botrytis Wide range of insect pests Also acts as a mammalian repellent
Cuprous oxide	Fungicide / Algaecide / Molluscicide	Wide range of crops, antifouling and other protective paints, fabric treatments	EPA: II Warning WHO: II Moderately hazardous		Inorganic FRAC: M	
Cyazofamid	Fungicide	Potatoes, vines, vegetables, fruit and herbs	EPA: III Caution WHO: U Unlikely to present acute hazard	Low risk, Basic PPE required	QiI FRAC: C4	Mainly controls oomycete diseases. Downy mildew, pythium, potato late blight
Cyfluthrin	Insecticide	Wide variety of Crops, Residential and Industrial uses	EPA: II/III Caution/Warning Restricted Use Pesticide WHO: IB Extremely hazardous	Highly Hazardous WHO Ib Risk to Bees Risk to aquatic systems	Pyrethroid IRAC: 3A	
Cymoxanil	Fungicide	Potatoes, vines, vegetables, fruit and herbs	EPA: II Warning WHO: II Moderately hazardous	Low risk, Basic PPE required	QiI FRAC: C4	Controls a range of diseases including Downy mildews and potato late blight
Cyproconazole	Fungicide	Cereals, corn soybean, Peanuts	EPA: III Caution WHO: II Moderately hazardous	Highly Hazardous Reproductive toxicity PAN Bad actor	DMI FRAC: G1	
Cyromazine	Insecticide	Mainly vegetable crops (including mushrooms) and potatoes	EPA: III Caution WHO: III Slightly hazardous	Low risk, Basic PPE required Possible groundwater contaminant PAN Bad actor	(Triazine) IRAC: 17	Insect growth regulator effective against flies and some other insects. Sometimes incorporated in animal feed to control flies in compost Metabolites have been found in groundwater, suspected link to agricultural use

Table 1 - AIs Approved by the PERSUAP.

Active Ingredient	Type	Crops/Situation	Toxicity EPA, WHO	General categorization	MOA group	Notes
Diatomaceous earth	Insecticide	Wide range of crops, stored products and industrial situations	EPA: III Caution WHO: Not Listed	Low risk, Basic PPE required	Non-specific mechanical and physical disruptors IRAC: UNM	EPA registered as Silicon Dioxide
Dicamba	Herbicide	Cereals, Turf, Pastures, non crop land	EPA: III Caution WHO: II Moderately hazardous	Low risk, Full PPE required PAN Bad actor	Benzoate HRAC: 4	Broadleaf herbicide Normally used in coformulations with other herbicides
Difenoconazole	Fungicide	Wide range of crops	EPA: III Caution WHO: II Moderately hazardous	Low risk, Basic PPE required	DMI FRAC: G1	Often used in co-formulation with other Fungicide AS
Dimethomorph	Fungicide	Vegetables, grapes, potatoes, ornamental crops	EPA: III Caution WHO: III Slightly hazardous	Low risk, Basic PPE required	CAA FRAC: H5	Limited shelf life, keep cool
MCPA, Dimethylamine salt	Herbicide	For broadleaf weed control in cereals, other grasses and some other crops	EPA: I Danger WHO: II Moderately hazardous (MCPA†)	Low risk, Full PPE required Known groundwater contaminant	Phenoxy-carboxylates HRAC: 4	
Diuron	Herbicide	Pre-emergence herbicide for use in cereals and a range of other, mainly perennial, crops	EPA: III Caution WHO: III Slightly hazardous	Medium Risk Use only by trained personnel Risk to wildlife PAN Bad actor	Urea HRAC: 5	
Emamectin Benzoate	Acaricide	Control of mites and some insects on vegetables, cotton, soybean and some fruit Tree injection	EPA: III Caution Restricted Use Pesticide WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to aquatic systems Risk to Bees	Avermectin IRAC: 6	Natural product produced by fermentation of actinomycete soil bacteria
EPTC	Herbicide	Control of grasses and some broadleaf weeds in a range of crops	EPA: II Warning WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to wildlife Risk to Bees Risk to Bystanders PAN Bad actor	Thiocarbamate HRAC: 15	EPA Registered as Carbamothioic acid, dipropyl-, S-ethyl ester

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Active Ingredient	Type	Crops/Situation	Toxicity EPA, WHO	General categorization	MOA group	Notes
Etoxazole	Acaricide	Fruit, fruiting vegetables and cotton	EPA: III Caution WHO: III Slightly hazardous	Medium Risk Risk to aquatic systems	(Diphenyl oxazoline) IRAC: 10B	
Famoxadone	Fungicide	Some fruit and vegetables	EPA: III Caution WHO: U Unlikely to present acute hazard	Medium Risk Risk to aquatic systems Risk to wildlife	QoI FRAC: C3	Only available in US co-formulated with cymoxanil Effective against a wide range of fungi, including downy mildews and blights Limited shelf life
Fenpyroximate	Acaricide	Range of fruit, vegetables and ornamental crops	EPA: II Warning WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to aquatic systems Risk to wildlife	METI IRAC: 21A	Considered very safe to bees
Flonicamid	Insecticide	Wide range of crops	EPA: II/III Caution/Warning WHO: II Moderately hazardous	Low risk, Basic PPE required	(Pyridine) IRAC: 29	Controls aphids, whiteflies, plant bugs and caterpillars
Florasulam	Herbicide	Post emergence control of broadleaf weeds in cereal crops	EPA: III Caution WHO: U Unlikely to present acute hazard	Low risk, Basic PPE required Possible groundwater contaminant	Triazolopyrimidine - Type 1 HRAC: 2	Only available in US in coformulations with other AIs
Fluazifop-p-butyl	Herbicide	Grass herbicide for use in a wide range of broadleaf crops	EPA: III Caution WHO: III Slightly hazardous	Low risk, Basic PPE required Known groundwater contaminant PAN Bad actor	FOP HRAC: 1	
Fluazinam	Fungicide	Range of vegetable and fruit crops, Turf	EPA: II/III Caution/Warning WHO: Not Listed	Medium Risk Use only by trained personnel Risk to Bees Risk to Bystanders	2,6-dinitro-anilines FRAC: C5	Turf uses have a lower EPA hazard warning than crop uses
Fludioxonil	Fungicide	Wide range of crops	EPA: III Caution WHO: U Unlikely to present acute hazard	Low risk, Basic PPE required	PhenylPyrroles FRAC: E2	Used as a foliar spray, seed treatment and post harvest treatment. Often co-formulated with other fungicides

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Active Ingredient	Type	Crops/Situation	Toxicity EPA, WHO	General categorization	MOA group	Notes
Flumetsulam	Herbicide	Corn, soybeans	EPA: III Caution WHO: U Unlikely to present acute hazard	Low risk, Basic PPE required Possible groundwater contaminant	Triazolopyrimidine - Type 1 HRAC: 2	
Fluroxypyr	Herbicide	Broadleaf herbicide for use in cereals and some other crops	EPA: II/III Caution/Warning WHO: U Unlikely to present acute hazard	Low risk, Basic PPE required	Pyridyloxy-carboxylate HRAC: 4	EPA warning phrases appear to vary with concentration of active in formulation
Flutriafol	Fungicide	Wide range of crops	EPA: III Caution WHO: II Moderately hazardous	Low risk, Basic PPE required* Possible groundwater contaminant	DMI FRAC: G1	Often co-formulated with other fungicides
Folpet	Fungicide	Wide range of crops and some industrial uses	EPA: I/II Warning/Danger WHO: U Unlikely to present acute hazard	Medium Risk Use only by trained personnel Risk to aquatic systems PAN Bad actor	Phthalimide FRAC: M	Possible carcinogen Low resistance risk. May be mixed with other fungicides as part of resistance management strategies
Fomesafen	Herbicide	Pre-emergence in beans and other legumes, cotton, potatoes	EPA: EPA II-IV depending on concentration/co-formulants Caution-Danger WHO: II Moderately hazardous	Low risk, Basic PPE required Known groundwater contaminant	Diphenyl ether HRAC: 14	For control of broadleaf weeds post-emergence. Normally co-formulated with other herbicides. Limited shelf life
Fosetyl-Aluminium	Fungicide	Horticultural crops and turf	EPA: III Caution WHO: U Unlikely to present acute hazard	Low risk, Full PPE required	Phosphonate FRAC: P 07	Effective against a range of diseases including downy mildew and pythium. Also effective against some bacterial diseases Listed as Aluminum tris (O-ethyl phosphonate) on US labels
Fosthiazate	Nematicide	Tomatoes (only)	EPA: I Danger Restricted Use Pesticide WHO: Not Listed	Use only by trained personnel* PAN Bad actor	Organophosphate IRAC: 1B	

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Active Ingredient	Type	Crops/Situation	Toxicity EPA, WHO	General categorization	MOA group	Notes
Garlic extract, garlic oil	Insecticide, Mammalian Repellent	Wide range of crops	EPA: Minimum Risk chemical, exempt from FIFRA registration Min Risk WHO: Not Listed	Low risk, Basic PPE required	Botanical essence IRAC: UNE	In some EPA registered products co-formulated with other AIs
Garlic spray	Insecticide, Mammalian Repellent	Wide range of crops	EPA: Minimum Risk chemical, exempt from FIFRA registration Min Risk WHO: Not Listed	Low risk, Basic PPE required	Botanical essence IRAC: UNE	
Glufosinate-Ammonium	Herbicide	For total vegetation control	EPA: II/III Caution/Warning WHO: II Moderately hazardous	Highly Hazardous Reproductive toxicity	Phosphinic acid HRAC: 10	Used to control weeds in "Liberty Link" GM crops **Some US uses RUP**
Glyphosate, isopropylamine salt	Herbicide	Broad spectrum herbicide for land clearance and use in woody crops	EPA: III Caution WHO: III Slightly hazardous (Glyphosate†)	Medium Risk Risk to wildlife PAN Bad actor	Glycine HRAC: 9	Used to control weeds in "Roundup Ready" GM crops
Halosulfuron-methyl	Herbicide	Range of crops	EPA: III Caution WHO: Not Listed	Low risk, Basic PPE required	Sulfonylurea HRAC: 2	For broadleaf and sedge control Applied pre planting or to established crops
Hexythiazox	Acaricide	Wide range of crops	EPA: III Caution WHO: U Unlikely to present acute hazard	Low risk, Basic PPE required PAN Bad actor	(Carboximide) IRAC: 10A	
Hymexazol	Fungicide	Sugar beet seed treatment	EPA: II Warning WHO: III Slightly hazardous	Low risk, Full PPE required PAN Bad actor	Heteroaromatic FRAC: A3	For control of soilborne fungi
Imazapic	Herbicide	Peanuts, industrial, non-crop areas, trees and brush	EPA: III Caution WHO: III Slightly hazardous	Low risk, Basic PPE required Potential groundwater contaminant	Imidazolinone HRAC: 2	

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Active Ingredient	Type	Crops/Situation	Toxicity EPA, WHO	General categorization	MOA group	Notes
Imidacloprid	Insecticide	Wide range of crops, Veterinary, domestic, industrial uses	EPA: III Caution WHO: II Moderately hazardous	Highly Hazardous Risk to Bees HIGHLY TOXIC Potential groundwater contaminant	Neonicotinoid IRAC: 4A	Used a foliar spray and a seed treatment
Indaziflam	Herbicide	Forestry, Woody fruit, Grass, Industrial, Amenity areas	EPA: II/III Caution/Warning WHO: Not Listed	Low risk, Basic PPE required	Alkylazine HRAC: 29	Often used in coformulation with other Herbicide AIs
Indoxacarb	Insecticide	Wide range of crops, industrial and domestic areas	EPA: III Caution WHO: II Moderately hazardous	Medium Risk Risk to Bees	Oxadiazine IRAC: 22A	For control of caterpillars, some beetles and other plant eating insects, roaches, ants
Iodosulfuron-methyl sodium salt	Herbicide	Broadleaf weed control in Cereal crops, maize, grass and soybean	EPA: II (IV some uses) Caution (Danger) WHO: Not Listed	Medium Risk Risk to aquatic systems Potential groundwater contaminant	Sulfonylurea HRAC: 2	GUP applied to cereals preplanting, **RUP when applied to emerged wheat**
Iprodione	Fungicide	Wide range of mainly Horticultural crops	EPA: III Caution WHO: III Slightly hazardous	Highly Hazardous Carcinogen Potential groundwater contaminant PAN Bad actor	Dicarboximide FRAC: E3	Frequently co-formulated with other fungicides
Kresoxim-methyl	Fungicide	Range of fruit, vegetable and ornamental crops	EPA: III Caution WHO: III Slightly hazardous	Low risk, Basic PPE required Potential groundwater contaminant PAN Bad actor	QoI FRAC: C3	
Lemongrass oil	Fungicide Insect repellent		EPA: Minimum Risk chemical, exempt from FIFRA registration Min Risk WHO: Not Listed	Low risk, Basic PPE required*	Plant Extract FRAC: BM	May have some herbicidal activity
Linuron	Herbicide	Range of crops	EPA: III Caution WHO: III Slightly hazardous	Highly Hazardous Reproductive toxicity Known groundwater contaminant PAN Bad actor	Urea HRAC: 5	

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Active Ingredient	Type	Crops/Situation	Toxicity EPA, WHO	General categorization	MOA group	Notes
Mancozeb	Fungicide	Wide range of crops	EPA: III Caution WHO: U Unlikely to present acute hazard	Medium Risk Use only by trained personnel Risk to wildlife PAN Bad actor	Dithiocarbamate FRAC: M	Used as both foliar and seed treatment Frequently co-formulated with other AIs
Phytelene of marigold	Insecticide / Acaricide	All food crops	EPA: IV None WHO: Not Listed	Low risk, Basic PPE required*	Botanical essence IRAC: UNE	Marigold extract EPA registration as "Oils, tagetes"
MCPA	Herbicide	Grass, Cereals, brush control	EPA: II/III Caution/Warning WHO: II Moderately hazardous	Low risk, Full PPE required PAN Bad actor	Phenoxy-carboxylates HRAC: 4	Normally co-formulated with other herbicides
Mecoprop (MCPP)	Herbicide	Turf	EPA: III Caution WHO: II Moderately hazardous	Low risk, Full PPE required	Phenoxy-carboxylates HRAC: 4	Normally co-formulated with other herbicide AIs
Mecoprop-P (MCPP-P)	Herbicide	Turf, non-crop areas	EPA: III Caution WHO: II Moderately hazardous	Low risk, Full PPE required PAN Bad actor	Phenoxy-carboxylates HRAC: 4	Normally co-formulated with other herbicide AIs
Mefenoxam (Metalaxyl M)	Fungicide	Wide range of crops	EPA: II/III Caution/Warning WHO: II Moderately hazardous (Metalaxyl†)	Low risk, Full PPE required Known groundwater contaminant	Phenylamide FRAC: A1	Biologically active enantiomer of metalaxyl Used as both foliar and seed treatment Frequently co-formulated with other AIs
Mesotrione	Herbicide	Range of crops	WHO: III Slightly hazardous	Low risk, Basic PPE required Known groundwater contaminant	Triketone HRAC: 27	
Metalaxyl	Fungicide	Wide range of crops , Primarily as a seed treatment	EPA: II/III Caution/Warning WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to wildlife Known groundwater contaminant	Phenylamide FRAC: A1	Frequently co-formulated with other AIs Metalaxyl is a mixture of 2 enantiomers, only one, metalaxyl-M (or mefenoxam see above) is biologically active

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Active Ingredient	Type	Crops/Situation	Toxicity EPA, WHO	General categorization	MOA group	Notes
Metam-Sodium	Fumigant	Soil Sterilant	EPA: I Danger Restricted Use Pesticide WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to aquatic systems Risk to wildlife PAN Bad actor	Methyl isothiocyanate generators IRAC: 8F	
Metolachlor	Herbicide	Range of broadacre crops	EPA: III Caution WHO: III Slightly hazardous	Medium Risk Use only by trained personnel Risk to wildlife Known groundwater contaminant PAN Bad actor	α-Chloroacetamide HRAC: 15	
Metribuzin	Herbicide	Soy, Cereals, Corn, Potatoes, Sugarcane, Turf and some other crops	EPA: III Caution WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to wildlife PAN Bad actor	Triazinone HRAC: 5	Limited shelf life Generally co-formulated with other AIs
Mineral Oil, refined	Insecticide	Wide range of crops	EPA: III Caution WHO: Not Listed	Medium Risk Risk to aquatic systems	Non-specific mechanical and physical disruptors IRAC: UNM	Main use is on dormant tree and bush crops, both fruiting and ornamental
Mineral Oil, unrefined	Insecticide	Wide range of crops	EPA: III Caution WHO: Not Listed	Low risk, Basic PPE required PAN Bad actor	Non-specific mechanical and physical disruptors IRAC: UNM	Main use is on dormant tree and bush crops, both fruiting and ornamental
Mono- and di-potassium salts of Phosphorous Acid	Fungicide	Range of fruit, vegetable and ornamental crops	EPA: III Caution WHO: Not Listed	Low risk, Basic PPE required	Phosphonate FRAC: P 07	EPA registration as Dipotassium phosphite Both soil and foliar applied Also used as a seed treatment
Neem oil	Insecticide	Wide range of crops, residential areas	EPA: III Caution WHO: Not Listed	Low risk, Basic PPE required	Botanical essence IRAC: UNE	EPA registrations as Neem oil & Clarified hydrophobic neem oil Azadirachtin, the purified active ingredient in neem oil is also registered
Nicosulfuron	Herbicide	Corn, some grasslands	EPA: III Caution WHO: U Unlikely to present acute hazard	Low risk, Basic PPE required Known groundwater contaminant	Sulfonylurea HRAC: 2	Also used on GM herbicide tolerant sorghum Limited shelf life

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Active Ingredient	Type	Crops/Situation	Toxicity EPA, WHO	General categorization	MOA group	Notes
Novaluron	Insecticide	Wide range of fruit and vegetable crops Aquatic areas for mosquito control	EPA: II/III Caution/Warning WHO: U Unlikely to present acute hazard	Medium Risk Risk to aquatic systems	Benzoylurea IRAC: 15	EPA Class II when used alone for agricultural pest control. Class III when co-formulated with other insecticide AIs
Oxyfluorfen	Herbicide	Corn, cotton, fruit and vegetables, domestic and industrial hard surfaces	EPA: II/III Caution/Warning WHO: U Unlikely to present acute hazard	Medium Risk Use only by trained personnel Risk to aquatic systems Risk to wildlife PAN Bad actor	Diphenyl ether HRAC: 14	Limited shelf life, keep cool
Paecilomyces lilacinus	*Nematicide*	Wide range of fruit and vegetable crops	EPA: III Caution WHO: Not Listed	Low risk, Basic PPE required*	Fungal agent IRAC: UNF	A soil fungus used to control plant parasitic nematodes 2 strains - 251 and PL11 - are registered by the EPA
Pendimethalin	Herbicide	Wide range of crops	EPA: III Caution WHO: II Moderately hazardous	Medium Risk Risk to wildlife	Dinitroaniline HRAC: 3	Limited shelf life
Penoxsulam	Herbicide	Aquatic areas, rice, turf, tree fruit, non-crop land	EPA: III Caution WHO: U Unlikely to present acute hazard	Low risk, Basic PPE required	Triazolopyrimidine - Type2 HRAC: 2	
PCNB (Quintozene)	Fungicide	Turf, vegetable (Seedlings only), ornamentals	EPA: III Caution WHO: U Unlikely to present acute hazard (Quintozene)	Medium Risk Use only by trained personnel Risk to aquatic systems Risk to Bees Risk to Bystanders	Aromatic Hydrocarbon FRAC: F3	Also known as Pentachloronitrobenzene (PCNB) Mainly used to control soil borne pathogens
Fenoxaprop-p-ethyl	Herbicide	Grassweed control in cereals, (inc rice) and turf	EPA: II/III Caution/Warning WHO: III Slightly hazardous	Low risk, Basic PPE required	FOP HRAC: 1	(Listed as Phenoxaprop-p-ethyl in previous PERSUAP)
Potassium laurate	Insecticide	Wide range of crops	EPA: II/III Caution/Warning WHO: Not Listed	Low risk, Basic PPE required	Non-specific mechanical and physical disruptors IRAC: UNM	Also known as insecticidal soap

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Active Ingredient	Type	Crops/Situation	Toxicity EPA, WHO	General categorization	MOA group	Notes
Propanil	Herbicide	Postemergence weed control in Rice	EPA: III Caution WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to aquatic systems Risk to wildlife	Amide HRAC: 5	Keep cool
Propargite	Acaricide	Beans, corn, cotton, hops, potato, sorghum and some other crops	EPA: I Danger Restricted Use Pesticide WHO: III Slightly hazardous	Medium Risk Use only by trained personnel Risk to wildlife PAN Bad actor	ATP inhibitor - type 3 IRAC: 12C	
Propiconazole	Fungicide	Wide range of crops	EPA: II/III Caution/Warning WHO: II Moderately hazardous	Highly Hazardous Reproductive toxicity PAN Bad actor	DMI FRAC: G1	
Propoxycarbazone-Sodium	Herbicide	Wheat, pasture	EPA: III Caution WHO: Not Listed	Low risk, Basic PPE required	Triazolinone HRAC: 2	
Pseudomonas fluorescens A506	Bactericide / Fungicide / Frost protectant	Fruit, tomato, potato	EPA: III Caution WHO: Not Listed	Low risk, Basic PPE required	Microbial FRAC: BM	Controls soil-borne diseases caused by Fusarium and Rhizoctonia spp. including fire blight. Has non ice nucleating properties and can improve frost hardiness
Pyraclostrobin	Fungicide	Wide range of crops	EPA: III Caution WHO: Not Listed	Medium Risk Use only by trained personnel Risk to aquatic systems Potential groundwater contaminant	QoI FRAC: C3	Normally co-formulated with another fungicide AI for resistance management purposes
Pyridaben	Insecticide / Acaricide	Fruit, greenhouse tomatoes and cucumbers, ornamentals	EPA: III Caution WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to aquatic systems Risk to Bees	METI IRAC: 21A	
Pyroxsulam	Herbicide	Wheat and triticale	EPA: III Caution WHO: III Slightly hazardous	Low risk, Basic PPE required	Triazolinone HRAC: 2	

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Active Ingredient	Type	Crops/Situation	Toxicity EPA, WHO	General categorization	MOA group	Notes
Quinclorac	Herbicide	Rice, grass, cranberries, rhubarb, asparagus	EPA: III Caution WHO: III Slightly hazardous	Low risk, Basic PPE required	Quinoline-carboxylate HRAC: 4	
Quizalofop-P-ethyl	Herbicide	Wide range of crops	EPA: III Caution WHO: II Moderately hazardous (Quizalofop†)	Low risk, Basic PPE required	FOP HRAC: 1	Keep cool
S-metolachlor	Herbicide		EPA: III Caution WHO: III Slightly hazardous (Metolachlor†)	Medium Risk Use only by trained personnel Risk to aquatic systems Known groundwater contaminant PAN Bad actor	Chloroacetamide HRAC: 15	S-enantiomer of metolachlor. Both are USEPA registered
Sethoxydim	Herbicide	Grass weeds in a wide range of broadleaf crops, turf, non-crop sites	EPA: II Warning WHO: III Slightly hazardous	Low risk, Basic PPE required	DIM HRAC: 1	
Simazine	Herbicide	Tree fruit, corn, strawberries, turf	EPA: III Caution WHO: U Unlikely to present acute hazard	Medium Risk Risk to wildlife Known groundwater contaminant PAN Bad actor	Triazine HRAC: 5	Soil acting herbicide
Soap spray	Insecticide, Mammalian Repellent	Wide range of crops	EPA: II/III Caution/Warning WHO: Not Listed	Low risk, Basic PPE required*	Non-specific mechanical and physical disruptors IRAC: UNM	Soap is a generic term for salts of fatty acids and include a range of chemicals. Ammonium soaps of fatty acids, Potassium laurate and soap are all EPA registered. Lauryl sulfate and Sodium laurylsulfate are exempt from EPA registration
Sodium carbonate	Microbicide	Industrial and domestic areas	EPA: III Caution WHO: Not Listed	Low risk, Basic PPE required*	Inorganic salt -	Washing Soda
Spinosad	Insecticide	Wide range of crops Aquatic areas for Mosquito control	EPA: III Caution WHO: III Slightly hazardous	Medium Risk Risk to Bees	Spinosyn IRAC: 5	For control of caterpillars, beetles and some leafminers

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Active Ingredient	Type	Crops/Situation	Toxicity EPA, WHO	General categorization	MOA group	Notes
Spirotetramat	Insecticide	Wide range of fruit and vegetable crops	EPA: II/III Caution/Warning WHO: III Slightly hazardous	Low risk, Full PPE required	Inhibitor of acetyl CoA carboxylase IRAC 23	Mainly effective against immature insect stages
Streptomycin sulfate	Bactericide (Antibiotic)	Range of fruit and vegetable crops	EPA: III Caution WHO: Not Listed	Low risk, Basic PPE required PAN Bad actor	Glucopyranosyl antibiotic FRAC: D4	PAN bad actor due to potential for exacerbating antimicrobial resistance in human pathogens
Sulfosulfuron	Herbicide	Small grain cereals, corn, canola, sunflower, beans, potato, grassland, non-crop areas	EPA: III Caution WHO: Not Listed	Low risk, Basic PPE required	Sulfonylurea HRAC: 2	
Sulphur	Fungicide / Acaricide	Wide range of crops	EPA: III Caution WHO: III Slightly hazardous	Low risk, Basic PPE required	Inorganic FRAC: M / IRAC: UN	Widely used in organic agriculture
Tebuconazole	Fungicide	Wide range of crops, wood preservative, domestic gardens	EPA: III Caution WHO: II Moderately hazardous	Low risk, Full PPE required Known groundwater contaminant	DMI FRAC: G1	Used as both foliar and seed treatments
Terbuthylazine	Algaecide	Only approved for algae control in closed water systems	EPA: III Caution WHO: III Slightly hazardous	Medium Risk Risk to wildlife	Triazine HRAC: 5	No EPA permitted crop uses
Tetraconazole	Fungicide	Canola, peanuts, soybean, sugarbeet and a range of other crops	EPA: III Caution WHO: II Moderately hazardous	Medium Risk Risk to wildlife PAN Bad actor	DMI FRAC: G1	US labels inc lude warnings to avoiding use in areas where endangered mammal and bird species may be affected, due to adverse effects on reproduction.
Thiamethoxam	Insecticide	Wide range of crops, residential gardens	EPA: III Caution WHO: II Moderately hazardous	Highly Hazardous HIGHLY TOXIC	Neonicotinoid IRAC: 4A	US labels contain warnings about protecting pollinators Limited shelf life Used for both foliar and seed treatments
Thiophanate-methyl	Fungicide	Wide range of crops	EPA: III Caution WHO: U Unlikely to present acute hazard	Medium Risk Use only by trained personnel Risk to wildlife PAN Bad actor	MBC FRAC: B1	Used as both foliar and seed treatments

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Active Ingredient	Type	Crops/Situation	Toxicity EPA, WHO	General categorization	MOA group	Notes
Thiram	Fungicide Animal repellent	Wide range of crops (as a seed treatment) Foliar treatment peaches, strawberries, turf	EPA: III Caution WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to aquatic systems Risk to wildlife Risk to Bees	Dithiocarbamate FRAC: M	Mainly used as a seed treatment. Very limited foliar uses permitted
Triadimefon	Fungicide	Turf, ornamentals	EPA: III Caution WHO: II Moderately hazardous	Low risk, Full PPE required Potential groundwater contaminant PAN Bad actor	DMI FRAC: G1	Many uses recently withdrawn
Tribenuron methyl	Herbicide	Small grain cereals Soybeans, pre-emergence Many other crops pre planting	EPA: III Caution WHO: Not Listed	Low risk, Basic PPE required	Sulfonylurea HRAC: 2	Normally co-formulated with other AIs Also used on Herbicide tolerant canola and sunflowers
Trichlorfon	Insecticide	Turf, ornamentals	EPA: II/III Caution/Warning WHO: II Moderately hazardous	Highly Hazardous Listed under Rotterdam Convention Unacceptable risks for operators, workers and bystanders. High risk to Aquatic invertebrates. PAN Bad actor	Organophosphate IRAC: 1B	No EPA approved food crop uses
Trichoderma harzianum	Fungicide, growth promoter	Wide range of crops	EPA: III Caution WHO: Not Listed	Low risk, Basic PPE required*	Microbial FRAC: BM	Protects against soil borne pathogens. Apply to soil, seed or cuttings for transplanting. Two strains, T-22 and T78 are registered by EPA
Triclopyr	Herbicide	Grassland (inc Turf), non-crop land	EPA: EPA II-IV depending on concentration/co-formulants Caution-Danger WHO: II Moderately hazardous	Low risk, Full PPE required Potential groundwater contaminant	HRAC: 4 Pyridyloxy-carboxylate	Often co-formulated with other AIs

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Active Ingredient	Type	Crops/Situation	Toxicity EPA, WHO	General categorization	MOA group	Notes
Trifloxystrobin	Fungicide	Wide range of crops	EPA: III Caution WHO: U Unlikely to present acute hazard	Medium Risk Use only by trained personnel Risk to aquatic systems Potential groundwater contaminant	FRAC: C3 QoI	Often co-formulated or used with other AIs for resistance management purposes
Trifloxysulfuron-Sodium	Herbicide	Citrus, cotton, sugarcane, turf, tomato (transplants)	EPA: III Caution WHO: Not Listed	Low risk, Basic PPE required	HRAC: 2 Sulfonylurea	US EPA lsited as 2-Pyridinesulfonamide, N-[[(4,6-dimethoxy-2-pyrimidinyl) amino]carbonyl]-3-(2,2,2-trifluoroethoxy)-, monosodium salt, monohydrate
Vegetable oils: Soybean oil, canola oil, olive	Insecticide	Wide range of crops	EPA: III Caution WHO: Not Listed	Low risk, Basic PPE required	IRAC: UNM Non-specific mechanical and physical disruptors	Soy and corn oil are EPA Minimum risk chemicals.

Table 2 - AIs that were approved in the previous F2F PERSUAP but are RUP for agricultural uses

Active Ingredient	Type	Crops/Situation	Toxicity EPA, WHO	General categorization	MOA group	Notes
Beta-cyfluthrin	Insecticide	Household and wide range of crops	EPA: II Warning Restricted Use Pesticide WHO: IB Extremely hazardous	Highly Hazardous WHO Ib Risk to Bees Risk to aquatic systems	Pyrethroid IRAC: 3A	Previous PERSUAPs listed this as WHO II, **RUP for crop uses**
Cypermethrin	Insecticide	Mainly used for household, industrial and livestock. Some Crop uses	EPA: II (IV some uses) Caution (Danger) Restricted Use Pesticide WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to aquatic systems Risk to Bees	Pyrethroid IRAC: 3A	Pyrethroid **RUP for most agricultural uses,** GUP for turf and garden ornamentals Moderate acute toxicity, high carcinogenicity, significant risk to non-target organisms
Cypermethrin, alpha	Insecticide	Wide range of crops, Industrial and Veterinary use	EPA: II (IV some uses) Caution (Danger) Restricted Use Pesticide WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to aquatic systems Risk to Bees	Pyrethroid IRAC: 3A	Pyrethroid **RUP for most agricultural uses,** GUP for turf and garden ornamentals Moderate acute toxicity, high carcinogenicity, significant risk to non-target organisms
Dazomet	Pre-planting soil fumigant	Controls a range of weeds, disease, insect and nematode pests Also has industrial uses as a fungicide and anti-microbial	EPA: I Danger Restricted Use Pesticide WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to aquatic systems Risk to wildlife Risk to Bees PAN Bad actor	Methyl isothiocyanate generators IRAC: 8F	**RUP for agricultural uses** Dazomet itself is not listed as a PAN bad actor but it works by releasing methyl-isothiocyanate
Deltamethrin	Insecticide	Wide range of crops Fly control in livestock houses Veterinary pest control Residential and Industrial uses	EPA: I Danger Restricted Use Pesticide WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to aquatic systems Risk to Bees	Pyrethroid IRAC: 3A	**Agricultural uses are RUP** Permitted for home vegetable gardens
Diflubenzuron	Insecticide	Wide range of crops and industrial situations	EPA: III Caution Restricted Use Pesticide WHO: III Slightly hazardous	Medium Risk Use only by trained personnel Risk to aquatic systems Risk to wildlife	Benzoylureas IRAC: 15	Insect Growth Regulator. Mainly effective against insect larval stages and eggs **RUP due to toxicity to aquatic invertebrates**

Table 2 - AIs that were approved in the previous F2F PERSUAP but are RUP for agricultural uses

Active Ingredient	Type	Crops/Situation	Toxicity EPA, WHO	General categorization	MOA group	Notes
Fenpropathrin	Insecticide	Wide range of crops	EPA: II Warning Restricted Use Pesticide WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to aquatic systems Risk to wildlife Risk to Bees PAN Bad actor	Pyrethroid IRAC: 3A	**RUP due to risk to aquatic organisms**
Fipronil	Insecticide	Industrial, domestic, veterinary pest control Very limited (RUP) crop uses, Potato furrows, corn seed treatment, ornamentals	EPA: III Caution WHO: II Moderately hazardous	Highly Hazardous HIGHLY TOXIC	Phenylpyrazole IRAC: 2B	Mainly used for public health ad structural pests **Crop uses are RUP due to risk to aquatic organisms** Use as seed treatment on corn permitted ONLY on seed for export
Lambda-Cyhalothrin	Insecticide	Wide range of crops, veterinary, domestic and industrial situations	EPA: III Caution Restricted Use Pesticide WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to aquatic systems Risk to Bees	Pyrethroid IRAC: 3A	**Agricultural uses are RUP due to toxicity to fish and aquatic organisms**
Permethrin	Insecticide	Wide range of crops, industrial and residential uses.	EPA: III Caution Restricted Use Pesticide WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to aquatic systems Risk to wildlife Risk to Bees PAN Bad actor	Pyrethroid IRAC: 3A	**Agricultural uses are RUP due to toxicity to fish and aquatic organisms**
Thiodicarb	Insecticide / Molluscicide	Seed treatment for cotton and soybean only	EPA: III Caution Restricted Use Pesticide WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to aquatic systems Risk to wildlife Risk to Bees Risk to Bystanders PAN Bad actor	Carbamate HRAC: 18	**Only US registered use is as a seed treatment co-formulated with imidacloprid. This is an RUP**

Table 3 - AIs that were approved in the previous F2F PERSUAP but are no longer approved for any uses by US EPA

Active Ingredient	Type	Toxicity EPA, WHO	General categorization	Notes
Alachlor	Pre-emergence herbicide	EPA: I Danger WHO: II Moderately hazardous	Highly Hazardous Listed under Rotterdam Convention PAN Bad actor	
Aromatic oil: Chevron 100 neutral oil		WHO: Not Listed		No Registration as an AI - although may be used as a co-formulant
Cypermethrin, beta	Insecticide	WHO: Not Listed	Medium Risk Use only by trained personnel Risk to aquatic systems Risk to Bees	No US registration but Cypermethrin (which is a mix including β-cypermethrin) is registered
Bitertanol	Fungicide	WHO: U Unlikely to present acute hazard		
Cyanazine	Herbicide	WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to wildlife PAN Bad actor	
Diclofop-Methyl	Herbicide	EPA: I Danger Restricted Use Pesticide WHO: II Moderately hazardous (Diclofop†)	Medium Risk Use only by trained personnel Risk to wildlife PAN Bad actor	Post emergence control of grass weeds EPA registered but recently subjected to restrictions. No current products appear to be marketed
Dicofol	Acaricide	WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to wildlife Risk to Bystanders PAN Bad actor	
Dimethenamid	Herbicide	WHO: II Moderately hazardous	Low risk, Basic PPE required	
Fenitrothion	Insecticide	WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to wildlife PAN Bad actor	No longer registered
Flubendiamide	Insecticide	WHO: III Slightly hazardous	Low risk, Basic PPE required	US registrations cancelled 2016

Table 3 - AIs that were approved in the previous F2F PERSUAP but are no longer approved for any uses by US EPA

Active Ingredient	Type	Toxicity EPA, WHO	General categorization	Notes
Maneb	Fungicide	WHO: U Unlikely to present acute hazard	Medium Risk Use only by trained personnel Risk to wildlife Risk to Bees Risk to Bystanders PAN Bad actor	
Milbemectin	Insecticide	WHO: Not Listed		
Profenofos	Insecticide	WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to aquatic systems Risk to wildlife Risk to Bees Risk to Bystanders PAN Bad actor	
Rotenone	Insecticide	EPA: I Danger WHO: II Moderately hazardous	Medium Risk Use only by trained personnel Risk to Bees Risk to Bystanders	RUP; only registered as a fish killer
Spiroxamine	Fungicide	EPA: III Caution WHO: II Moderately hazardous		No current registrations
Thiacloprid	Insecticide	WHO: II Moderately hazardous	Medium Risk Risk to aquatic systems Risk to wildlife PAN Bad actor	
Triadimenol	Fungicide	WHO: II Moderately hazardous	Highly Hazardous Reproductive toxicity	
Trichoderma viride	Fungicide	WHO: Not Listed	Low risk, Basic PPE required	Cancelled at registrant's request - by non-payment of maintenance fees
Tricyclazole	Fungicide	WHO: II Moderately hazardous		

ANNEX 2DESCRIPTION OF THE F2F PROGRAM

A2.1 F2F PROGRAM GOAL, PURPOSE, AND OBJECTIVES

The Farmer-to-Farmer (F2F) Program was first authorized by the U. S. Congress in 1985 to provide for the transfer of knowledge and expertise of U. S. agricultural producers and businesses on a voluntary basis to middle-income countries and emerging democracies. The U.S. Congress re-authorized F2F in the 2014 Farm Bill, designating it the John Ogonowski and Doug Bereuter Farmer-to-Farmer Program, and re-authorized it again in the 2018 Farm Bill. The F2F Program provides voluntary technical assistance services in the agricultural sector to build institutions, transfer technology and management expertise, and link small farmers to markets. The Program seeks to increase farm production and farmers' incomes by: establishing a program to assist in increasing food production and distribution and improving the effectiveness of the farming and marketing operations of agricultural producers in those countries; using US voluntary service to improve agricultural and agribusiness operations and agricultural systems and strengthen cooperatives and other agricultural groups in those countries; and transfer knowledge and expertise of United States agricultural producers and businesses to other countries while enhancing the democratic process by supporting private and public agriculturally related organizations.

The core F2F Program is implemented under cooperative agreements with US institutions for the provision of volunteer services for international agricultural development. The Implementing Partners (IPs) work closely with overseas USAID Missions and local partner organizations, supporting a variety of development programs aimed at reducing poverty and stimulating sustainable and broad-based economic growth. Program evaluations have consistently found that F2F programs provide high quality technical assistance services from volunteers. Since F2F's inception, the program has completed more than 22,000 volunteer assignments assisting over 14,000 local hosts, directly assisting more than 2.5 million agricultural professionals and impacting over 178 million indirect beneficiaries. Volunteers work with groups ranging from individual producers to research agencies and financial institutions. Programs build institutions and transfer technology and management expertise to link small farmers with markets that exploit comparative advantages in production, processing, and marketing.

The new phase of the F2F Program over the next five years (FY24-28) has nine IPs with Leader With Associate Cooperative Agreements. The FY24-28 F2F Program cycle will encourage greater attention to issues of global climate change and sustainable natural resources management, opportunities for rural youth, and nutritional impacts of agricultural development.

A2.2 F2F Program Activities and Methodology

The F2F program relies on the expertise of volunteers from U.S. farms, land-grant universities, cooperatives, private agribusinesses, and non-profit farm organizations to respond to local needs of host country farmers and organizations. Since the F2F Program began, volunteers have been recruited from all 50 U.S. states and the District of Columbia. In general, these volunteers have domestic careers, farms, and agribusinesses, or are retired and want to participate. Typically, volunteers spend about two to three weeks in the host country. Volunteers usually work with medium and small agro-enterprises, cooperatives, individual producers, agricultural extension and research agencies, and financial institutions. The specific assignments for volunteers are defined on a rolling basis in conjunction with local partners and in response to requests from local farms, agribusiness firms, and agricultural support institutions.

Once the need for an F2F volunteer is identified, the host country partner, in collaboration with the F2F country program, will develop an SOW. Volunteers are then recruited for the assignment. All F2F IPs have volunteer databases from which they can identify appropriate volunteers. IPs may also recruit a volunteer who has the necessary skills directly. One or more CVs may be sent to the field office for review by F2F country staff and the host organization.

Once a volunteer is identified for the assignment, the IP sends a briefing packet to the volunteer. An environmental brochure or flyer describing the conditions of the IEE is among the items in the briefing packet. From the point a volunteer agrees to undertake an assignment until the volunteer departs for the host country, there is regular correspondence with a volunteer and the F2F office.

Once the volunteer arrives in-country, they will meet with F2F country staff for a briefing, and at the end of their stay, for a de-briefing. When a volunteer is in the field, F2F IPs provide different levels of support. The volunteer works directly with the host organization, and in many cases may only return to the F2F country office for an end-of-trip debriefing. In-country staff may assist with translation services. In some cases, a technical staff member from the F2F country program office will travel with the volunteer at the start of an assignment, and then go back to the field to meet the volunteer at the end of an assignment.

ANNEX 3INTEGRATED PEST AND CROP MANAGEMENT TOOLS AND TACTICS

IMPLEMENTING IPM SYSTEMS

IPM is an integral part of safe pesticide use and supporting the use of pesticides only within an IPM framework is a core requirement of this PERSUAP.

The heart of IPM is an understanding of the relationship between pest injury, damage, yield loss, and economic loss. IPM was developed within the discipline of economic entomology. Farmers who are not trained in IPM may spray a crop upon seeing a single insect in a field or a few brown spots of a disease on a leaf. Pesticides are expensive and present a hazard to both human health and the environment so should only be used as a last resort and when economically justified.

This document provides outline advice on the implementation of IPM systems into the Value Chains supported by the F2F project.

In addition, it also contains advice on Integrated Crop Management which looks at all aspects of crop production, not just pest management as IPM systems do. This may be useful where there are other issues, such as water salinity or erosions that need to be considered in the agricultural context.

A3.1 ELEMENTS OF INTEGRATED PEST MANAGEMENT PROGRAMS

Although farmers are likely using numerous IPM tactics, without really calling them that, IPM philosophy or planning is often not an active part of crop production in many parts of the developing world; thus, a basic understanding of the steps or elements needed in an IPM program are addressed below. This slightly modified strategy was developed by FAO in Indonesia in the 1980s as described on the following websites:

http://www.fao.org/docrep/006/ad487e/ad487e00.htm
http://www.fao.org/docrep/006/ad487e/ad487e02.htm
http://en.wikipedia.org/wiki/Farmer_Field_School
http://www.ipm.ucdavis.edu/PMG/crops-agriculture.html

Step 1: Learn indigenous IPM tactics. Some farmers are already using their own forms of GAPs and IPM, many of which are novel, self-created, adapted for local conditions, and many of which work well. These local tools and tactics need to be well understood and considered when making pest management programs. Accurate assessments of these farmers' GAP and IPM technologies, as well as an understanding of actual losses due to different constraints in farmers' fields are required before designing a crop production and pest management program. Standards and

Certification (S&C) farmers will have records of historical pesticide use and trends, as well as information on current use of local IPM tactics.

Step 2: Identify key pests for each target crop. Although perhaps up to ten species of pests may impact a crop and yields at different plant growth stages, generally only two or three are considered serious enough to justify control. Farmers should be encouraged to monitor their population size, life cycle, the kind of damage they cause, and actual losses. Note that crop loss figures based on farmers' perceptions of damage and loss are often overestimated.

Step 3: Evaluate all management options. Use of best management practices, preventive measures, and non-chemical options to control pest impacts may eliminate the need for synthetic pesticides.

Step 4: Choose IPM methods, identify needs and establish Priorities. Continue dialog with project field staff, ministry extension staff, and farmers when choosing methods to be used. Consider the feasibility of attractive methods, including the availability of resources needed, farmers' perceptions of pest problems, their abilities to identify pests, their predators, diseases, and parasites. Select an appropriate blend of IPM tools. A good IPM program draws from and integrates a variety of pest management techniques, like those presented in the above list. 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, not necessarily eliminate it.

Step 5: Implement effective activities and training to promote IPM. Next, identify strategies and mechanisms for fostering the transfer of the needed IPM technology under various project and institutional arrangements, mechanisms, and funding levels. Define what is available for immediate transfer and what may require more adaptation and validation research. Set up an initial planning workshop to help define and orient implementation activities and begin to assign individual responsibilities.

Learning-by-doing/discovery training programs
The adoption of new techniques by small-, medium- and large-holder farmers occurs most readily when program participants acquire knowledge and skills through personal experience, observation, analysis, experimentation, decision-making, and practice. At first, frequent (usually weekly) sessions are conducted for farmers during the cropping season in farmers' fields by trained instructors or extension agents.

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, advance knowledge of nearby infestations for early action leading to yield improvement).

Educational material
In many countries, basic written and photographic guides to pest identification and crop-specific management techniques are unavailable or out of date.

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.

Food market incentives (especially important to promote trade and independence)
Promoting international standards and certification such as GlobalG.A.P.[7], BRCGS[8], Fair Trade[9] and Organic standards[10] for access to the lucrative and rapidly growing S&C systems-driven international and regional food markets can be a strong incentive to adopt IPM. However, the benefits of many such certifications are questionable and may be too expensive except for the very elite.

Step 6: Partner successfully with other IPM implementers. 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 therefore highly important that partners articulate a common, detailed vision of IPM, centered on the crops and conditions the project will encounter.

Confirm partner institutions' commitment to IPM
The extent of commitment to IPM integration into project, design, and thus implementation, depends strongly upon the following key variables:

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

Step 7: Monitor the fields regularly. At minimum twice a week, farmers should monitor their fields for pests, as some pest populations increase rapidly and unexpectedly; this increase is usually related closely to the stage of crop growth and weather conditions, but it is difficult to predict the severity of pest problems in advance. Moreover, hotspots or foci of infestation or disease are common in fast growing vegetable crops and vine crops such as melons or cucumbers and can be addressed before the crop is damaged.

Step 8: 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 9: Monitoring, Recordkeeping, and Evaluation. For the use and maintenance of Good Agriculture Practices (including safe pesticide storage, use and disposal) records should be kept of the following: farmer and farm employee training records certification; farm soil, water, biodiversity, cropping and pesticide use maps; pesticide purchase and stock records; price increases or decreases, chemical application instructions including target pest, type of chemical applied, dosage, time of spray, rates at which pesticides were applied, harvest interval days, application machinery, PPE required and used, and any special instructions on mixing, exposure to children or dangers.

[7] globalgap.org; International Standards for Good Agricultural Practice
[8] brcgs.com; Supply chain assurance services.
[9] www.fairtrade,net; Fairtrade changes the way trade works through better prices, decent working conditions and a fairer deal for farmers and workers in

developing countries

[10] https://www.onecert.com/Documents/OneCert_Standards.pdf; International Organic Standards

Also, for project staff, beneficiaries, produce processing facilities, food warehouses, seed multipliers, or farmers that store seed or food and deal with stored seed and food pests, there are warehouse Best Management Practices (BMPs) and monitoring reports that incorporate some IPM tactics. These monitoring forms track, by location or warehouse, use of pallets, stacking, general hygiene and sanitation, damaged packages, actual infestations or signs of rodents, molds, insects, drainage, locks and security measures, use of IPM tactics including least toxic chemicals and strict BMPs, including restricted access, for use of common but hazardous fumigants like aluminum phosphide.

INTEGRATED CROP MANAGEMENT

Agricultural systems may have other impacts on the environment that are not directly related to pest management. These factors cannot therefore be addressed through IPM systems, which are focused on pest management. The concept of ICM covers all aspects of crop production including pest control and other issues such as salinity and erosion management.

ICM is a method of farming that balances the requirements of growing a profitable crop with responsibility and sensitivity to the environment. It includes practices that avoid waste, enhance energy efficiency, and minimize pollution. It encompasses virtually everything that happens around the production of crops by a farmer or grower.

For many farmers or growers, adoption of ICM involves some changes to existing practice. Most importantly, though, ICM aims to ensure long-term sustainable crop production for the benefit of both the farmer and consumer.

ICM combines the best of modern technology with some basic principles of good farming practice. ICM is a whole-farm, long-term, multi-year strategy. It should not be applied to just one crop, or one field, or for one season. Although primarily concerned with crop production, livestock management is equally important on mixed farms (Integrated Farming Systems) because livestock are consumers of crops and providers of organic nutrients.

By careful assessment, monitoring, and planning, natural resources can be used fully and supplemented where necessary with inputs such as fertilizers and crop protection products. As well as enhancing crop yields, ICM protects the environment by encouraging practices to ensure continued soil health and reduce erosion, conserving water supplies, and in the case of Azerbaijan managing soil salinity.

As ICM involves the whole farm and is site specific, there are no hard and fast rules about how to achieve this. Individual farms differ in many ways: location, climate, soil type, cropping pattern, to name a few. However, amongst all this diversity, there are some general guidelines that can help all farmers and growers take practical steps to improve their management practices.

ICM requires attention to detail, planning, and monitoring, and should take account of the following factors.

Crop Rotation: A diverse crop rotation has numerous benefits. It can enhance and maintain soil fertility, for example by inclusion of appropriate fallow land. Ensuring green cover in the fall helps prevent nitrate leaching. A diverse rotation can also reduce the impact of weeds, pests, and diseases by interrupting pest and disease life cycles. This can be helped further by choosing suitable resistant varieties of crops.

Soil husbandry: A fundamental natural resource on the farm is the soil. Maintenance of soil stability, structure, and fertility is central to any ICM plan. Erosion caused by wind or water is a particular danger on some soil types and it is important to identify the risks and minimize them. Measures might include establishing permanent grass or planting specific erosion breaks.

Cultivation techniques and timing will have a major impact on soil structure. Non-inversion cultivation requires less energy than plowing and does less damage to the soil fauna. They also help reduce erosion. However, these benefits need to be balanced against any resulting changes in the weed spectrum.

Crop nutrition: The use of nitrogen fixing plants, green manures, and a planned fertilizer strategy designed to supply the demands of the growing crop, is both economically and environmentally sound. All fertilizers must be applied with care, avoiding field boundaries, wildlife habitats and water courses. Timeliness is as important for fertilizer applications as it is for crop protection products.

Water management: Good water management is essential in many parts of the world, especially where crops are irrigated, or soil salinity is a problem. For long-term sustainability, ICM systems need to consider how they source, store, and use water. Traditional methods of irrigation may result in increased salinity and, on sloping land, increase erosion. More modern techniques, particularly using closed irrigation systems, which minimize water loss and target the use of water more accurately to the crop, can reduce erosion and help maintain low salinity levels that do not adversely affect the crop.

Crop protection: An essential aspect of ICM is the effective management of damaging pests through an effective IPM system. Prevention through cultural measures, rotation, and variety choice should be the first line of defense.

However, invasion or infection of weeds, insects, or diseases is inevitable in any farming system, and they may need to be controlled if they are not to cause economic loss. Much can be done to minimize the impact of pests by monitoring the crop, for example by scouting for pests or trapping.

Where control becomes necessary, all options should be considered. Biological control methods should be explored, especially for glasshouse crops and fruit production. In many cases, chemical control remains the most appropriate choice and most modern crop protection products have been developed with the requirements of ICM in mind. They target specific pests, so they do not affect beneficial organisms, and they break down quickly to harmless substances when the job is done. Care in the choice of product, the dose, timing, and method of application will minimize impact on non-target organisms.

Waste management: Proper waste management is important. Ensuring proper disposal of unused agrochemicals, their packaging, and sprayer washings will minimize pollution. Crop debris and animal waste should be collected and either destroyed or treated/composted in a way that ensures pests are destroyed, after which it can be used as a soil improver. Wastewater, especially if used to wash produce, should be carefully disposed of to prevent or minimize the risk of it carrying plant diseases to other crops.

Wildlife and landscape management: ICM involves planning across the whole farm, not just cropped areas. Non-farmed areas, trees, hedgerows, water courses, etc. are all important to wildlife and maintaining biodiversity. Also important are field margins and stubble or fallow areas. From the farmers' viewpoint, they provide important sources of beneficial organisms that help control pests and may help reduce erosion or protect crops from damaging weather events.

Planning and assessing: A planned approach is essential to allow the farmer to achieve long-term objectives. As well as preparing plans, this involves keeping informed and updated on technical developments. Ongoing training of farmers is therefore critical.

Measurement is also essential. It allows farmers to know what is successful in encouraging them to strive further and allows them to adapt and improve further plans.

NONCHEMICAL TECHNIQUES TO CONTROL PESTS

A3.2 COMPLEMENTARY CROPS

Complementary, or companion, planting is the growing of two crops near one another that provide a benefit, for example by confusing or repelling pests, attracting pollinators, providing shade, improving soil fertility or suppressing weeds. It typically works best for small plots of land such as vegetable gardens but may in some cases may also be possible in larger fields using intercropping, where two or more crops are grown together or trap cropping techniques.

As an example, garlic or onion and tomato can be produced with cabbage to fight crucifer worm. The secondary crops can be planted at the same time as cabbage, or 2 to 4 weeks earlier. Garlic and onion reduce infestations better than tomato. Wikipedia (https://en.wikipedia.org/wiki/List_of_companion_plants) provides a useful referenced list of companion plants.

For broad acre crops, maslin, a mixture of different crops, typically but not always cereals, has been grown for many thousands of years and still is in some parts of the world but less commonly than in the past. They offer some security by guaranteeing some yield when conditions are poor but can also reduce the incidence of pests. Growing mixtures of cereals, such as wheat and rye or barley and oats has been shown to significantly reduce the level of major fungal diseases.

A3.3 Solarization

Solarization is a method of sterilizing soil by heating it. It can be used to control a wide range of pests, insects, nematodes, weeds, and some diseases. It can be particularly useful for controlling soil borne nematodes, which are otherwise extremely difficult to control, and for which chemical control measures often rely on highly toxic pesticides.

Solarization should be carried out during the warmer, sunnier parts of the year. Ground should be thoroughly cultivated, as if preparing a seedbed. It should then be watered thoroughly so that it is moist down to at least 12 inches, and then covered with a dark colored or transparent tarpaulin, which is either buried or weighted down at the edge to seal it. The covers should be left in place for several weeks, at least 2-3 depending on the climate.

Where solarization is carried out farmers should be encouraged to either keep tarpaulins for re-use or dispose of them responsibly.

A3.4 Manufacture of some example artisanal pesticides

NATURAL OR ARTISINAL PESTICIDES, PRODUCTION AND USE TECHNIQUES

The use of biological products from vegetable extracts to fight insects or disease vectors is not a new idea. There are several natural products available for killing or repelling insect pests. In this manual we present some of them.

APPLICATION OF SOME NATURAL PESTICIDES FOR TARGET PESTS

Product	Thrips	Caterpillars (cabbage, tomato)	Aphids	Chinch bugs
Garlic	+	+	+	+

Neem	+	+	+	
Hot pepper		+	+	
Tobacco*	+	+	+	+
Ashes (lessis)	+	+	+	

* Tobacco contains nicotine and possibly other alkaloids that have an insecticidal action. Nicotine is classed as a 1b toxin by the WHO and is no longer registered as an insecticide by the US-EPA. Care should therefore be taken recommending it's use

Neem (*Azadirachta indica*)

Neem is a wonderful insecticide, 100% natural, minimally toxic to humans and animals, active against more than 200 insects, mites, grasshoppers, nematodes, fungi, and bacteria. The active ingredients in *Azadirachta indica* are found in all parts of the tree, but are most concentrated in the seed. 12 kg of seed or 80 kg of leaves will make enough pesticide to treat about 1 ha (2.5 ac).

Azadirachtin, the active agent in neem extract, acts as a repellent and insect growth regulator. It disrupts molting and may cause sterility in some insects. It also has some fungicidal properties. It does not normally kill insect pests directly so users will not find dead insects after treatment. Azadirachtin is registered as a pesticide by the EPA.

- Frequency of treatment: once per week.
- Treat only in the evening, after 17:00, to avoid sunshine, as neem solution is sensitive to sunlight.

<u>Preparation and application of neem leaves pesticide against crop pests</u>

In order to make 15 liters of liquid:

- In the late afternoon (around 17:00) take 3 kg of fresh neem leaves (15 fistfuls corresponds to 3 kg of leaves) and place in a big pot with 15 L of water.
- Boil the mixture until the green of the leaves disappears. This will ta
  intensity of the fire heat.
- Allow the liquid to cool for 24 hr.
- The next day around 17:00, filter the mixture with fine cloth.
- Add 15 ml of liquid soap or diluted soap (or use 2 three fingered pinches of ground white soap, stir until dissolved).
- The liquid is then ready for spraying.

<u>Preparation and application of neem seeds {fruit} against crop pests</u>

- Gather mature neem seed (fruit) - especially those that fall to the ground.
- Dry on a mat in the shade for one week. Place them in jute bags to use later.
- Remove the fruit husk to get at the kernels inside, after storage

in a dry aerated place.**For immediate use:**

- Soak the fruits in water for 5 hours. Wash them well to separate the kernel from the pulp.
- Dry the kernels on a mat for one hour.
- Use 1 kg, about 12 Nescafe coffee containers or 7 tomato cans of 400 g size.
- Use 500 g of seed (5 ½ measures in a Nescafe container, or 3 ½ of the 400 g tomato can) to pound into powder.
- Place the powder in a bucket and add 10 liters of water.
- Mix the concoction, cover the bucket, and let it soak for up to 24 hours before using for treatment.
- Filter it using a sifter and cloth or just a cloth. Pour the solution into the sprayer.
- Add 15 ml of liquid soap or diluted soap (or 2 three fingered pinches of ground white soap, stir until dissolved).
- Treat an area up to 400 m^2 with 10 liters of the solution.

The remains of the neem leaves or seeds can be mixed into garden soil to help fight soil borne pests. Neem seed cake obtained after pressing oil out of neem kernels, can be also mixed directly with the soil at a proportion of 3 kg per 2 liters. The effect on nematodes is noticeable.

Hot Pepper (*Capsicum frutescens*)
The mature fruit has insecticidal properties, with active ingredients concentrated in the fruit and seeds. Chilli oil (Capcacin) is registered for use as a pesticide by the US EPA.

- *Mode of action:* Toxic by ingestion; insecticide, repellent, fumigation, and antiviral.
- It is particularly effective against tomato and cabbage caterpillars, aphids and chinch bugs.

Preparation of 10 liters of solution with hot pepper pods

- Use 250 g of hot pepper fruits (measured as 2 ½ cans that held 400 g of tomato).
- Pound the fruits till ground.
- Wrap the pounded hot pepper in a cloth.
- Prepare 10 liters of water in a bucket.
- Around 17:00, soak the pounded pepper in 10 liters of water.
- Cover the bucket; leave it to soak for 24 h.

The day of treatment:

- After stirring, press and squeeze the cloth wrapping into the bucket; filter the liquid.
- Pound a piece of white soap and place 3 three-finger pinches of soap powder into a liter of water; stir it well.
- Add the liter of soapy water to the bucket and stir well to obtain 10 liters of pepper pesticide.

Garlic
Garlic oil is considered a minimum risk chemical by the EPA that can be used without product registration.

There are two recipes for making a garlic-based spray, one using just water and the other vegetable oil to extract the garlic oil.

Oil based

- Make a mash: 20 g of garlic soaked in 20 ml of vegetable oil for 24 hours.
- Add to the oil, 1 liter of water and 10 ml of biodegradable soap; mix.
- Filter the mix; the result is concentrated.
- Dilute the concentrated liquid in 4 times its volume of water before use for treatment.

Water based

- Soak 100 g of ground garlic cloves in 10 liters of cool water for 24 hours.
- Boil for 15 to 20 minutes, then let the mixture cool.
- Add 10 ml of liquid soap to filtered concoction before treating plants in the evening.

Ashes

Ash may be used dry on plant foliage or to prepare a liquid spray, known as lessis in some parts of Africa, that is effective against pests such as cabbage carrot, and onion flies and larvae.

To prepare Lessis

- Place 2 kg of ashes in a bucket and fill with 5 liters of water.
- Stir the mixture a little and let it sit all night.
- The next day, the ashes will be concentrated at the bottom of the bucket.
- Carefully pour the liquid off the top into a watering can. If using a sprayer, it is better to filter the liquid.

ANNEX 4 ELEMENTS OF PESTICIDE SAFER USE TRAINING

A4.1 TRAINING IN SAFER USE

To ensure safer use of pesticides, USAID through its IPs must ensure that all activities using pesticides offer adequate training for individuals who use, store, or transport pesticides.

Basic pesticide safe use training must address the following minimum elements:

- Definition of pesticides.
- Pesticide risks, the understanding that pesticides are bio-poisons.
- Risks associated with release of pesticides into the environment and avoiding harmful effects.
- Concepts of AIs versus formulated products.
- Classes of pesticides and the concept of broad spectrum versus narrow spectrum, target specific pesticides.
- Concept of proper application rates and timing.
- Pesticide resistance and techniques for avoiding its development.

PRACTICE-FOCUSED TRAINING IN THE CORE ELEMENTS OF SAFER PESTICIDE USE:

- Integrated Pest Management (IPM).
- Reading and interpreting pesticide labels and SDS, including understanding PPE requirements and other precautions, dosage rates, and to identify AIs and expiration dates.
- Use of proper PPE and its treatment and maintenance.
- Proper use and maintenance of equipment including calibration of sprayers. Safer mixing and application of pesticides including ensuring compliance with re-entry and pre-harvest intervals specified by the label/SDS.
- Safer purchase, transport, and storage of pesticides.
- Pesticide first aid and spill response.
- Clean-up and disposal.
- Record keeping and monitoring.

PROFESSIONALLY TRAINED AND CERTIFIED APPLICATORS.

Applicators are considered to be professionally trained or certified when they are deemed to have a practical knowledge of:

- pest problems and control practices associated with agricultural operations;
- proper storage, use, handling, and disposal of pesticides and containers; and
- legal responsibility.

They must have the ability to:

- read and understand pesticide labels and labeling;
- apply pesticides according to labeling instructions and warnings; and
- recognize common pests and damage caused by them;
- local environmental situations to be considered during application to avoid contamination; and
- poisoning symptoms and procedures to follow in case of a pesticide accident.

Private applicators may be certified by a formally recognized authority that is acceptable to the USAID MEO (or REA) that demonstrated their qualifications by:

- Passing a written or oral test.
- Attending a training course.
- Another system approved by USAID.

A4.2 Training in IPM

IPM is an integral part of safe pesticide use and supporting the use of pesticides only within an IPM framework is a core requirement of this PERSUAP. Therefore, pesticide safe use training must build an understanding of IPM fundamentals.

Crop protection specialists aim to develop pest control methods that are compatible with the goals of sustainable and productive agricultural activities. To meet these goals, crop protection must use an Integrated Pest Management approach -IPM. I PM focuses on six control areas:

- *Cultural pest control* is the use of farming or cultural practices that make the crop environment less favorable to pest species—for example, choosing sowing and harvest dates that minimize damage; intercropping; vegetation management; and crop rotations.
- *Biological control* is the manipulation, conservation, or introduction of the natural enemies of predators, parasites, or pathogens.
- *Physical and mechanical control* is the application of direct or indirect measures that kill the pest, disrupt its physiology by means other than using chemicals, exclude it from an area, or adversely alter the pest's environment.
- *Host plant resistance* is the breeding and use of crop varieties that are less susceptible to pests like insects, diseases, nematodes, parasitic weed, and birds.
- *Judicious use of pesticides* is pesticide application designed to protect rather than avenge the crop. The use of pesticides has a cost beyond the price of the product and its application; it also has an effect on beneficial organisms, such as natural enemies and pollinators. The decision to use a pesticide is thus based on an assessment that the pest population, or expected population, will cause damage that exceeds all these costs: the economic threshold. Determining the economic threshold requires considerable research and experience. Decision making needs to be based on regular scouting or monitoring such as through trapping.
- *Legal/regulatory control* includes the enforcement of measures and policies that range from quarantine to land and water management practices. These policies include the prevention of the entry and establishment of undesirable plant and animal pests in a country or area, and eradication, containment, or suppression of pests already established in limited areas (quarantines). This approach to pest management must involve area-wide operations that include many rural households and are enacted for the common good of both farmers and society at large.

Formally, the development of IPM strategies requires the following steps (See also Annex 3).

- Identify the major pests, quantify losses caused by them in a given agro-ecosystem, and determine the economic thresholds;
- Study the biology, behavior, and population dynamics of the pests to understand the features that can be exploited for pest management;
- Establish the role of local natural enemies and develop mass-rearing, or mass-culture for disease agents on insects;
- Study and develop other suitable components of IPM, such as intercropping and other cultural practices;

- Integrate these components into an appropriate IPM technology and test for compatibility and efficacy under varied ecological conditions; and
- Develop a simple protocol for monitoring the impact of the IPM approach in the field.

> In some of the USAID target regions, much of the technical capacity for the above steps is lacking, but the essential steps in IPM are the correct identification of the pests or pathogens to which the various crops are subject, and a realistic assessment of the damage they can potentially cause. Together with capacity building delivery, technical assistance are the right mechanisms to support IPM implementation and adoption.

With this information, it is possible to develop a proactive approach to plant protection, rather than responding to infestations reactively, after the damage has been done. A proactive IPM system includes the following five key elements.

1. Good agricultural practices. Healthy plants grown in good conditions are more resistant to pests and diseases. Because healthy crops grown in fertile soils are generally resistant to pests and tolerant of disease, IPM practices must include practices to improve plant health and integrated soil fertility management. Effective IPM measures include composting, vermiculture, mulching, establishing hedges, terracing, and other soil erosion control measures, as well as cultivating on contours, reducing acidity with lime amendments, and promoting agroforestry systems. The use of resistant varieties, when available, is also important.

2. Routine preventive measures. These include crop rotation for annual crops.

3. Encouragement of natural enemies. These may be reared in a laboratory and released, but more important, is not killing them by inappropriate pesticide application.

4. Monitoring pest density. This element involves monitoring for the presence of economically harmful densities of pests that may occur because of favorable conditions. This objective may be achieved with pheromone traps or simple examination of the plants.

5. Selection of an effective control method. If necessary, an effective control method must be chosen. The best option may range from mechanical removal of the pests to the selection and use of a safe and effective pesticide. An IPM plan should be prepared providing guidance regarding chemical- and non-chemical control measures for common pests of important crops.

A4.3 Understanding Pesticide Labels and Safety Data Sheets

PESTICIDE LABEL AND SAFETY DATA SHEET

Pesticide product labels must provide critical information about how to safely and legally handle and use pesticide products. A label of any pesticide container must have all the information about hazards of this pesticide product as well as information needed for its safe and effective use. Additional important details about risks of pesticide products and instructions about safe use can be found in the product manufacturer's Safety Data Sheet (SDS).

Full product labels and SDS must be available from manufacturers and can often be found online, particularly for well-known large manufacturers. While there are no complete data bases of pesticide products, some product SDSs are available online at https://ordspub.epa.gov/ords/pesticides/f?p=PPLS:1 and at http://www.greenbook.net.

The label on a pesticide container has four main functions:

1. Tell the user what pest and crop (or situation) the product can be used on.
2. Tell the user how and when to apply the pesticide for the best effect.
3. Tell the user how to handle, use, and store the pesticide safely.
4. Identify pesticide hazards to human health and ecosystems.

Pesticide labels must identify health, eco-system, and physical hazards that can be associated with each chemical used. It is important to know the hazard classification of each chemical used, to determine the various aspects of safely handling that chemical. A pesticide pictogram(see below) can provide information about risks and safety measures required, including required PPE.

Pesticide labels must contain:

- Name of the product/product identifier
- Name, address, and telephone number of a manufacturer
- Active ingredients
- Other ingredients-co-formulants
- Product formulation
- Level of toxicity
- Signal word
- Hazard statement(s)
- Precautionary statement(s)
- Pictogram(s)
- Directions for handling the product safely
- First aid procedures in case of an accident
- Any special instructions or warnings about its use, transport, storage, or disposal
- The crop on which or situation where a pesticide can be used
- The pests which the product will control
- The rate of application of the product (how much of it to use)
- The time and method of application
- The net contents (weight when packed) of the container

Supplementary information can be provided, for example information about PPE requirements.

Further information and detail about the product must be provided in the manufacturer SDS.

Pesticide products must always have a label and be stored in a properly labeled container. To eliminate the hazard associated with smallholders buying or keeping small, unlabeled packages of pesticide, farmers need access to appropriately sized containers, such as small, single-use sachets of pesticides.

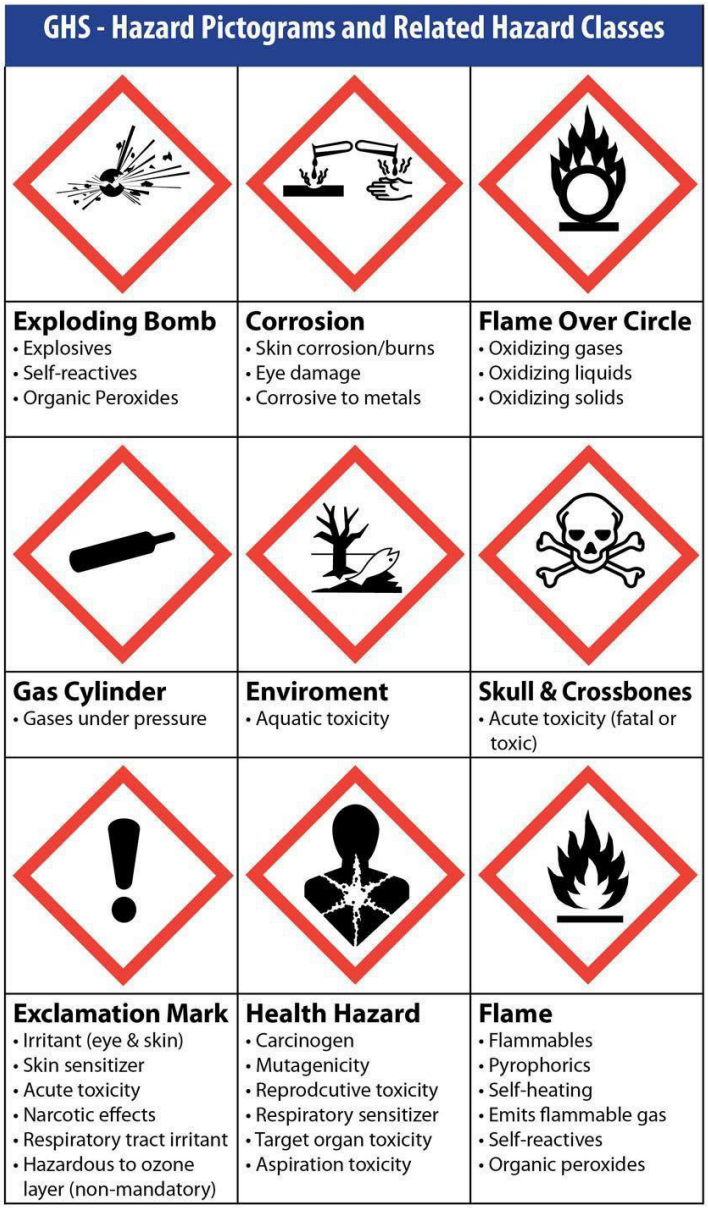
To ensure that products treated with pesticide are safe for human consumption the label and SDS provide instruction to the applicator about the amount of time that must lapse (in days) after a pesticide application before the crop is safe to be picked. It is important to adhere to the Pre-Harvest Interval (PHI) to ensure no unacceptable chemical residues will be found on the harvested product. Adhering to the PHI ensures that the product is safe for domestic consumption/use or export.

HAZARD COMMUNICATION STANDARD

With the exception of minimum risk pesticides, pesticides are considered hazardous substances. However, the diverse and sometimes confusing information on pesticide labels and Safety Data Sheets of products that arrive from different countries can create confusion among those who seek to use hazard information effectively. For example, labels and

safety data sheets may include symbols and hazard statem
Containers may be labeled with such a large volume of inf
recognized. Given the differences in hazard classification c
may also be incorrect.

In the US, (per Hazard Communication Standard US 29 CFR 1910.1200) all manufacturers or distributors of any products containing chemicals when introducing a product into a local or foreign market are required to evaluate and properly communicate the chemical hazards of the product. The evaluation is performed by classifying each chemical based on published toxicological or other data to determine its physical and health hazards. Most but not all countries have the same requirements.



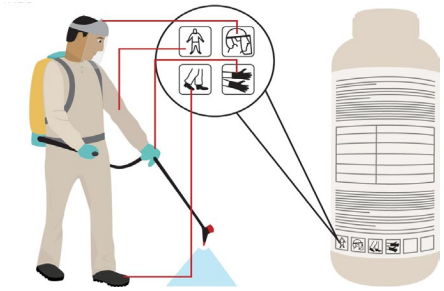
Increasingly, in order to improve safety and health of workers and the general population, all countries and agencies are modifying their required Hazard Communication Standard (HCS) by adopting the UN Globally Harmonized System of Classification and Labelling of Chemicals (GHS) for more effective communications on chemical hazards.

The original standard of communication of hazards allows chemical manufacturers and importers to convey information on labels and material safety data sheets in whatever format they choose. The GHS provides a standardized approach, including detailed criteria for determining what hazards chemical poses, as well as standardized label elements assigned by hazard class and category. This more standardized approach to classifying the hazards and conveying the information is expected to be more effective.

For detail regarding Hazard Communication Standard: Labels and Pictogram see U.S. Occupational Safety and Health Administration brief: https://www.osha.gov/Publications/OSHA3636.pdf.

An example of an item that may be considered supplementary is the PPE pictogram on the label indicating what workers handling the chemical may need to do and wear to protect themselves. Pesticide safety training must address the types of PPE, when they should be worn and why.

Personal protection equipment icons



Pesticide PPE Pictograms

PESTICIDE SAFETY AND USE OF PROTECTIVE CLOTHING AND EQUIPMENT

Training should address the types of personal protective equipment (PPE), when they should be worn and

why. There are three principal routes that chemicals enter the body:

- Accidental or deliberate ingestion
- Dermal, through handling, measuring and pouring the concentrate
- Inhalation of small particles or dust during handling and spraying

Dermal exposure represents the most common hazard. Avoiding exposure by using PPE and by paying attention to personal hygiene by washing exposed parts of the body after work and before eating, smoking and toileting will minimize risk. Personnel Protective equipment must be selected in accordance with the label recommendation. It must be comfortable to wear/use and be made of material, which will prevent penetration of the pesticide.

PPE will only remain effective if it is correctly selected and maintained. Where the equipment is damaged, repairs must restore it to its original condition otherwise the item must be replaced. Items such as the respirator must be checked on a regular basis and filter elements changed in accordance with the manufacturer's instructions.

Remember, products containing the same active ingredient but sold under different brand names may pose different risks due to differences in the product formulation. Care must be taken to always refer to the individual label for the product being used.

HANDLER PPE FOR WORKER PROTECTION STANDARD PRODUCTS

ROUTE OF EXPOSURE	**EPA TOXICITY CLASSIFICATION BY ROUTE OF EXPOSURE OF END-USE PRODUCT**			
	I DANGER	**II WARNING**	**III CAUTION**	**IV CAUTION**
Dermal Toxicity or Skin Irritation Potential[1]	Coveralls worn over long- sleeved shirt and long pants	Coveralls worn over long-sleeved shirt and long pants	Long-sleeved shirt and long pants	Long-sleeved shirt and long pants
	Socks	Socks	Socks	Socks
	Chemical- resistant footwear	Chemical- resistant footwear	Rubber boots or shoes	Rubber boots or shoes
	Chemical- resistant Gloves[2]	Chemical- resistant Gloves[2]	Chemical- resistant Gloves[2]	No minimum[4]
Inhalation Toxicity	Respiratory protection device[3]	Respiratory protection device[3]	No minimum[4]	No minimum[4]
Eye Irritation Potential	Goggles[5]	Goggles[5]	No minimum[4]	No minimum[4]

1 If dermal Toxicity and skin irritation toxicity categories are different, PPE shall be determined by the more severe toxicity classification of the two. If dermal toxicity or skin irritation is category I or II, refer to the pesticide label/MSDS to determine if additional PPE is required.
2 Refer to the pesticide label/MSDS to determine the specific type of chemical-resistant glove.
3 Refer to the pesticide label/MSDS to determine the specific type of respiratory protection.
4 Although no minimum PPE is required for these toxicity categories and routes of exposure, some specific products may require PPE. Read pesticide label/MSDS.

5 "Protective eyewear" is used instead of "goggles" and/or "face shield" and/or "shielded safety glasses" and similar terms to describe eye protection. Eyeglasses and sunglasses are not sufficient eye protection.

Note: Where necessary, farmers can make their own PPE. For example, a plastic or water repellent apron from the waist to ankle length, can be fashioned from a large piece of plastic purchased in the local market (important if walking through the spray path).

A4.4 Screening for Pesticide Quality

When buying pesticides check the following and do not buy if:

1. the product is not registered in your country.
2. bottle has been opened.
3. label shows that it is expired.
4. pesticide is in a quantity much larger than is needed for one season.
5. label is in a language that is not understood.
6. label is missing, damaged or unreadable.
7. bottle is damaged and/or leaking.
8. manufacturer and/or distributor name and contact information are not on the label.
9. pesticide shop smells of pesticides.
10. floor of the pesticide shop has spilled pesticides on it.
11. label has no safety and PPE information on it.
12. label has no poison control information on it.
13. label does not clearly identify the active ingredient names.

CHECK WHO THE MANUFACTURER IS

Products manufactured in the US, Europe or Australia, or by US, European or Australian companies are subject to vigorous quality checks. Those manufactured elsewhere may not be subject to such checks and may be poorer quality or counterfeit.

As possible, and if available, choose pesticides from well-known international companies such as:

- ADAMA
- AMVAC
- Arysta Lifescience
- Bayer
- BASF
- Chemtura
- Crop Production Services
- Dow Agrosciences
- Drexel
- DuPont
- FMC
- Gowan
- HELM Agro
- Monsanto
- Nufarm
- Sumitomo
- Syngenta
- United Phosphorous (UPL)
- Valent

The National Pesticide Information Centre maintain a list of pesticide Manufacturers and Registration holders, http://npic.orst.edu/ingred/manuf.htm.

CAREFULLY CONSIDER THE LABEL

- it must be securely attached to the package
- information on it should be clearly printed and be in one or more national languages
- it should indicate the name of the manufacturer's supplier and its addressee, the active ingredient, product name, batch number, weight or volume, date of manufacture and expiry date
- means of application (application rate, species on which it works, method, decontamination methods, safety measures and first aid) should be clearly written
- grammar and spelling errors on the label are a clear sign of a fake product
- pay attention to the fact that the agricultural chemicals are never packed in medical containers
- pay attention to the price of pesticides, damaged, counterfeit or out of date products are often offered very cheaply

A4.5 Pesticide Mixing and Application Training

GENERAL PRECAUTIONS

When applicators mix pesticides, they are handling them in the most concentrated form. It is during this process that they face the greatest risk of exposure and the greatest risk of environmental contamination. Handling diluted pesticides and pesticide containers is also hazardous and precautions must be taken.

Users should wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet. If pesticides get under clothing, the user should remove the clothing immediately, wash the affected skin thoroughly, and put on clean clothing. Users should remove PPE immediately after handling pesticides. Users should wash the outside of gloves before removing. As soon as possible, wash the skin thoroughly and change into clean clothing.

The following precautions must be taken when mixing pesticides:

- Consider using pesticide formulations that reduce applicator risks
- Never drink, eat or smoke while handling pesticides
- Preferably don't work alone, but if you must work alone inform someone that you will be applying pesticides and which chemicals you will be using. Make sure to inform others about emergency pesticide procedures.
- Don't mix near a drain but have water and detergent available
- Maintaining pesticide equipment is an important aspect of pesticide safety
- Preferably work outdoors when mixing pesticides. Don't stand with wind in your back or face when mixing pesticides. If must mix indoors make sure to have enough aeration and light
- Open containers carefully and do not reuse tools used for opening for any other purposes
- Measure materials accurately
- Keep container well below eye level when pouring pesticides to avoid exposure to eyes and face.
- Avoid overflow
- Clean up any spills immediately

METHODS OF APPLICATION

Methods of pesticide application will depend on the pesticide formulation.

Liquid pesticide formulations are commonly applied by sprayers, foggers or soil injection. Sprayers are one of the most common forms of pesticide application, especially in conventional agriculture. Sprayers range in size and complexity. Liquid foliar applications are directed to the leafy portion of the plant. Soil applications are placed directly on or in soil instead of on the growing plant.

Granular pesticides, especially those used for post-harvest storage, are applied most commonly by hand. Some granular products are designed so that they can be shaken out of the package without requiring any special application equipment. Granules can also be placed inside bait stations. Once applied, granular pesticides release the active ingredient slowly; some must be watered-in after (or before) application to activate the insecticidal action.
Insecticide dusts are important tools in the control or elimination of ants and spiders and can be applied by hand to areas where the pests tend to hide or migrate.

Application of a pesticide to seeds is a process designed to reduce, control, or repel disease organisms, insects, or other pests that attack the seed or seedlings. The kinds of seeds that are normally treated with one or more pesticides are: maize, peanuts, cotton, sorghum, wheat, oats, rye, barley, millet, soybeans (under some conditions), and most vegetable seed. Most dressed seed is pretreated by manufacturers.
Certain pesticides may be placed in bait traps, including pheromones. The amount of active ingredient in most bait formulations is quite low—usually less than five percent. The bait either attracts the pests or is placed where the pests will find it. Pests are killed by eating the bait that contains the pesticide. Pheromone bait traps may capture but not kill pests.

Fumigation of commodities is a highly dangerous procedure requiring a high quality of training and specialist equipment. Some commodities can be fumigated under gas impermeable tarpaulins. In other cases, vehicles or containers are fumigated with their loads. The most satisfactory method is to use purpose-built fumigation structures.
It is essential that fumigation be carried out as stipulated in USAID guidelines (https://www.usaid.gov/environmental-procedures/environmental-compliance-esdm-program-cycle/fumigation-pea) and only then with the approval of the MEO or BEO who will ensure that these requirements are fulfilled. Aluminum phosphide is available for domestic uses in small agro-shops, but it should never be supported for any uses by
non-professionals.

Proper Spray Technique: Protecting Against Pesticide Spray Drift

Inevitably, pesticide drift will be carried by the wind poses a risk to health, the environment or adjacent crops. Many farmers apply pesticides with a knapsack sprayer, so delivery of pesticides is either in front of the person spraying or to the side, not to the back, as is the case with tractor-drawn sprayers, so that farmers may walk into the spray.
Pesticides may be carried to settle on sensitive ecosystems, such as national parks if they are nearby. Herbicides pose the greatest risk for environmental damage, especially when their drift lands on a neighbor's crops and kills or severely damages them.

The potential for drift to travel long distances has been demonstrated with highly residual chlorinated hydrocarbon pesticides, such as DDT, which have moved through the atmosphere and been found in measurable quantities at both poles on earth. Pesticides that can be transported to the earth's distant poles are bound tightly to dust particles carried high into the atmosphere and transported by jet streams. Their presence only represents a very small percentage of the drift. Spray drift is a mostly local phenomenon, whereby spray droplets move to areas near the field.

There are several ways in which pesticide drift can be minimized, including the following:

Increase spray droplet size. Fog-sized droplets can travel three miles (4.8 km) while coarse droplets typically travel less than 10 feet (3 meters). To increase droplet size, the farmer can reduce spray pressure (e.g., 30–50 pounds per square inch [2–3.5 kg/cm^2] with 5–20 gallons [19–76 liters] of water per acre [0.4 ha]), increase nozzle orifice size, use special drift reduction nozzles, and purchase drift retardant additives that increase spray viscosity where available. However, do not use larger droplets than recommended on the label.

Distance between nozzle and target. Reduce the distance between the nozzle and the target crop. The closer the nozzle is to the target, the smaller and sharper the "spot size" (i.e. area being wetted by the pesticide). The farther away the nozzle is held from the surface, the larger and less defined the spot size. Several other factors will affect the optimal distance such as type of nozzle, pressure, angle, walking speed, sprayer type and setting, type of crop, targeted pest and pesticide used.

Temperature and relative humidity. As pesticides vaporize under high temperature, low relative humidity and/or high temperature will cause more rapid evaporation of spray droplets between the spray nozzle and the target.
Evaporation also reduces droplet size, which in turn increases the potential drift of spray droplets. For this reason, is best not to spray during when temperatures are above 30 degrees Celsius.

Avoid spraying when the wind speed > 10 mph (16 km/h). Because drift occurs as droplets suspended in the air, it is advisable to minimize applications during windy days. If spraying must be done, the farmer should spray away from sensitive areas. Local terrain can influence wind patterns, so every applicator should be familiar with local wind patterns and how they affect spray drift.

Do not spray when the air is completely calm or when a temperature inversion exists. When the air is completely still, small spray droplets become suspended in the warm air near the soil surface and will be readily carried aloft and away from susceptible plants by vertical air movement. Temperature inversion occurs when air near the soil surface is cooler than the higher air. Temperature inversions restrict vertical air mixing, which causes small, suspended droplets to remain in a concentrated cloud and impact plants two miles or more downwind. This cloud can move in unpredictable directions due to the light, variable winds common during inversions. For further information about pesticide safer use and environmental stewardship see: https://pesticidestewardship.org/.

HAZARD NOTIFICATION

In rural areas farmers and agricultural workers should be encouraged to provide notice of their pesticide use to members of their communities and their family. Different approaches to notification are needed in different situations, and the most effective arrangements should be promoted among neighbors through open and effective two-way communication. A formal notification should be required where spraying takes place near sensitive places such as childcare centers and hospitals or in common areas.

The re-entry interval (REI) (also known as restricted entry interval or re-entry time) is the minimum amount of time that must pass between the time a pesticide was applied to an area or crop and the time that people can go into that area without protective clothing and equipment. Observe REI and include REI information in hazard communications.

HARVESTING CROPS TREATED WITH PESTICIDES - THE PREHARVEST INTERVAL (PHI)

The pre-harvest interval (PHI) is the wait time between a pesticide application and when a crop can be harvested. The label will state how long the crop must remain in the garden or field after spraying. During the PHI, the pesticide may be broken down in the plant, or on its surface. Sun, rain, and warm temperatures may affect how quickly this happens. Following the PHI reduces risk from using pesticides on food.

A4.6 Pesticide Handling Transport and Storage Training

TRANSPORT

Pesticides must be managed safely from the point of purchase to application to disposal of pesticide waste and containers. There are number of hazards associated with transporting pesticides. Careless handling of containers, incorrectly maintained equipment, and other related incidents that lead to pesticide leaks and

spills. Poorly maintained vehicles, transporting pesticides in passenger compartments, and poorly secured cargo areas can contribute to pesticide leaks and spills.

Where IPs or beneficiary groups will be transporting pesticides, training must address the fundamentals of safe transport of pesticides. (Some of the largest accidents involving pesticides have occurred during transportation.) Drivers should be trained on how to deal with and contain spills and should be trained not to transport pesticides in vehicles also carrying food. Many agro-dealers are small and ship their stock individually in relatively small quantities. Agro-dealers should be made aware of ways to minimize potential risks during transportation.

Minimum elements of safe transport are:

- Keep pesticides away from passengers, livestock, and foodstuffs;
- Do not carry pesticides in driver's compartment;
- Containers must be in good condition;
- Do not transport packages with any leakage; and,
- Transport under cover and protected from rain and direct sunlight.

Pesticide containers must be thoroughly inspected at the time of purchase, before loading. Even when handling unopened pesticide containers, in case any of the containers leak, workers must wear protective equipment. Only pesticides with legible labels that are securely attached to the containers should be purchased. Leaking or insecurely closed products should not be accepted.

When loading containers, they must be handled carefully and not tossed. They should not be slid over rough surfaces that could rip bags or puncture rigid containers. Anything in the cargo area that could damage, or puncture containers should be removed. Floor and sides of the cargo area should preferably be covered with a synthetic liner. This will make it easier to clean up any spilled materials. In addition, pesticides must be protected from temperature extremes. Very hot or very cold temperatures can reduce the effectiveness of the pesticide and damage the container.[11]

STORING

Storing pesticides properly protects human and animal health, safeguards wells and surface and ground waters, and prevents unauthorized access to hazardous chemicals. Pesticides must never be stored in or around sleeping areas, eating areas, food storage areas, or where children may inadvertently touch or play with them. Pesticides should be stored in a safe and secure area away from living areas.

The pesticide label is the best guide to storage requirements for every product. The SDS provides additional information on normal appearance and odor, as well as flash points, fire control recommendations, boiling point, and solubility.

Some pesticides are inflammable and can catch fire. IPs should train first respondents to manage pesticide fires. The smoke from such a fire is highly hazardous and effluent from water spray can do great harm to the environment. If firefighters use water to put out a fire, the runoff will be highly toxic. Contain small fires with fog, foam, or dry powder. If only water is available, use it as a fine spray or fog. Use only as much water as absolutely necessary. Make sure water and spilled chemicals are being contained. For larger fires, consider withdrawing and allowing the fire to burn out. This option is preferred over using water to fight the fire since use of water can lead to widespread environmental contamination. Clean equipment and all clothing. All personnel involved should shower after fighting the fire.

A4.7 Providing First Aid for Pesticide Poisoning

Pesticide users must be prepared for emergencies and have a plan and clean up supplies. The plan must include inventory of the types and quantities of stored chemicals and their SDSs, emergency response contact, a list of emergency response medical agencies, emergency equipment and supplies available, and what staff is available and

trained to operate the equipment and provide emergency aid. All pesticide users must have an emergency response plan and know the sequence of actions to take in a crisis. Training must be provided to pesticide users and those expected to help in an emergency situation.

Pesticide poisoning first aid

First aid issue	Appropriate action
General	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.
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 victim 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 (if available).
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.

A4.8 Proper Pesticide Container Disposal Training

Once pesticides have been used, the empty containers need to be properly disposed of. Training must address proper disposal. In some cases, farmers can return used containers to the dealer for safe disposal. The table below provides a summary of the best practices for disposal.

Proper methods to dispose of pesticides and their empty containers

Container type	Disposal statements
Metal Containers (non-aerosol)	Triple rinse. Then offer for recycling or reconditioning, or puncture and bury.
Paper and Plastic Bags	Completely empty bag into application equipment. Then bury empty bag.
Glass Containers	Triple rinse. Then bury.
Plastic Containers	Triple rinse. Then offer for recycling or reconditioning, or puncture and bury.

ANNEX 5 FAKE, ADULTERATED, AND COUNTERFEIT PESTICIDES

CropLife International (CLI), the plant science and pesticide industry advocacy group (https://croplife.org/crop-protection/anti-counterfeiting) notes that:

"Counterfeiting is a dangerous and growing problem for all industries, including the plant science industry. Counterfeiting of plant science products brings to bear a range of negative effects for the industry, farmers and the environment."

These negative impacts of counterfeit pesticides include:

- economic ruin for the farmer; potential loss of harvest due to use of an ineffective counterfeit
- discouragement to honest local entrepreneurs from investing in legitimate product development
- hampering of investment, employment, technology transfer and tax revenues
- the potential harm to the environment as counterfeits are not tested for safety (whereas legal products are extensively tested before they are authorized and fulfill strict requirements)
- risk that buyers of export crops will boycott crops treated with counterfeit pesticides thus posing an economic risk to countries relying on export crops
- risks of human, animal and environmental poisoning

The effect of counterfeiting is that it could eliminate the incentive for plant science companies to continue to invest considerable time and money in the development of new technologies that can help assure global food security and alleviate hunger and poverty. Furthermore, counterfeit pesticides risk the health and safety of workers and farmers."

The European Crop Protection Association (ECPA) goes even further, to note that:

> "Counterfeit and illegal pesticides are being produced, marketed and sold by criminals around the world. Improved access to technology and legislative loopholes facilitates the trade of counterfeit and illegal products. This is serious organized crime.
>
> Counterfeit and illegal pesticides are untested and unauthorized. They can result in yield losses for farmers, and potentially pose risks to human health and the environment.
>
> ECPA works with authorities and supports communication activities to raise awareness and help bring an end to the trade in counterfeit and illegal pesticides. Counterfeit and illegal pesticides arrive on the European market primarily via smuggling or under the cover of illegal parallel imports."

Eighty-six percent of counterfeit goods caught by European customs originated in China. Four percent came from Malaysia and two percent came from the United Arab Emirates.

Newsfood.com reported that:

> "In June 2008, regional police in Russia uncovered a major pesticide-counterfeiting facility. Police raided premises near the city of Kursk, close to the Ukraine border, where around 100 tons of counterfeit and illegal pesticide products were found with an estimated market value of over $1 million euros. Most of the products were illegal copies of patented and branded products from major legitimate manufacturers pre-packed into containers ready for commercial sale.
>
> Adjacent to the warehouse, the police uncovered equipment designed to apply labels and stickers to the bottles, as well as other packaging equipment. Initial examination of the symbols on the seized product

containers indicated that the products were manufactured in China. There are also indications that the transport routes to Kursk may be different for differing consignments, with some arriving by sea and others by road and some possibly running through an EU port. Many likely end up in, or passing through, Ukraine to other European destinations. This raid followed a major seizure in late 2006 at the port of Odessa, Ukraine where over 500 tons of counterfeit and illegal pesticides were seized."

In December 2015, 190 tons of counterfeit pesticides were seized by Europol in seven countries over several days (https://www.euractiv.com/section/justice-home-affairs/news/190-tonnes-of-illegal-pesticides-seized-by-europol/). This operation focused on the marketing and sale of counterfeit pesticides, including infringements of intellectual property rights such as trademarks, patents and copyright, as well as targeting the illegal trade of pesticides. CLI and ECPA assisted the operation with data about counterfeits.

Types of counterfeit and illegal pesticides include fakes, adulterated, counterfeits and illegal parallel imports. Fakes can contain anything from water or talc to diluted (adulterated) and outdated or obsolete pesticide stocks, including banned or restricted chemicals to enhance activity. Some fakes sometimes contain illegal and untested copies of the generic (off-patent) and proprietary active substance. Fake products are often sold in simple plain bottles with minimal labeling describing their use, and no health or environmental precautions.

Counterfeits are sophisticated pirated copies of legitimate, branded products, and usually have high-quality labeling and packaging that mimics that of legitimate brands. Counterfeits are often difficult even for experts to distinguish from legitimate products. Most counterfeits will contain a copy of the original active ingredient, but at an unknown quantity and quality, often with highly toxic manufacturing impurities that harm human health.

Illegal parallel imports are generic copies of legitimate, parallel-traded generic products. These generic products have been repackaged and sold as brand-name products, with the same or a very similar product name.

Challenges of quantifying the problem.

- There are insufficient funds for testing, enforcement, seizures and prosecution.
- National enforcement is weak.
- Inadequate judicial frameworks and penalties.

Potential solutions that should be promoted by all USAID agriculture programs:

- Upgrade Ministry of Agriculture or other analytical laboratories to be able to test for AIs and byproducts
- Randomly test samples of all products imported to determine amount and quality of AIs
- Do additional samples of suspect products
- If products fail the test, immediately impound and seize them from markets
- Use CLI's database of counterfeits to identify illegal pesticides
- Encourage the local government customs officials to seize illegal pesticides
- Encourage government officials to prosecute counterfeiters
- Promotion of products from reputable stores or distributors
- Train beneficiaries to avoid bargains from unknown suppliers
- Product labels must be in the national language/s
- Avoid promoting non-registered products made in China or Malaysia
- Ask for a receipt that includes accurate purchase details
- Only purchase legitimate, registered pesticides
- If information relating to the sale of illegal products is found, contact the relevant national authority

FUTURE PESTICIDE QUALITY VERIFICATION SYSTEMS

Two companies currently focus on detecting counterfeit pharmaceuticals, mPedigree (https://mpedigree.com/en/) and Sproxil (https://www.sproxil.com/about-us/). Both aim—in the future—to be able to detect counterfeit pesticides as well, and merit following and perhaps using for this purpose. One drawback of using these applications is that they market to and favor larger international producers who have sufficient financial resources, and could block legitimate smaller companies producing legal, off-patent generic pesticides.

CERTAINTY WITH PESTICIDE QUALITY

In an ideal world, USAID teams and projects would like to be able to identify all counterfeit chemicals for farmers, but without analytical capability by and funding for the MOA, or a regional International Standards Organization
(ISO)-certified laboratory sub-contracted and paid to randomly check imported products for AI presence and concentration, as well as to check for other chemical contaminants or additions, this will continue to be challenging, if not impossible. None of these conditions exist. Kindly see http://www-pub.iaea.org/MTCD/Publications/PDF/te_1612_web.pdf.

Annex 4 provides additional information on how to improve quality assurance with pesticide choices in the section “Screening for Pesticide Quality”

SOME ADDITIONAL GUIDANCE IS PROVIDED IN THE FOLLOWING SOURCES:

- Best Practice Guidance to Identify Illegal Trade of Pesticides, Series on Pesticides No. 99, OECD, Paris: https://one.oecd.org/document/ENV/JM/MONO(2018)35/en/pdf.
- Quality Control Of Pesticide Products, IAEA Vienna, 2009: https://www-pub.iaea.org/MTCD/Publications/PDF/te_1612_web.pdf.
- National Pesticide Information Centre: http://www.npic.orst.edu/ingred/ptype/illegal/index.html.
- US Environmental Protection Agency: https://www.epa.gov/safepestcontrol/avoid-illegal-household-pesticide-products.
- The International Code of Conduct on Pesticide Management FAO, Rome, 2014: https://www.fao.org/3/I3604E/i3604e.pdf.
- Counteraction to Counterfeit and Contraband Pesticides. Methodology, OSCE, ENVSEC, 2015: http://www.osce.org/secretariat/192516?download=true.
- http://npic.orst.edu/ingred/manuf.htm.

IEE ATTACHMENT B: ENVIRONMENTAL GUIDELINES FOR F2F VOLUNTEERS

Why do we need Environmental Guidelines?

A healthy environment and sustainable use of natural resources are essential to long-term economic growth. As with all USAID financed programs, the Farmer-to-Farmer Program is required to comply with USAID environmental regulations found in **Title 22 of the Code of Federal Regulations, Part 216**[3], specifying that the environment is to be safeguarded from adverse consequences in the implementation of all program activities. If not planned and implemented wisely, even the best intentioned assistance programs can have very real adverse impacts on real people's lives including not only their personal health but also the sustainability of the natural resources on which their present and future livelihood depends.

Within this framework, it is USAID's policy to:

- Ensure that the environmental consequences of USAID financed activities are identified and considered by USAID and the host country prior to a final decision to proceed, and that appropriate environmental safeguards are planned, adopted, implemented, and monitored;
- Assist developing countries to strengthen their capabilities to appreciate and effectively evaluate the potential environmental effects of proposed development strategies and projects, and to select, implement and manage effective environmental programs that mitigate potential adverse effects;
- Identify and mitigate impacts resulting from USAID actions upon the environment, including those aspects of the biosphere which are common and cultural heritage of all mankind; and
- Define environmental limiting factors that constrain development and identify and carry out activities that assist in restoring the renewable resource base on which sustained development depends.

Regardless of the type of their assignment, volunteers are expected to study the environmental impact assessment documents that were developed for their programs by USAID, their home organization, and the host government. The purpose is to enable volunteers to be able to consider the potential environmental consequences of their work and to promote active environmental stewardship. Volunteers have a tremendous opportunity to disseminate a uniform and consistent message to promote environmentally sound practices throughout the agricultural communities in which they work.

Disclaimer: The purpose of these guidelines is not to provide the volunteer with technical standards and procedures for food production, processing, storage, etc. The guidelines are to serve as a benchmark for the volunteer in reflecting on how his/her recommendations, advice, and efforts can serve to instill environmental stewardship and promote environmentally sound solutions.

Volunteer Responsibility & Good Practices:

Promoting Ecologically Sound Solutions

While the environmental impact assessment and other project design documents provide an important framework, volunteers are encouraged to think of ways in which, through their individual assignments, they can promote sustainable solutions to agricultural production, processing, and distribution issues while maintaining an ecological equilibrium in those communities.

To identify solutions to certain environmental problems, a series of questions need to be asked and answered.

- *What is the source of the environmental problem?*
- *What is the magnitude and impact of the problem?*
- *What measures will help avoid or reduce the problem?*
- *How to implement these measures?*

Volunteers are encouraged to consider environmental impacts and issues that indirectly relate to the agricultural sub-sector, as well as long-term and cumulative impacts on the local, regional, and global environments. As they consider their ideas for new kinds of interventions, volunteers must discuss them with their home organization's managers, their USAID manager, and host country counterparts to ensure that they have considered all potential impacts and that there will be a good chance for achieving the hoped for results.

Will my recommendations and efforts promote….

- soil and water conservation?
- protection of water, soil, air, and food from contamination? pollution prevention? ▪ ecologically sound management and disposal of wastes?
- integrated pest management (particularly alternatives to chemical inputs—the last resort)? ▪ the importance of occupational health and safety both on the farm and in the industry? → better bathroom facilities with soap for employees?
- awareness of environmental health risks?
- reform of government policies and regulations to better manage and protect natural resources? ▪ reform of government policies and regulations to better protect farmers and other agricultural industry workers from environmental hazards?
- procedures for measuring, assessing, monitoring and mitigating the environmental impact of unsound practices currently in use?
- the emergence of an indigenous agricultural research capacity committed to developing processes and environment-friendly technologies?
- enabling agricultural exports by ensuring no inappropriate pesticides were used in production

Adverse Environmental Conditions and Protecting Your Health & Safety:

When we send volunteers on their assignments, we want to ensure that all volunteers are aware of severe environmental pollution problems and health risks that exist in certain areas. These hazards can be localized or regional. They can arise both from existing contamination and from the lack of adequate information, education, and regulatory controls.

Volunteers must exercise caution when actively participating in any of the agricultural production, processing, or distribution practices. Volunteers should be conscious of the general lack of enforceable environmental protection regulations and the prevalence of antiquated and defective equipment and machinery. Due to the lack of financial resources for maintenance and upkeep of equipment, training, and the provision of proper storage facilities, volunteers should use discretion when visiting farms and observing practices that involve machinery and facilities such as these.

With regard to pesticides, USAID's Environmental Compliance Procedures state that "all proposed projects involving assistance for the procurement or use, or both, of pesticides shall be subject to the procedures prescribed…" These procedures are jointly completed by USAID, the host government and partner organizations. Depending on the details of an activity, you may encounter such reviews with titles of Initial Environmental Examination, Environmental Assessment, or Pesticide Evaluation Review – Safe Use Action Plan (PERSUAP). These reviews are prepared prior to

implementation of an activity in order to identify and

understand potential environmental repercussions of proposed activities and to ensure mitigative actions are incorporated into the activities. The term 'pesticide' refers to any chemical or biological substance that is used to kill or repel pests. It is the generic term that includes insecticides (insect killers), herbicides (weed killers), rodenticides (rodent killers), fungicides (fungus killers), etc. Volunteers must understand and appreciate that all pesticides are poisons and many also can cause cancer, birth defects and other long term illnesses or even death. Some pesticides are more dangerous than others and the environmental impact assessment that is conducted on an activity selects the safest ones possible while creating requirements for expert training in their application and handling. The analysis evaluates the economic, social and environmental risks and benefits of the planned pesticide use, prescribes a limited list of pesticides that may be permitted to be purchased and/or used (even if they are purchased with non-activity funds) in an activity while establishing safety protocols and ensuring local health clinics have trained staff and antidotes to identify and treat pesticide poisonings. Volunteers may encounter situations where pesticides are being used that have not been approved for procurement or use in the activity. In such cases the volunteer should immediately report the situation to their program manager and to the local USAID manager to jointly develop a solution to the problem.

In all cases, volunteers need to :

- Take care of their own health first and if necessary, do not participate in that activity; ▪ Note possible negative effects on the environment;
- If a volunteer comes across inappropriate or misapplication of an approved pesticide and the volunteer is trained in pesticide use and safety, open the discussion up to alternative practices based on the findings of the approved environmental impact assessment that is in place for the activity; then report on the situation to their program manager and the USAID manager;
- If a volunteer is asked to recommend a pesticide and the volunteer is fully trained in pesticide application and safety and has studied the approved environmental impact assessment documents for the activity, the volunteer should recommend the appropriate approved pesticide from the assessment along with the approved training of the people who will use the pesticide.
- If the volunteer is not fully trained in pesticide application and safety, the volunteer should refer the request to their program manager and USAID manager with a request that a pesticide expert visit their site to provide the appropriate recommendation and training.

Volunteers should consider bringing with them: First aid kit, copies of passport, personal health card (shots, allergies, etc.), emergency phone numbers, contact names, allowable medications, cell phone, and technical support material.

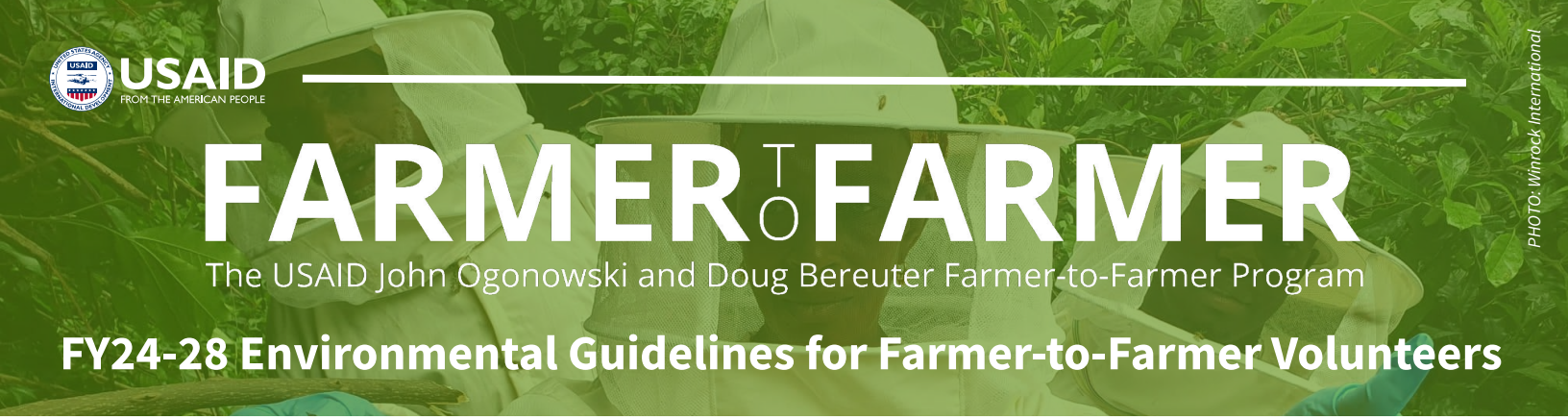
Key Recommendations:

It is highly recommended that volunteers compile a general environmental evaluation for their individual assignments to gauge any potential negative (or positive) impacts. Discussion should concentrate on environmental degradation, health and safety risks to the environment and humans, and recommendations for monitoring the project after assignments have been completed. This brief assessment should be included in the volunteers' final report. The following are helpful tools in this assessment process; USAID Environmental Compliance Procedures; and review of baseline information, if provided. If not provided, conduct a basic baseline survey to support your interventions.

Specific and detailed Environmental Guidelines include USAID/Africa Bureau's Environmental *Guidelines for Small-Scale Activities in Africa,* LAC's *Environmental Guidelines for Development Activities,* and the Asia/ME *Sectoral Environmental Guidelines.*The Africa Bureau's 18 sectoral environmental guidelines can be found in Section II of the http://www.encapafrica.org/egssaa.htm. Section III covers Micro- and Small Enterprises.
Information sources on environmental health and safety:

- Hughes, J. Donald, *The Face of the Earth: Environment and World History*, 2000. ▪ Marrs, Timothy C., Ballantyne, Bryan, *Pesticide Toxicology and International Regulation*, 2004.
- Pavlinek, Peter*, Environmental Transitions: Transformation and Ecological Defense in Central and Eastern Europe*, 2000.
- Younes, Maged, et al, *International Food Safety Handbook: Science, International Regulation, and Control*, 1999.
- State Dept., International Travel Information: http://travel.state.gov/travel/travel_1744.html. ▪ CDC, Travelers' Health (by destination): http://www.cdc.gov/travel/.
- Regulating Pesticides, International Issues: http://www.epa.gov/oppfead1/international/#I3 ▪ The International Programme on Chemical Safety (IPCS): http://www.who.int/ipcs/en/.

BROCHURE: ENVIRONMENTAL GUIDELINES FOR F2F VOLUNTEERS



USAID
FROM THE AMERICAN PEOPLE

FARMER TO FARMER

The USAID John Ogonowski and Doug Bereuter Farmer-to-Farmer Program

PHOTO: Winrock International

FY24-28 Environmental Guidelines for Farmer-to-Farmer Volunteers

A healthy environment and the sustainable use of natural resources are essential to long-term economic growth. As a Farmer-to-Farmer (F2F) volunteer, you are expected to consider the potential environmental consequences of your work and to promote active environmental stewardship. F2F volunteers have a tremendous opportunity to disseminate a uniform and consistent message to promote environmentally sound practices throughout the agricultural communities in which you work.

These guidelines provide an orientation to USAID policies and benchmarks for you to consider how your recommendations, advice, and efforts can promote environmental stewardship and environmentally sound solutions for hosts and their communities.

USAID Environmental Policies

As with all USAID funded programs, F2F is required to comply with federal environmental regulations to safeguard the environment from adverse consequences in implementation of all program activities. Even the best intentioned activities can have real, adverse impacts on people's health, livestock health, biosafety and the natural resources on which hosts' livelihoods depend, and the viability of their farms or businesses. It is USAID's policy to:

- Ensure that the environmental consequences of USAID-funded activities are identified and considered by USAID and the host country prior to a final decision to proceed and that appropriate environmental safeguards are adopted
- Assist developing countries to strengthen their capabilities to appreciate and effectively evaluate the potential environmental effects of proposed development strategies and projects, and to select, implement and manage effective environmental programs
- Identify impacts resulting from USAID's actions upon the environment, including those aspects of the biosphere which are the common and cultural heritage of all mankind
- Define environmental limiting factors that constrain development and identify and carry out activities that assist in restoring the renewable resource base on which sustained development depends

Prior to implementation of this F2F project, USAID conducted an Initial Environment Examination (IEE) that identifies environmental risks and prepared a Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP). Each F2F implementing partner has prepared an Environmental Management and Mitigation Plan (EMMP) that adheres to USAID's environmental regulations as well as the laws and policies of the country in which they—and you— work. Compliance with these rules and regulations and your own sound judgement as a volunteer steward of your host's environment and natural resources are crucial to managing and mitigating the risks inherent in your assignment.

Volunteer Responsibility & Good Practices

F2F volunteers bear a significant responsibility in your work with your hosts:

- Follow USAID regulations and the laws and policies of your host country
- Consider the direct environmental impacts of your work and recommendations to host organizations
- Ensure that host organizations (and others in the country) have the tools and resources to implement and replicate your recommendations
- Consider the indirect environmental impacts and issues that relate to the agricultural sub-sector and cumulative impacts on the local, regional and global environments
- Discuss your ideas for new interventions with local experts, your home organization's managers, input and service providers to be sure you have considered all potential impacts
- Learn which pesticides, veterinary medicines and fertilizers are registered in your country of assignment. Work with your hosts to emphasize the importance of reading and following labels and application instructions, and using personal protective equipment. Get translations of labels as needed

As a specialist in your field, you will be aware of the environmental issues in your area of expertise. As you develop recommendations and guidance for your host, it is a good practice to ask a series of questions that help you identify solutions to environmental problems:

- What is the source of the environmental problem?
- What is the magnitude and impact of the problem?
- What measures will help mitigate the problem?
- How to implement these measures?

It is good practice to determine how your recommendations and activities mitigate and manage environmental impacts. If your assignment involves pesticide application or recommendations (including organic options), you must reference the active ingredients in the F2F PERSUAP, available from your volunteer sending organization. Compare that list with the host country's registered active ingredients (also available from your sending organization), and ensure your recommendations are consistent with both documents. Any recommended products not listed in the PERSUAP, and any genetically modified organisms, must be approved by USAID *before* they can be discussed or recommended to your host.

Many developing countries are experiencing climate variability and change, including more intense heat waves, droughts, floods, storms and unexpected rainfall. It may be appropriate to provide assistance to prepare for and adapt to this change, including building awareness and using satellite data to help understand challenges in food security, water, climate and land use. See the SERVIR website for maps and resources.

PHOTO: Farmer-to-Farmer Program

VISIT
farmer-to-farmer.org

Protecting Your Health & Safety

When we send you on your volunteer assignment, we want to ensure that you are aware of the severe environmental pollution problems and health risks that may exist in certain areas. These hazards can be localized or regional. They can arise both from existing contamination and from a lack of information, education and regulatory controls.

You must exercise caution when actively participating in any agricultural production, processing, or distribution practices. Be conscious of the general lack of enforceable environmental protection regulations and the prevalence of antiquated and defective equipment and machinery. Due to the lack of financial resources for maintenance and upkeep of equipment, training, and provision of proper storage facilities, you should use discretion when visiting farms and observing practices that involve machinery and storage facilities. If you encounter a situation where pesticides are being used improperly with serious risk of human exposure, please report this to your F2F contact or a USAID official. While this is especially critical for USAID-funded projects, it is equally important in any other farming or gardening situation.

In all cases, you need to:

- Take care of your own health first and, if in doubt, do not participate in an activity until you can obtain professional advice
- Note possible negative effects on the environment
- If you see inappropriate use of pesticides and you are trained in pesticide use and safety, open a discussion on alternative practices
- Take every opportunity to provide safe use information to your host. This may include the use of personal protection equipment, backpack sprayers, and proper container storage/disposal. In some situations it may be appropriate to help farmers identify and use other forms of pest control
- If you are asked to recommend a pesticide and you are trained in pesticide application and safety, please recommend only the appropriate, approved pesticide from the PERSUAP
- If you are not trained in pesticide application and safety, you should request that a pesticide expert visit the site to provide appropriate recommendations

What to Do Now

To prepare for your assignment, we recommend you conduct an informal environmental review to gauge any potential negative (or positive) impacts. This is for your use as you prepare for and implement your assignment. Your review should concentrate on environmental degradation, health and safety risks to the environment and humans, recommendations that mitigate these risks, and how to monitor the project post-assignment. If you are preparing a training program for pesticide use, food processing, or natural resource management, do some advanced planning based upon USAID regulations, your scope of work, and any background information provided to you. Consult with F2F staff and volunteers who have been to that country or worked with your hosts. This will aid your ability to plan recommendations and plan for demonstrations. Plan to protect your own health and safety, bring any protective gear you will need to conduct the assignment, and review "what to bring" materials from your volunteer organization.

PHOTO: Catholic Relief Services

PHOTO: NCBA CLUSA

PHOTO: Winrock International

PHOTO: Partners of the Americas

Information Sources on Environmental Health and Safety

Title 22 Code of Federal Regulations, Part 216 (22 CFR 216) Agency Environmental Procedures
https://www.usaid.gov/environmental-procedures/22-cfr-216-agency-environmental-procedures

FY24-FY28 Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP)
https://farmer-to-farmer.org/file/2478

World Bank Environment
http://www.worldbank.org/en/topic/environm

UN Environment Program
https://www.unenvironment.org/

USAID's Climate Change and Development Strategy
https://www.usaid.gov/climate/strategy

SERVIR Global
https://servirglobal.net

USAID Resources on Climate Change
https://www.climatelinks.org