SIDE EVENT

The IESTI Equations and Minor Crops

Sunday, 1 October 2017
8:30 – 11:00 am
Van-Horne Room

GMUS-3
Third Global Minor Use Summit
Fairmont Queen Elizabeth Hotel
Montreal, Quebec, Canada

SPEAKERS

- LUCY NAMU, Head, Quality Assurance and Laboratory Accreditation, Kenya Plant Health Inspectorate Service
- CHERYL CLEVELAND, Global Consumer Safety, BASF Corporation, CropLife America
- GEOFFREY ONEN, Principal Government Analyst, Government Chemistry and Analytical Laboratory, Uganda
- IAN REICHSTEIN, Director, National Residue Survey, Department of Agriculture and Water Resources, Australia
- XAVIER SARDA, Head, Residues and Food Safety Unit, Agency for Food, Environmental and Occupational Health Safety, France

MODERATOR

- JULIE CHAO, Office of Agreements and Scientific Affairs, Foreign Agricultural Service, United States Department of Agriculture

AGENDA

- Opening remarks: purpose and events leading up to this session (Julie Chao, ~15 min)
- Understanding the relevance of the IESTI equations to minor crops: a developing country perspective (Lucy Namu, ~30 min)
- Proposed review of the IESTI equations and potential impact to minor crops: a technical perspective (Cheryl Cleveland, ~45 min)
- Next steps on the proposed review of the IESTI equations (Geoffrey Onen, Ian Reichstein, and Xavier Sarda, ~30 min)
- Discussion (All, ~30 min)

Organized by the Kenya Plant Health Inspectorate Service and the U.S. Department of Agriculture's Foreign Agricultural Service
Kindly RSVP to Julie.Chao@fas.usda.gov

What will be the impact of changes to the proposed review of the IESTI equation on minor crops?

Currently, minor crops face great challenges not least with the limited number of MRLs for specific crop/pesticide combinations to facilitate trade. Minor crops also have limited data for establishment of MRLs, with few registrants willing to invest in more data generation activities.

In the event that the process of review results in revision of the current International Estimated Short Term Intake (IESTI) equations and takes a conservative approach that results in estimated short term intakes that considerably exceed those of the present equations, many of the already limited MRLs may likely disappear. Codex Member States which use Codex MRLs (CXLs) implicitly use the IESTI equations. Although the same IESTI equations are used, the input parameters (residues, variability factors, unit weights, large portions) can differ among and between international bodies (JMPR, EFSA) and individual countries. Because of differences in these input parameters, the outcome of short-term dietary risk assessments may differ for a particular commodity-pesticide combination in different parts of the world and this may determine in many cases whether or not a CXL can be established for the commodity of interest for that pesticide. The use of different input parameters creates trade barriers and concerns among the general public as to whether the MRL can be considered safe.

As a result, an evaluation of the IESTI methodology was proposed by JMPR (2006, 2007, and 2010). In order to achieve this, JMPR recommended organizing a consultation, including relevant stakeholders and stressed the fact that to ensure international harmonization of the methodology changes to the equation cannot be implemented by JMPR alone, but should be discussed at the international level.

i) As part of the discussion at the pre-Global Minor Use Summit 3; the forum objective is to:
ii) share views of various countries that conduct the assessment using the current IESTI equations with specific parameters, providing special focus on minor crops;
iii) share findings and challenges in short-term intake dietary exposure assessment which may result in estimates that exceed the acute reference dose (ARfD) even when the residue levels found were still in compliance with the MRLs especially for minor crops;
iv) share views and challenges on the areas of joint collaboration in providing information in risk communication to various stakeholders; and
v) discuss options in probabilistic risk assessment using existing (and ideally real-world) information, with a special focus on minor crops.

Although the development of a calculation tool for assessing acute exposure is clearly a risk assessment task within the remit of JMPR, the risk managers at CCPR are requested to advise JMPR on their needs, i.e. define more clearly what the calculation tool should deliver and how conservative its calculations and outputs should be, as well as the degree to which the dietary exposure estimates should systematically overestimate true high end exposures in the name of consumer protection. As a pre-condition for CCPR to accept the results of a new calculation tool, it is important that the impact of any changes in the current IESTI equations or calculation tool and its parameters is properly assessed, both in terms of consumer protection and MRL establishment. Since the use of different risk assessment policies for addressing short-term exposures may potentially create trade barriers especially for minor crops, the meeting would seek to agree on critical considerations that should be made in reviewing the current IESTI methodologies. It is recalled that during the 49th Session of the CCPR (CCPR 49), the Chair of the Electronic Working Group (EWG) reported that it could not fully accomplish its work because of the divergent views on the need to revise the IESTI equations; therefore the EWG was re-established with the following Terms of Reference:

i) To provide information on the history, background and use of the IESTI equations.
ii) To review and provide illustrative comments on advantages and challenges that arise from the current IESTI equations and their impact on risk management, risk communication, consumer protection goals and trade.
iii) To gather relevant information on bulking and blending, as well as other information or data as outlined in Table 3 Appendix 2 of CX/PR 17/49/12 in order to feed into the risk assessors work through the JMPR Secretariat.

On the basis of the above considerations, a discussion paper would be developed providing recommendations for consideration at CCPR 50.

It is hoped that specific input parameters and factors would be discussed during the Pre-Summit meeting, for consideration during the review of the current equation can be presented to ensure that adequate mechanisms for collating this information on minor crops are proposed.

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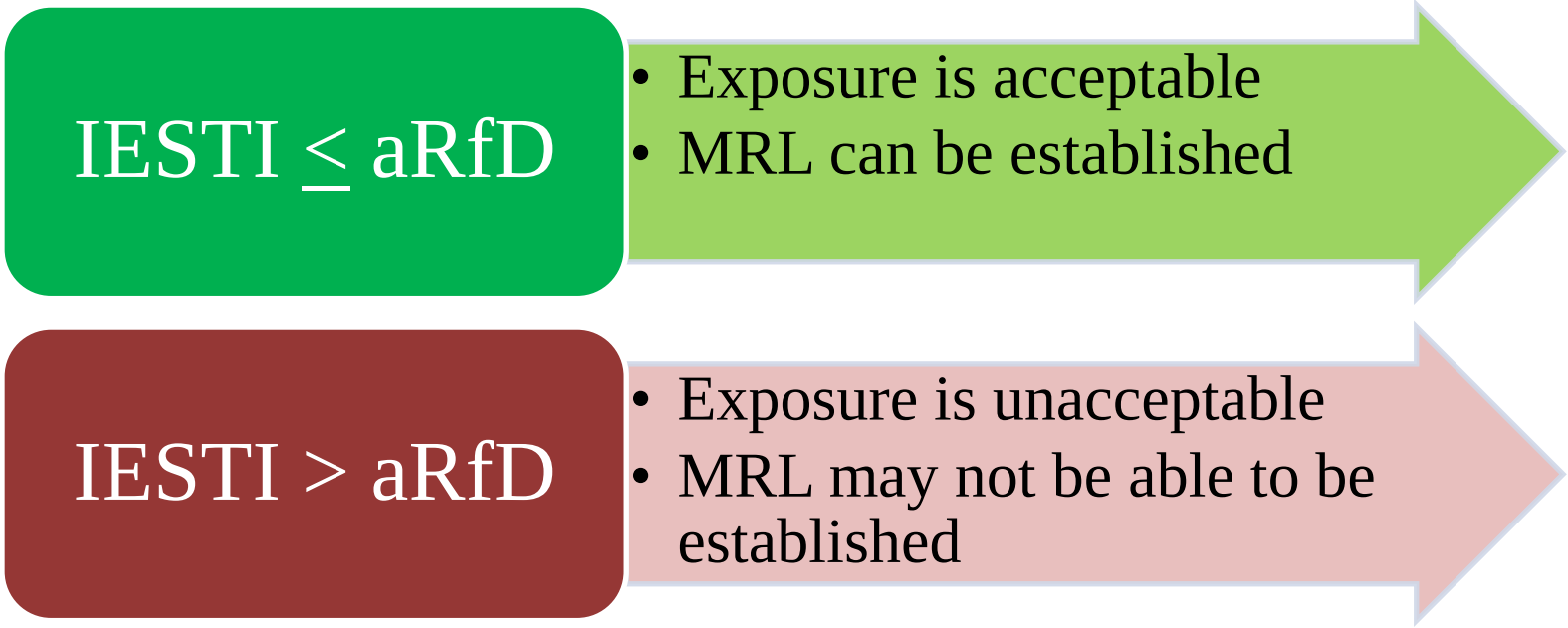
What are the IESTI equations?

- **I**nternational **E**stimated **S**hort-**T**erm **I**ntake
- A set of equations used to estimate one-day exposures to pesticides
- Individual commodity basis, not designed to assess multi-commodity exposure
- Intended to generate conservative/protective acute dietary exposure estimates

Why do the IESTI equations matter?

- Used by national and international bodies to determine if an MRL can be established



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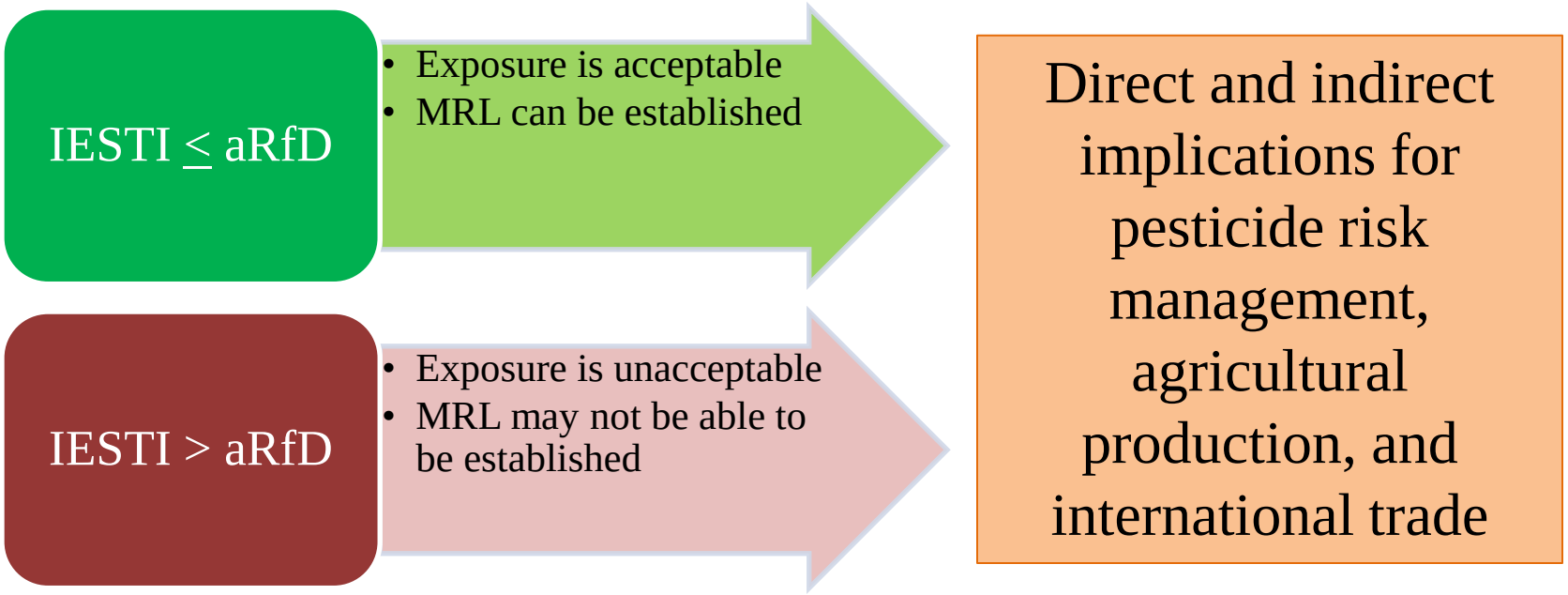
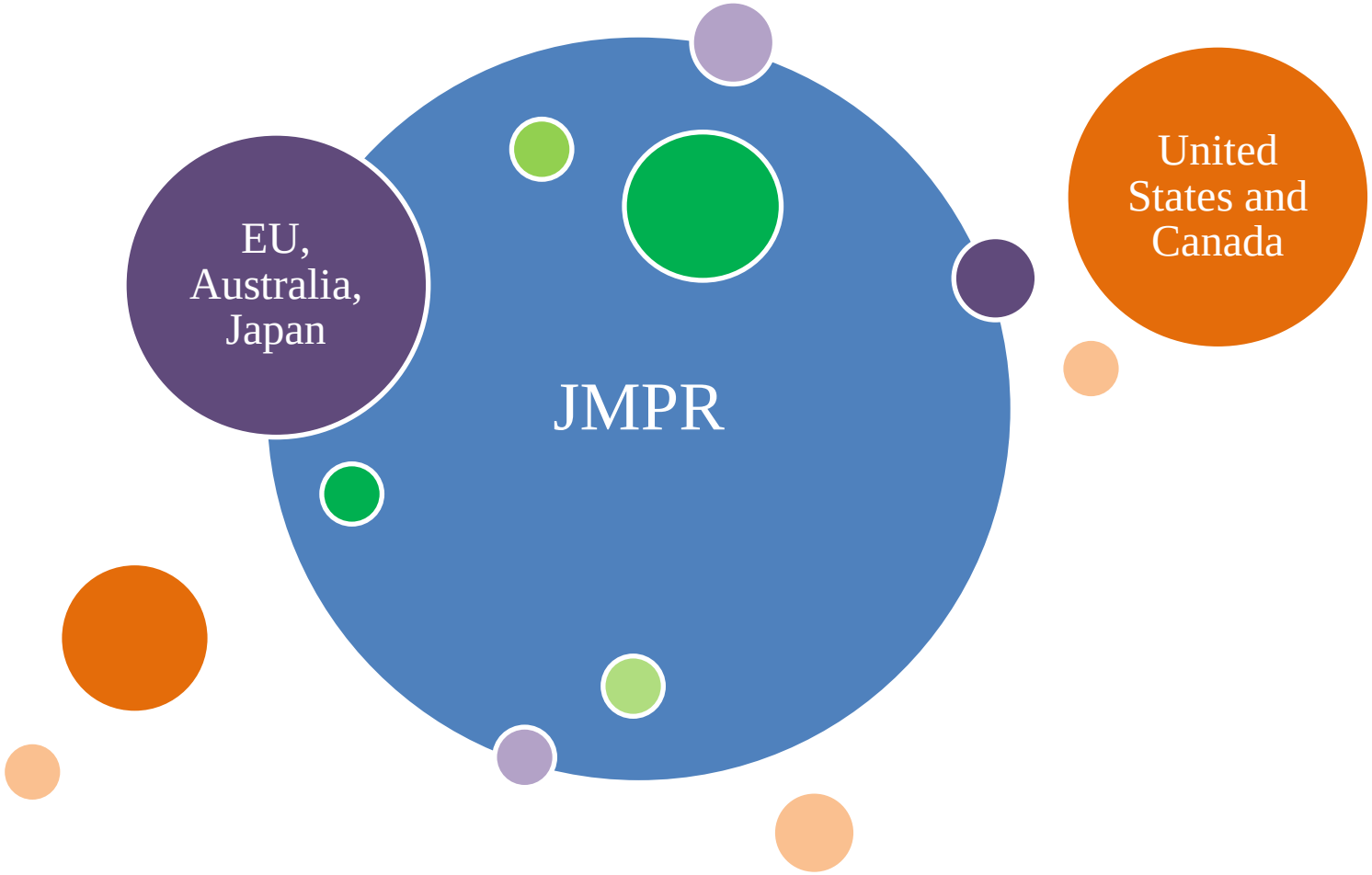


Who uses the IESTI equations?



Today's Session

CCPR EWG on the review of the IESTI equations: aim and process	Geoffrey, Ian, and Xavier
Relevance of IESTI to minor crops: a developing country perspective	Lucy
Proposed review of the IESTI equations and potential impact to minor crops	Cheryl
Group discussion and sharing of views	All

CCPR EWG on the review of the IESTI: aim and process

Geoffrey Onen
Ian Reichstein
Xavier Sarda

Food safety world-wide through Codex Alimentarius

FAO

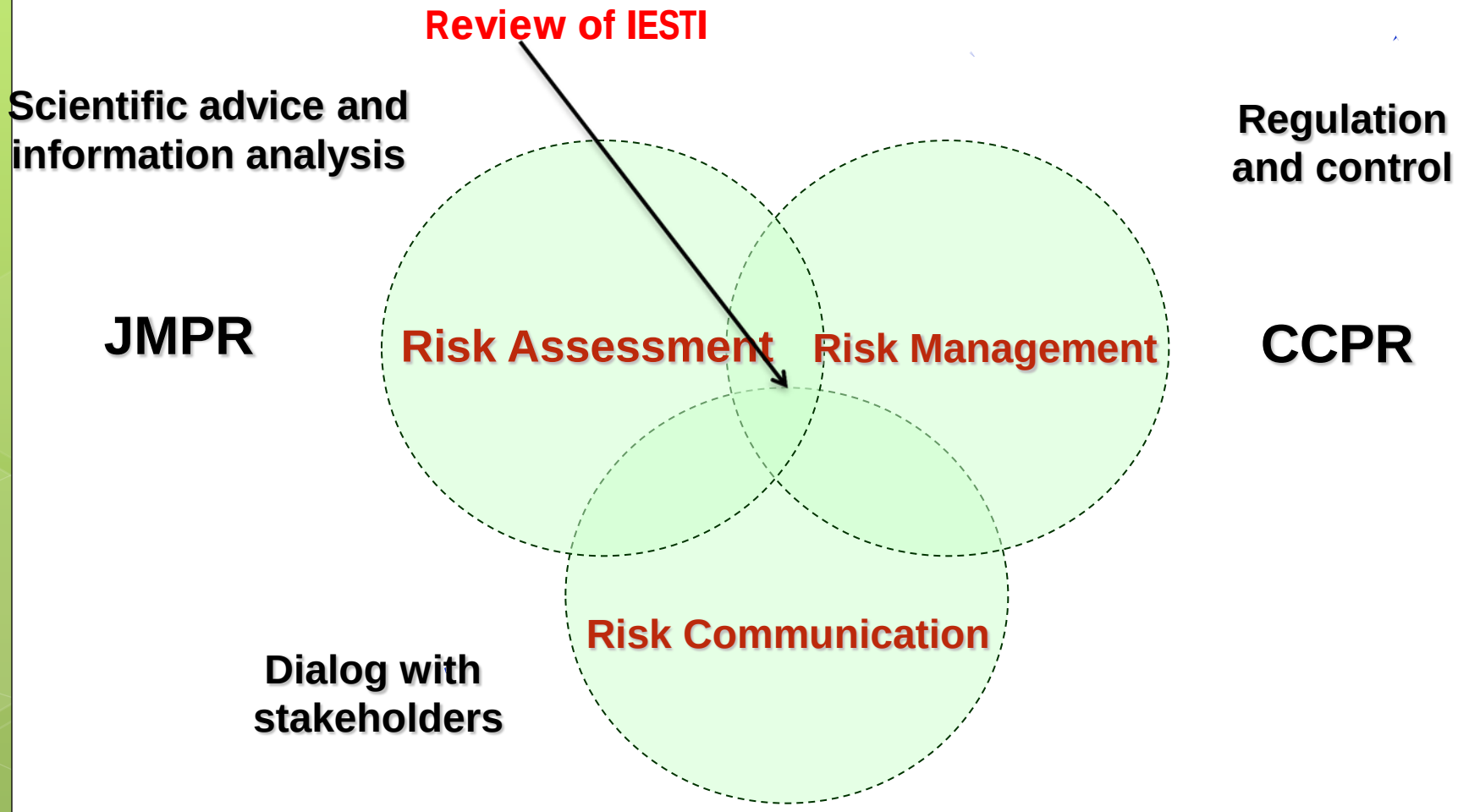
WHO

FAO/ WHO Food Standards

CODEX alimentarius

- Food 'law', United Nations 1962
- 186 Member States, 216 Observer organisations
- Standards indirectly binding through treaties (WTO)

Risk Analysis Paradigm



Codex Committee on Pesticide Residues- CCPR

History of IESTI

- 1997 FAO/WHO Geneva Consultation
- 1998 York International Conference on Pesticide Residues Variability and Acute Dietary Risk Assessment (PSD, UK)

- *ad hoc* Expert Meeting held before the 1999 CCPR (Annex V in JMPR 1999 report)
- JMPR meetings 1999, 2000, 2002, 2003, 2005, 2006

- changes consolidated at FAO/WHO 'Annapolis' workshop (WHO, 2008 = EHC 240)

Reviewing the IESTI

- Proposal by JMPR (2006, 2007, 2010). JMPR recommended organising an international consultation, including all relevant stakeholders.

- In response: September 2015 2-day **Scientific Workshop in Geneva**, organized by the European Food Safety Authority (EFSA) and the Dutch WHO Collaborating Centre on Chemical Food Safety (@RIVM). FAO and WHO co-sponsored this event.

Reasons for reviewing IESTI

- Check against current science and practicalities after 15 years of use
- Communicating that the legal standards (MRLs) are assessed may contribute to building trust among the general audience
- Amongst other factors, harmonizing the IESTI methodology may increase the acceptability of Codex MRLs and in turn help contribute to a level playing field in international trade.

Reasons for reviewing IESTI-2

- Use of OECD MRL calculator and harmonised MRL classes:
  - MRLs are derived in the same way everywhere
  - using the MRL instead of the HR will no longer lead to different conclusions in different countries

- HR is based on a small dataset.
  - In reality, residue levels may vary outside the dataset. The 'OECD – MRL calculation unrounded' is a statistically more reliable estimate of the highest residue. The OECD – MRL calculation in many cases results in a level at approximately 2x the HR

2015 Geneva Workshop main recommendations

- Replace the HR and STMR by the MRL in all cases of the IESTI equation
- Use a a default variability factor of 3
- Derive the P97.5 large portion from the distribution of consumption values expressed as g/kg body weight
- Proposal to remove the unit weight from the IESTI equations
- applicable to both MRL setting for individual commodities and enforcement purposes

2015 Geneva Workshop main re

- Repl … all ca…
- U…
- D… d… as… d
- Prop… the IESTI et…
- applicable … individual commodities and enforcement purposes

Recommendations; not world-wide consensus!

2016 CCPR

- 2 side events on IESTI, from Europe and from CropLife
- Discussion paper by EU + Australia

- EWG (chair NL, co-chair AUS) with ToR:
  'To identify advantages and challenges that might arise from the possible revision of the current IESTI equations and the impact on risk management, risk communication, consumer protection goals, and trade. The recommendations of the international EFSA/RIVM workshop cosponsored by FAO and WHO and the discussions in CCPR48 should be taken into account.'

2017 CCPR

- In-session WG meeting
- the EWG could not fully accomplish its work because of the divergent views on the need to revise the IESTI equations
- JMPR Secretariat: the periodic review of scientific methodologies is a normal process

CCPR 2017 – 2

ToR (chair NL, co-chairs AUS + Uganda)

I. To provide information on the history, background and use of the IESTI equations.
II. To review and provide illustrative comments on advantages and challenges that arise from the current IESTI equations and their impact on risk management, risk communication, consumer protection goals and trade.
III. To gather relevant information on bulking and blending, as well as other information or data as outlined in Table 3 Appendix 2 of CX/PR 17/49/12 in order to feed into the risk assessors work through the JMPR Secretariat.
IV. On the basis of the above considerations develop a discussion paper providing recommendations for consideration at CCPR 50.

CCPR 2017 - 3

Request to FAO/WHO risk assessors:

I. To review the basis and the parameters of the IESTI equations;
II. To benchmark the outcomes of IESTI equations to a probabilistic distribution of actual exposures; and
III. To present the outcome to CCPR.

CCPR 2018 - preview

- Two groups working in parallel: EWG and FAO/WHO working group
- CCPR 2018 will discuss the results from both groups and decide on a way forward

Review of IESTI & minor crops

- The review is ongoing and no decision has been made yet on whether to revise the IESTI equations and if yes, how.
- **Therefore, the impact on minor crop MRLs is yet unknown.**
- N.B. minor crops are defined by CCPR based on low consumption both world-wide and local. Large Portion will be small. Because of reduced number of trials, MRL may be relatively high. Trade-off in IESTI result?

Thank you for your attention!

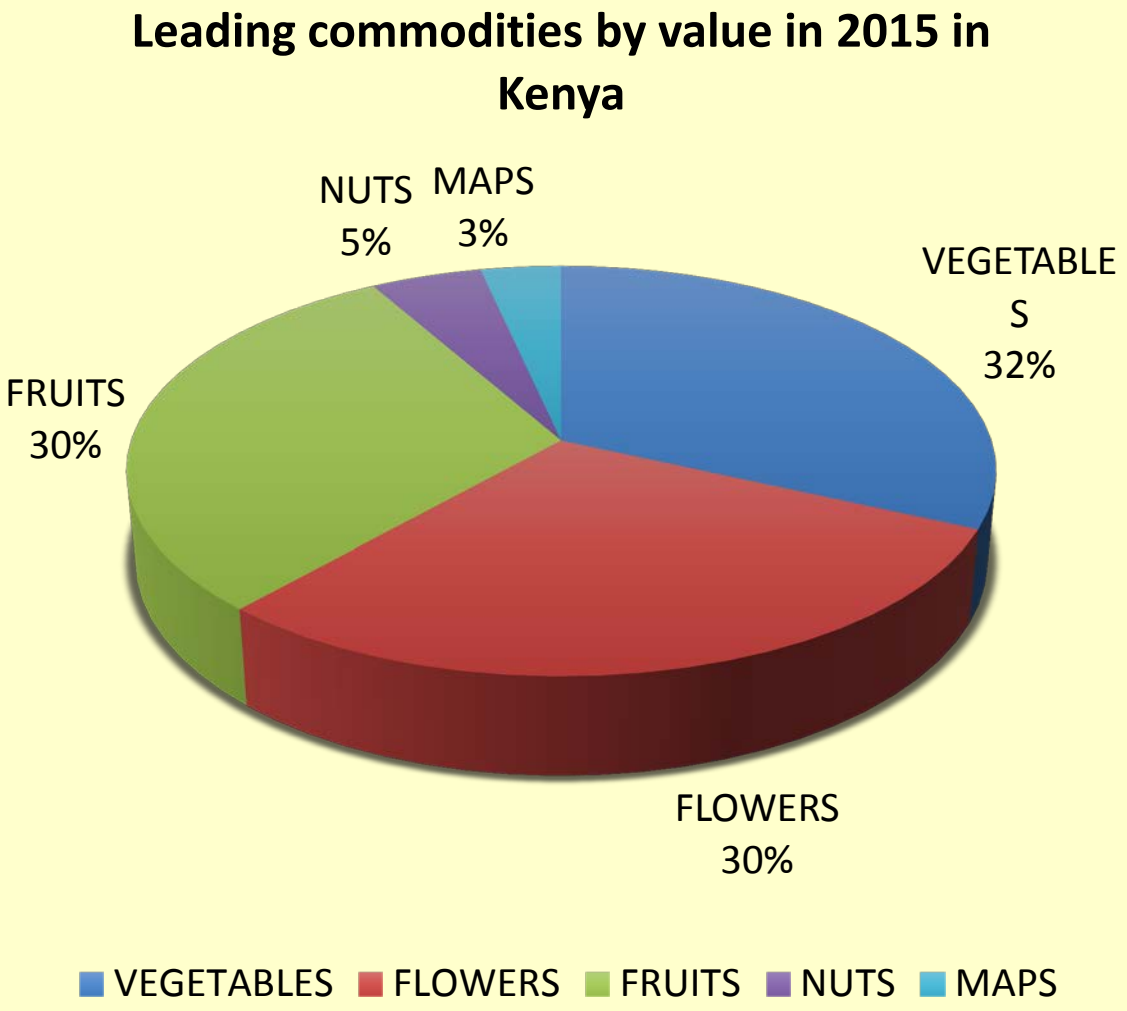
Understanding the relevance of the IESTI equations to minor crops: A developing country perspective

Lucy Namu

KENYA

Importance of minor / specialty crops

- Changing consumer demands → product diversification
- Minor / specialty crops grown by developing countries
  - High value / R.O.I percapita



Minor / specialty crops

Tropical Fruits (large)

Spices & Herbs

Tropical Fruits (small)

Fruiting / Legume veg.

Progress in CCPR(49) – Vegetable groups

- Group 09 Bulb vegetables,
- Group 012 Fruiting vegetables, other than cucurbits
- Group 18: Edible fungi
- Group 10: Brassica vegetables (except Brassica leafy vegetables)
- Group 13: Leafy vegetables
- Group 17: Stalk and stem vegetables
- Group 16: Roots and Tubers
- Group 15: Pulses
- Group 11: Fruiting vegetables, cucurbits
- Group 14: Legume vegetables

Others adopted

- Tropical and subtropical fruits (Edible / inedible peel)
  - Large
  - Medium
  - Small

Concerns

1. Limited MRLs on minor / specialty crops
2. IESTI equations used, however different parameters used (residues, variability factors, unit weights, large portions); hence different outcomes

Initial Proposals:

- Replaces data in current (HR and STMR) with MRL as exposure
- Vf = 3, introduce new CF to use with MRL
- Projects use of LPbw data not yet available

Concerns…/2

- Some MRLs established earlier have RL whose short term dietary exposures > ARfD.
- **Careful** Examination of
  - Trade impact
  - Variability factor, blending / bulking

Using IESTI

$$IESTI = \frac{LP \times HR}{bw}$$

(or HR-P)

Case 1

- $U_{(RAC)} \leq 25g$

Case 3

- Bulked /blended

$$IESTI = \frac{LP \times STMR}{bw}$$

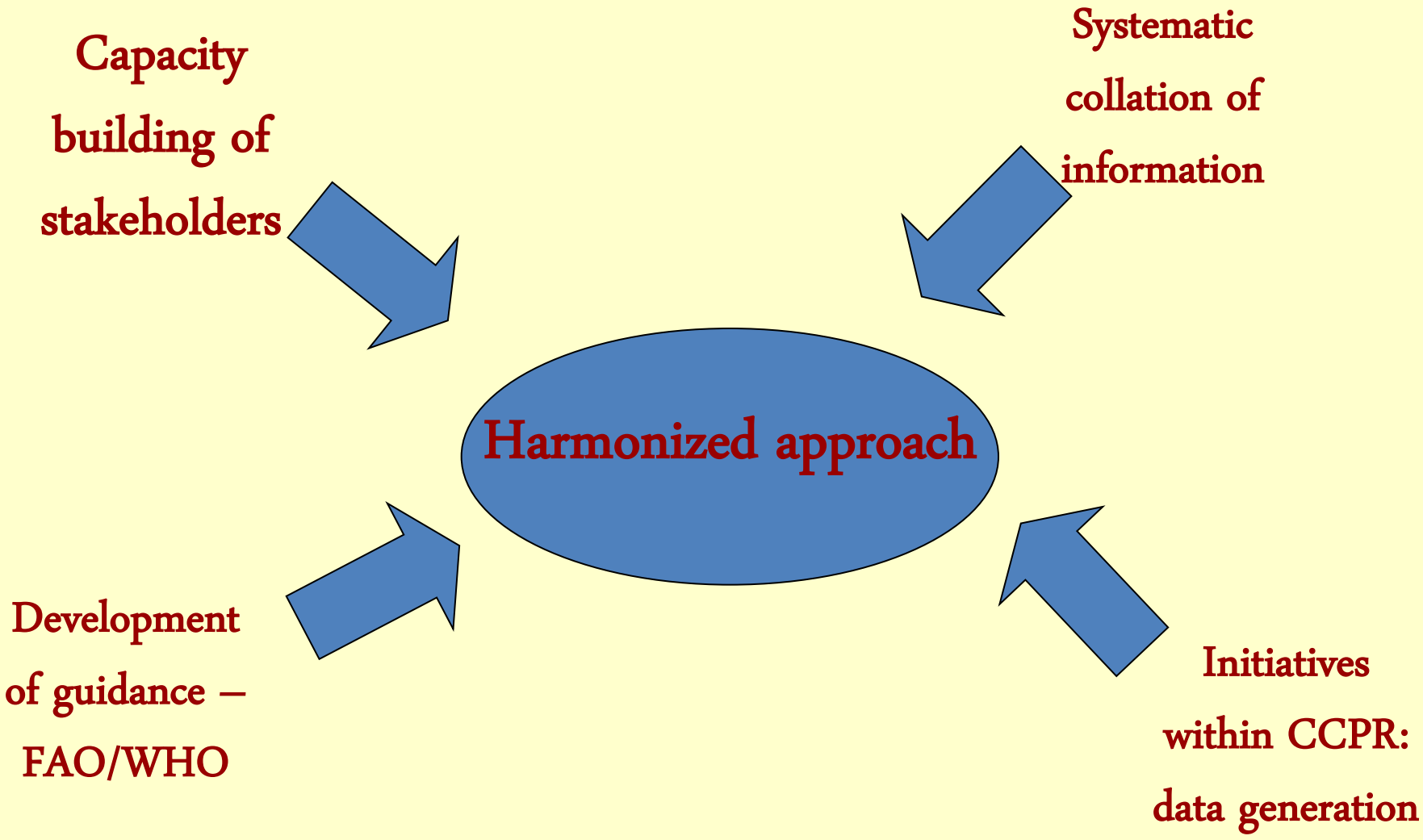
(or STMR-P)

Ongoing initiatives

- The TDS methodology is useful to assess dietary exposure to chemical contaminants.
  - Benin, Cameroon, Mali, Nigeria (STDF/PG/303)
  - Project still underway, pilot in region

- Regional harmonization in EAC

Tools that aid review




Thank you for your
kind attention

IESTI Perspectives

October 2017

Cheryl Cleveland, Ph.D.
via CropLife International






Cheryl B. Cleveland, Ph.D.

- Global Consumer Safety
  - 4 years at BASF
  - 27 years in industry
- Chair of CLA Dietary Assessment Work Group
- CARES NG Technical Working Group
- CLI focal point for CCPR IESTI eWG

Outline of talk

MRL and IESTI

Basics of Dietary Risk Assessment

Benchmarking

MRL= Maximum legal limit of a residue
(US Tolerance, CODEX CXL)

What it is

From residue studies of maximized use pattern to set upper bound for local enforcement of GAP using **OECD calculator**

Upper bound to check compliance with labeled use

Set in context of acceptable dietary risk/safety assessment

Conservative Screening exposure input in dietary safety assessment

What it is not

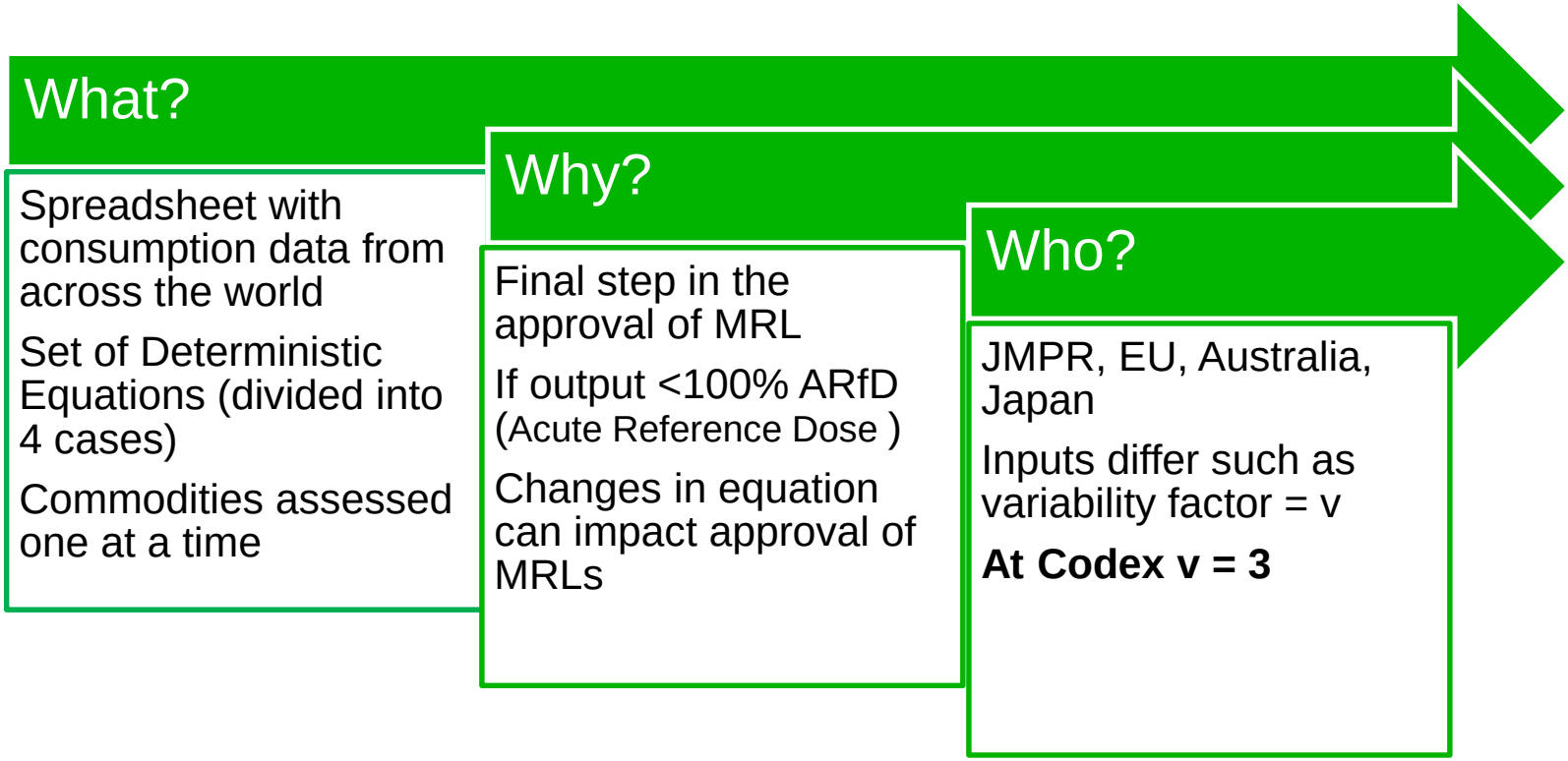
Stand alone value, divorced from supporting data.

An inherent property of active ingredient, it is dependent on use.

Stand-alone health standard; it is not a safety threshold.

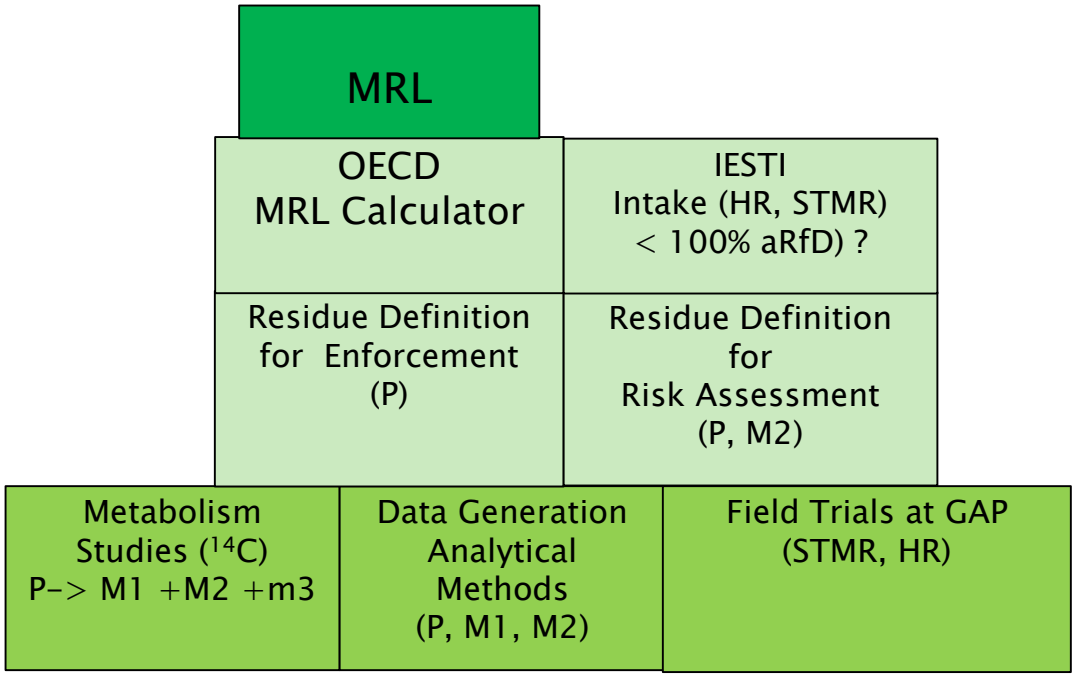
Realistic measure of typical exposure

IESTI – International Estimate of Short Term Intake

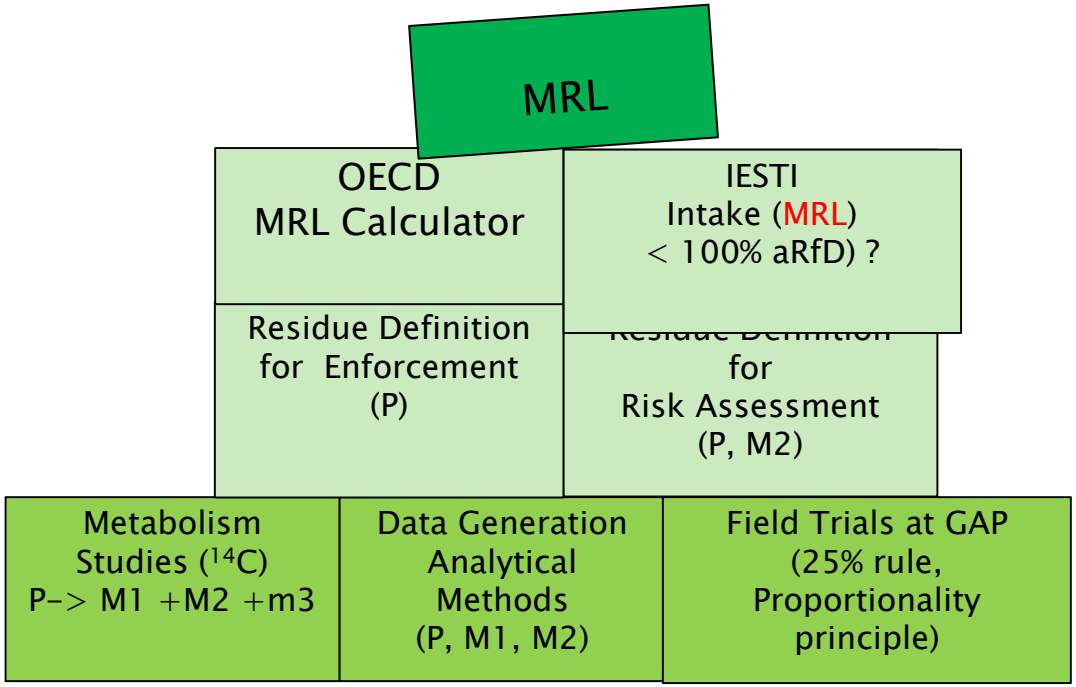


Used in acute risk assessments – 70% of newer AIs get an ARfD

Foundations of an MRL



Proposed Change for Future MRL



What is the IESTI Issue?

Many concerned that proposed change to the IESTI equation may lead to a loss of CODEX MRLs without international justification.

There is also concern the proposal leads to inflated dietary estimates for all commodities at international level.

IESTI Equations:
Proposal from EFSA / WHO workshop, 2015

Dietary exposure = consumption X residues

Case	
1	 U_{Rac} < 0.025 kg *including meat, eggs*
2a	 U_{Rac} > 0.025 kg **Single Units**
2b	
3	 **Blended and Bulked**

The proposal . . .

- Replaces all field data (HR and STMR) with MRL as exposure
- Keeps variability factor 3, but applies it to the MRL
- Removes unit weight from Case 2a
- Introduces new CF in order to use MRL
- Projects use of LP_{bw} data not yet available

IESTI Equations:
Proposal from EFSA / WHO workshop, 2015

Dietary exposure = consumption X residues

Case	Current IESTI (mg/kg bw)	*Proposed IESTI (mg/kg bw)*
1	$\frac{(LP \times (HR \text{ or } HR-P))}{bw}$	$LP_{bw} \times MRL \times CF \times PF$
2a	$\frac{((Ue \times (HR \text{ or } HR-P) \times v + (LP-Ue) \times (HR \text{ or } HR-P))}{bw}$	$LP_{bw} \times MRL \times v \times CF \times PF$
2b	$\frac{((LP \times (HR \text{ or } HR-P) \times v))}{bw}$	$LP_{bw} \times MRL \times v \times CF \times PF$
3	$\frac{(LP * STMR-P)}{bw}$	$LP_{bw} \times MRL \times CF \times PF$

The proposal . . .

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Case	Current IESTI (mg/kg bw)	*Proposed IESTI (mg/kg bw)*
1	$\frac{(LP \times (HR \text{ or } HR-P))}{bw}$	$LP_{bw} \times MRL \times CF \times PF$
2a	$\frac{((Ue \times (HR \text{ or } HR-P) \times v) + (LP-Ue) \times (HR \text{ or } HR-P))}{bw}$	$LP_{bw} \times MRL \times v \times CF \times PF$
2b	$\frac{((LP \times (HR \text{ or } HR-P) \times v))}{bw}$	$LP_{bw} \times MRL \times v \times CF \times PF$
3	$\frac{(LP * STMR-P)}{bw}$	$LP_{bw} \times MRL \times CF \times PF$

The proposal . . .

- Replaces all field data (HR and STMR) with MRL as exposure
- Keeps variability factor v= 3, but applies it to the MRL
- Removes unit weight from Case 2a
- Introduces new CF in order to use MRL
- Projects use of LP_{bw} data not yet available

IESTI Equations:
Proposal from EFSA / WHO workshop, 2015

Dietary exposure = consumption X residues

Case	Current IESTI (mg/kg bw)	Proposed IESTI (mg/kg bw)
1	$\frac{(\text{LPx (HR or HR−P))}}{\text{bw}}$	$LP_{bw} \times MRL \times CF \times PF$
2a	$\frac{((\text{Ue x (HR or HR−P)x v+ (LP−Ue) x (HR or HR−P))}}{\text{bw}}$	$LP_{bw} \times MRL \times v \times CF \times PF$
2b	$\frac{((\text{LP x (HR or HR−P) x v))}}{\text{bw}}$	$LP_{bw} \times MRL \times v \times CF \times PF$
3	$\frac{(\text{LP} * \text{STMR−P})}{\text{bw}}$	$LP_{bw} \times MRL \times CF \times PF$

The proposal . . .

- Replaces all field data (HR and STMR) with MRL as exposure
- Keeps variability factor 3, but applies it to the MRL
- Removes unit weight from Case 2a
- Introduces new CF in order to use MRL
- Projects use of LP_{bw} data not yet available

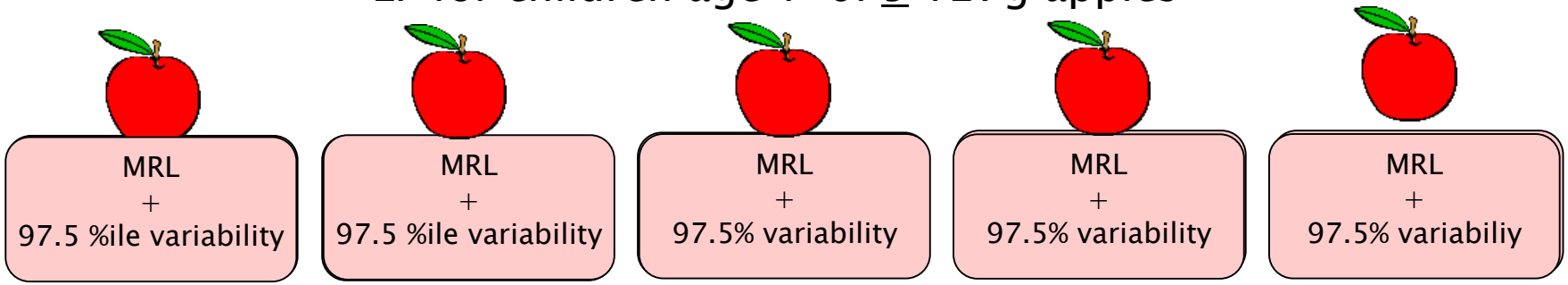
The Variability Factor

Is V=3 appropriate when used with the MRL?

Case 2a – apples and oranges

IESTI = MRL x V x LP

LP for children age 1-6: 5 127g apples



In the proposed IESTI equation EACH apple in the large portion consumption has BOTH an MRL-level residue AND p-97.5 level unit variability.

Smaller case 2a commodities like apricots, kiwi, fig, garlic, carrot, mandarin are even more affected by this compounded conservatism.

➔ **The variability factor is SIGNIFICANTLY over conservative for case 2a commodities**

Preliminary impact assessment - Revision of the IESTI equation

Case	Crops / commodities	Increase of Calculated exposure
1	 **Meal portion < 0.025 kg** *including meat, eggs*	1.7X
2a	 **Meal portion > 0.025 kg** Ue<LP *Use of 3 x MRL for all food*	3.5X
2b	 Ue>LP	2.3X
3	 **Bulked and blended**	5.2X

- **Prior to change: Investigations on the use of variability factor recommended**
- **Prior to revision: Investigations on blending procedures recommended**

Conversion Factors

To account for difference in residue definition between MRL for enforcement and risk assessment residue definition

- MRL is the marker for use (and any misuse) for compliance
- Definition for risk assessment may contain additional metabolites (based on metabolism and field data)
  - Currently field data on measured metabolites are added into exposure
  - Proposal projected to add in a conservative worst case CF from metabolism regardless of appearance

➔ **A survey of Codex residue definitions reveals that 20% of commodities have differing residue definitions for enforcement and risk assessment**

Part 2

Basics of Dietary Risk Assessment

Risk assessment – General principle

Hazard + Exposure ≠> Risk

<<<

=> **High!**

>>>

=> **Low!**

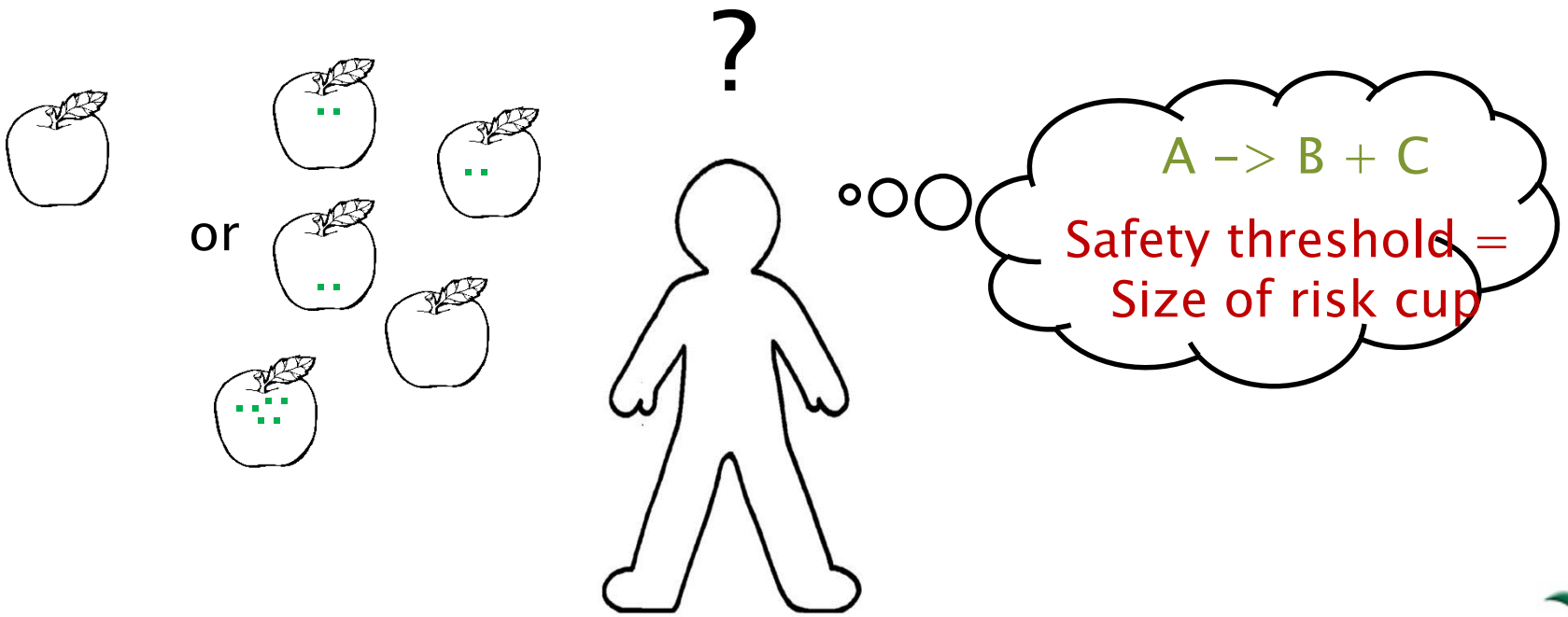
The risk to any hazard is a function of the exposure!
Exposure to plant protection product residues is estimated via IESTI equation

Dietary Risk Assessment for Pesticides

Risk = f (Exposure, Hazard->safety threshold)

Exposure = Consumption X Residue in Food

Hazard = f(Toxicological Endpoint, Residue Definition)

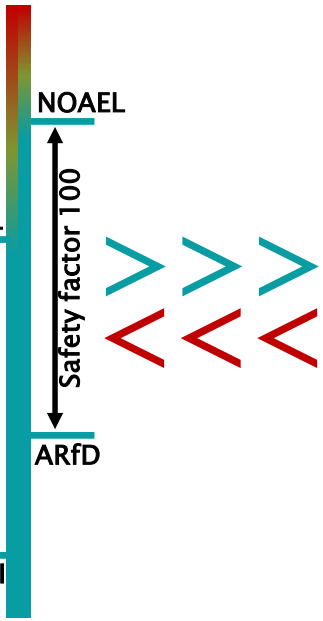


Risk assessment – Plant protection residues

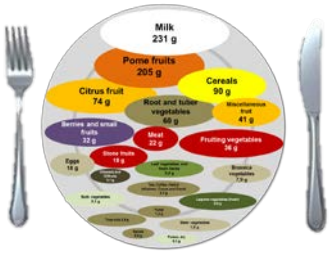
Hazard + **Exposure** => **Risk?**

ADI
Acceptable daily intake

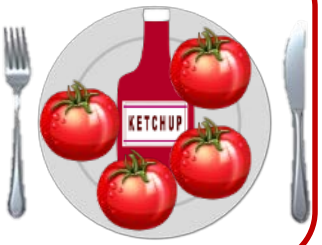
ARfD
Acute reference dose



IEDI
International estimated daily intake



IESTI
International estimated short-term intake



Low?
High?

What do we know about Dietary Exposure?

- The MRL is not a good measure of ACTUAL dietary exposure because . . .
  - *not all commodities are treated at the critical GAP and a variety of timings and actives are used*
  - *residue levels decline significantly between harvest and transportation to consumers*
  - *reduction of residues typically occurs in household preparation, cooking or industrial processing*
- Most global dietary models use field data (HR/STMR) - initial refinement in dietary exposure
- Dietary Monitoring data allows a *reality check* on models

Overview – Exposure Components and Acute Dietary Model OPTIONS

Level	Consumption	Residue Estimates	Model
Unrefined Less Resources	• Food Balance Sheets	• MRL and 100% Crop Treated	• Deterministic (single values) • Single foods assessments
Intermediate	• House Hold Surveys • Recipes for RACs	• Field Trial (HR and STMR) • *Worst Case Variability for HR* • AI-specific processing	• Probabilistic consumption with deterministic residue estimates
Refined Data intensive	• Individual Diet Surveys • Recipes for RACs and processed products	• Percent Crop Treated • Dietary Monitoring Data • Washing and Cooking Factors • *Duplicate Dinner Plates*	• Probabilistic consumption with residue distributions for individual foods

Acute CODEX process

Level	Consumption WHO	Residue Estimates	Model IESTI
Unrefined Less Resources		• 100% Crop Treated	• Deterministic (single values) • Single foods assessments
Intermediate	• House Hold Surveys • Recipes for RACs	• Field Trial (HR and STMR) • *Variability for HR* • *vF = 3* • AI-specific processing	
Refined Data intensive	• Individual Diet Surveys (97.5th % of 14 separate countries) • Recipes for RACs and processed products	• Percent Crop Treated • Dietary Monitoring Data • Washing and Cooking Factors • *(Case by Case)*	

Acute US Processes (with Tiered Residue Estimates)

Level	Consumption WWEIA	Residue Tiered Estimates	Model DEEM FCID
Unrefined Less Resources		• MRL and 100% CT	
Intermediate		• Field Trial (HAFT and averages) • *Worst Case Variability for HR* • AI-specific processing	• Probabilistic consumption with deterministic residue estimates (95%th)
Refined Data intensive	• Individual Diet Surveys • Recipes for RACs and processed products	• Percent Crop Treated (BEAD) • Dietary Monitoring Data (USDA PDP) • Washing and Cooking Factors	• Probabilistic consumption with residue distributions for individual foods (99.9%th)

Outline of talk

Benchmarking

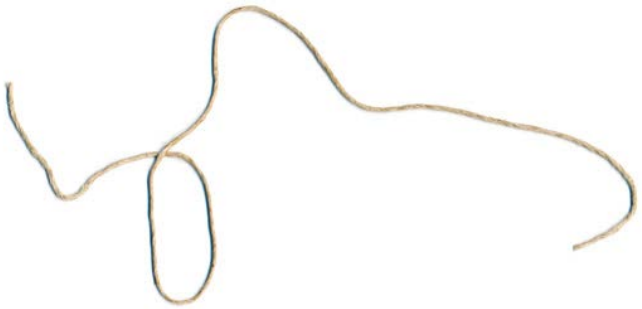
Why Benchmarking?

From Official 2017 Report REP17/PR of CCPR

The Committee agree to request FAO/WHO:

- To review the basis and the parameters of the IESTI equations;
- To benchmark the outcomes of IESTI equations to a probabilistic distribution of actual exposures; and
- To present the outcome to CCPR.

Why Benchmarking?



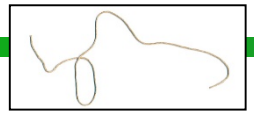
General IESTI and IEDI spreadsheets are valuable

- **enabled the adoption of many new Codex MRLs (CXL) each year**

Probabilistic Models envisioned as a calibration

- **aid for risk communication discussions,**
- **not replacement for routine assessments**

Dietary Risk Assessment Options



Deterministic

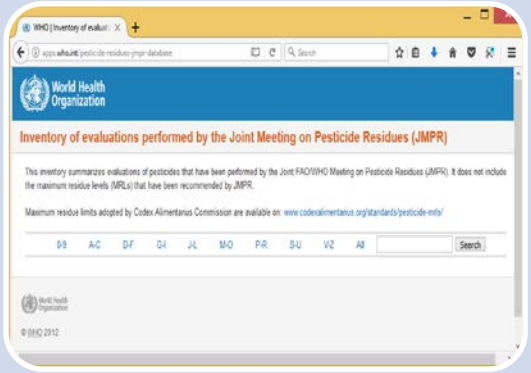
- Inputs are single value point estimates
  - Pesticide Residue in Food
  - Quantity of Food Consumed
- Risk estimate is single outcome
  - High end estimate
  - No context of variability
- Example: IESTI Spreadsheets

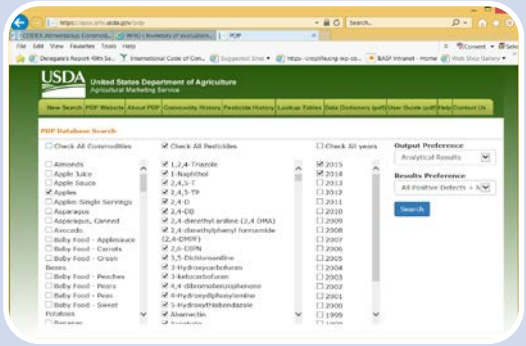
Probabilistic

- Takes distributions of input (residues and consumption patterns)
- Risk Estimates Outpu- distribution with probabilities assigned
  - Monte Carlo technique combines thousands of random samplings of input distributions to build final output exposure distribution
- Examples: CARES NG, US EPA DEEM

Apple Case Study for Benchmarking

Step 1: Active Ingredient Selection





CODEX MRL

- apple
- pome

ARfD

- **Children**
- General population

USDA PDP

- 2014-15
- >5% detects

Quote: California EPA Guidance on Dietary Risk Assessment March 2009

"When an **actual** measured residue value is needed for the exposure assessment, the **ideal residue data** set would be one with the pesticide concentration measured in many samples (*e.g.*, **more than one hundred**) and different food forms, during the years which **reflect actual range** of weather and pest conditions and current use practices, from representative **samples collected at the consumer level**. In practice, the residue data from multiple sources are often used due to the inherent limitations in each data set. The following considerations can be used to select one value or one set of values. **Overall, the USDA PDP is the preferred source** because it is designed to provide pesticide residue data for dietary exposure assessment . . . ."

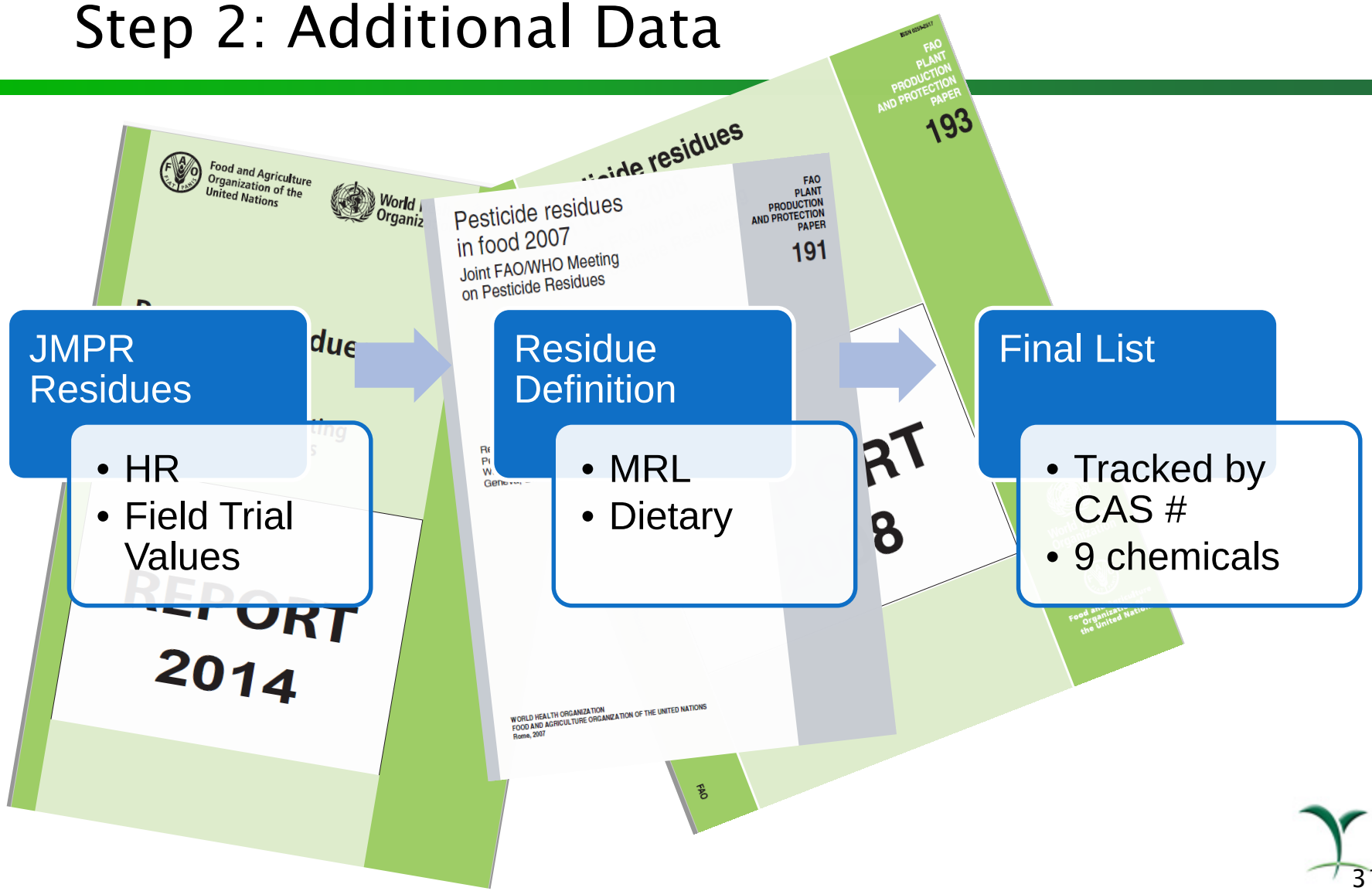
What is Dietary Monitoring?

Commodity	Sample Preparation Steps
Apples	Wash and drain. Do not peel. Remove the stem. Remove the core using a commercially available apple corer, or cut each apple in half or quarters and remove the core portion.
Bananas	If necessary, banana samples may be stored in a secure location at room temperature for up to 72 hours for ripening purposes. Peel each fruit.
Blueberries, Cultivated	Wash by the handful or by using a colander and drain.
Broccoli	Visually examine and discard any damaged portion or wilted florets. Trim away inedible portions of stems. Wash and drain.
Carrots	If carrots have any visible dirt, hold each carrot under cold running tap water and gently scrub the entire surface with a clean vegetable brush to remove any loose soil and grit. Wash and drain. Remove stem cap portion from each carrot.
Celery	Using a clean, dry knife, remove the inedible portion of the stalk to allow stems to separate. Wash and drain.
Cherries	Remove the stem from each cherry. Wash and drain. Remove the pit, being careful to remove as little of the meat as possible.
Frozen Product: Blueberries, Cherries, Green Beans, Sweet Corn	The samples may be chopped while frozen, or to prevent damage to the chopper/homogenizer blades, the sample may be thawed in a refrigerator or in a room temperature water bath. Open the containers and pour the entire contents into the chopper/homogenizer.

- From 2014 USDA PDP annual report

Apple Case Study for Benchmarking

Step 2: Additional Data



JMPR Residues

- HR
- Field Trial Values

Residue Definition

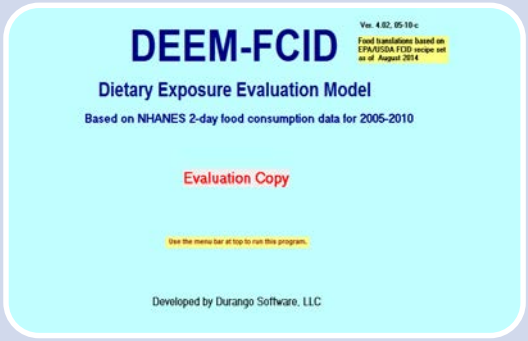
- MRL
- Dietary

Final List

- Tracked by CAS #
- 9 chemicals

Apple Case Study for Benchmarking

Step 3: Run Calculations



Deterministic

- IESTI
  - Current HR
  - Proposed MRL
  - 97.5th consumption

Quasi-Probabilistic

- MRL
- Consumption distribution

Probabilistic

- Field Distribution
- Monitoring Distribution

Probabilistic Models Used

- Dietary Exposure Evaluation Model (**DEEM-FCID**) is current US EPA model estimates dietary exposures arising from the use pesticides.
  - **Publicly available** for download since June 2012
- The Cumulative and Aggregate Risk Evaluation System - Next Generation (**CARES NG**) software updated but similar approach to calculate dietary exposures.
  - Cloud based with web interface; **public release** planned in late 2017
- Both use National Health and Nutrition Examination Survey/"What We Eat in America" (**NHANES/WWEIA**) survey to derive the consumption part of the exposure estimation.

Apple Case Study: Short Term Intakes (ug/kg bw/day)

Active Ingredient	IESTI Deterministic	IESTI Deterministic	Quasi Probabilistic	Probabilistic	Probabilistic
	Current	*Proposed*	*Acute w/MRL* 97.5th %ile User Only	*Field Trial Data* 95th %ile Per Capita	*PDP Data* 99.9th %ile Per Capita
A	**33.4**	**60** (+ 1.8x)	**13** (- 2.6x)	**1.7** (- 20.2x)	**1.3** (- 25.5x)
B	**50.9**	**225** (+ 4.4x)	**48.9** (- 1x)	**4.5** (- 11.3x)	**0.9** (- 54.4x)
C	**5.66**	**15** (+ 2.7x)	**3.3** (- 1.7x)	**0.6** (- 8.7x)	**0.2** (- 34.9x)
D	**13.6**	**22.5** (+ 1.7x)	**4.9** (- 2.8x)	**0.4** (- 30.8x)	**0.2** (- 69.7x)
E	**13.0**	**37** (+ 2.8x)	**8.1** (- 1.6x)	**0.7** (- 18.2x)	**0.2** (- 74.3x)
F	**413**	**750** (+ 1.8x)	**163** (- 2.5x)	**26** (- 15.9x)	**1.6** (- 256x)
G	**16.4**	**37.5** (+ 2.3x)	**8.2** (- 2x)	**1** (- 16.6x)	**0.6** (- 26.2x)
H	**113**	**225** (+ 2x)	**48.9** (- 2.3x)	**14.8** (- 7.6x)	**23.2** (- 4.9x)
J	**21.5**	**52.5** (+ 2.4x)	**11.4** (- 1.9x)	**1** (- 20.6x)	0.2 (- 128.7x)

Comparison with Current IESTI Intake (Fold Increase+/Decrease–)

All Case Study Benchmarks are not yet reflecting Probability of Percent Crop Treated – a more formal study will need to consider this aspect

(ug/kg bw/day)

Ing.			Probabilistic	Probabilistic	Probabilistic
			Acute w/MR 97.5th %ile User Only	*Field Trial Data* %ile Per Capita	*PDP Data* 99.9th %ile Per Capita
A	**33.4**	**60** (+ 1.8x)	**13** (- 2.6x)	**1.7** (- 20.2x)	**1.3** (- 25.5x)
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Comparison with Current IESTI Intake (Fold Increase+/Decrease–)

My Learnings from Case Study

- Case Studies are labor intensive!
- A public Codex Database of final residues used to established MRLs could be useful
- Current IESTI consumption for children populations age groupings are inconsistent and summed commodities open to country interpretations
- Difficult to depict overview in a single chart between deterministic and probabilistic outcomes.
- The current IESTI tool is considerably more conservative than EPA's P99.9 (or P95) criteria for MRLs (Chemical-Crop combinations)

Considerations for Benchmarking

- Dietary Benchmarking should be distinct from risk assessment.
  - Probabilistic sampling of worst case field data is not fully benchmarking.
- In risk assessment when you are missing data, you default to a conservative assumption
  - in benchmarking how do you ensure realistic assumptions?
  - Will incomplete data sets be rejected?

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Benchmarking Questions?

- Monitoring data as close to the consumer level as possible provides most refined assessment
  - Are worst case GAP field trials useful?
  - How will monitoring data gathered from various countries be QAed?
- Percent Crop Treated is an important refinement
  - how will global market share data be used?
- Exposure Percentiles for comparison?
  - Need discussion of Level of Protection
    - What are agreed %tiles for exposure?

Final Thoughts

- **Proposed changes to IESTI lead to larger projected dietary intakes, which could prevent the approval of some MRLs unnecessarily.**
- Risk communication is not solved by promotion of the MRL from a trading standard to a health standard.
- Details of the FAO workgroup procedures for the benchmarking exercise should be transparent to all.
- The quality of the new FAO technical group benchmarking exercise will depend on the quality of the food consumption info and the dietary exposure data used.
- 2017 CCPR IESTI eWG needs renewed participation to: a) address technical challenges to proposed equation and b) thoughtfully and globally consider protection goals related to benchmarking.

Acknowledgements

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US EPA provided consultation on content – Benchmarking exercise reflects EPA tiered approaches for dietary risk assessment

Web References

- IESTI spreadsheet Version 16, August 2017: http://www.who.int/foodsafety/areas_work/chemical-risks/gems-food/en/
- WHO IESTI Guidance: http://www.who.int/foodsafety/areas_work/chemical-risks/Guidance_IESTI_2014.pdf?ua=1
- USDA PDP Monitoring Data: https://www.ams.usda.gov/datasets/pdp
- CARES NG: http://caresng.org/
- CODEX MRL Pesticide Data Base: http://www.fao.org/fao-who-codexalimentarius/standards/pestres/pesticides/en/
- JMPR Acute Reference Doses: http://apps.who.int/pesticide-residues-jmpr-database


Thank
you

Quotes from Final eWG IESTI Discussion Document

- *Any change to the IESTI equations needs careful consideration and deliberation. It is clear from the complexity of the issue, from the comments of delegations at CCPR 2016 and the variety of viewpoints expressed by the current eWG that the discussion on a* ***possible revision of the IESTI equations will require continuous work over several years.***
- *. . . based on preliminary assessments the implementation of all recommendations made by the 2015 Geneva workshop could lead to a loss of Codex MRLs. The actual number of Codex MRLs that may be lost if the recommendations from the Geneva Workshop are implemented is unknown and* ***simple counts of MRLs that may be lost do not necessarily appropriately reflect the trade value****. . .*
- *Although the level of conservativeness of the current IESTI is not clearly defined, it is well accepted world-wide. Therefore, it* ***is proposed that changes to the IESTI should not lead to substantial changes in the level of conservativeness.***
- *FAO/WHO technical working group should be requested to develop a suitable approach to quantify the differences between the current and proposed IESTI, e.g. to* ***benchmark the outcome of the current and the newly proposed IESTI to a suitable probabilistic distribution of actual exposures***