Version 4: 01-23-2017

Pesticide Risk Tool Policy on Indicator Structure

Goal: To design the most credible and effective method of conveying pesticide risk information to users.

General policies:

1. A risk score taking into account exposure levels is preferable to a hazard score based only on pesticide toxicity. Pesticides may be inherently hazardous but be used in ways that result in minimal or no exposure, hence substantially decreasing their risk. This means that, a priori, risk scores will use information such as: a. pesticide application rates b. formulation and methods of application c. 'Use Pattern Adjustment Factors' – factors that modify the inherent toxic risk of an application by impacting exposure potential. These are determined empirically or through expert consultation; e.g. How much does the risk to various biota differ between foliar, ground and subsurface applications of the same product applied at the same rate.

2. Scores must be able to take into account the non-linearity of risk. For example, gains at the low end of the risk curve (e.g. halving the probability of bird mortality from 2% to 1%) may represent a trivial improvement in environmental performance compared to equivalent reductions at higher risk levels (e.g. reducing the probability of mortality from 80% to 40%).

3. Continuous scores are better than risk classes to avoid early loss of information.

4. Risk indicators will be one of three types, depending on the availability of information:

a. Empirically-based indicators that rely on actual field impact data. Provided the field record is adequate to support application of a verified, predictive exposure and impact model, this removes much of the arbitrary nature of indicators and offers greater clarity on risk management options. This is considered the 'gold standard' of indicators.

b. Indicators based on a reasonable theoretical construct but 'benchmarked' against specific incidents (e.g. the fish kill record) or against well studied pesticides. Here, the field data are insufficient to support application of a standalone predictive model, but can help define risk levels for various scores.

c. Indicators that rely entirely on risk quotients (typically expressions that relate projected exposure to predicted, single endpoint toxicity) without the possibility of validating the results or considering other endpoints (e.g. the bulk of human safety assessments, most assessments of reproductive and chronic toxicity etc).

5. While index scores may vary, all indices score shall be categorized into high, moderate and low risk. This will serve users to compare pesticides products for potential impacts and to highlight what pesticide applications require actions to mitigate.

6. Although some users may prefer a composite score, aggregating risk scores across all indices, this method of reporting has the potential to mask risk to individual indices, possibly leading to inappropriate actions with the potential for serious economic or toxicological costs. Take, for example, the case illustrated in the table below. If we set the risk thresholds at 0-10=low risk, 11-50=moderate

risk, and 51-100=high risk, adding up the scores from each index would give us the following composite scores.

	Index Scores										Composite Score
Pesticide A	10	10	10	10	10	10	10	10	10	10	100
Pesticide B	5	5	5	5	5	10	10	10	10	30	95
Pesticide C	1	2	2	5	5	5	5	5	30	30	90
Pesticide D	2	2	2	2	2	2	2	3	5	60	85

In this example, Pesticide A received the highest score despite the fact that it is the only application where all individual scores are in the low risk category. For each successive application, the risk goes up, yet the composite score goes down. These misleading scores are the result of decreasing scores in the low risk category. The threshold between low and moderate risk is considered to be a de minimus threshold, the point at which unacceptable risk begins. Decreases within the low risk category are essentially meaningless, yet they result in a lowering of the composite score.

7. Other methods under consideration are to drop low risk values from the composite score, only adding up moderate or high risk scores, or to simply report the number of indices falling into each risk category. Due to the potential for masking possibly worrisome changes in individual risk indices through a composite score, the project team has agreed that any composite score should be reported and used only in conjunction with individual index scores, and that furthermore, a method must be developed to flag, or highlight, significant increases in the scores of individual indices, regardless of whether the composite score goes up, falls, or remains unchanged. Due to the difficultly of this task, the project team has postponed development of a method for providing a composite risk score. The project team will instead focus on the development of individual indices but remains open to exploring methods for responsibly aggregating risk scores across indices.

8. The current plan for displaying risk information is as follows. The tool will display a summary of how many indices fall within each risk category (low, moderate, high). This risk summary will give the user a quick comparison of evaluated options (Figure 1). A more detailed display shows risk calculations for each index individually (Figure 2). Finally, the tool will display a list of resources at risk along with pathways of exposure to guide the user’s mitigation strategies (Figure 3).