APPENDIX E. ASSESSING TERRESTRIAL INVERTEBRATE EXPOSURE TO PESTICIDES

In addition to the normal uncertainties associated with using one surrogate species to represent all members within its taxa (*e.g.*, using a rat to represent 'mammals'), here are some things to consider when using, or considering to use, T-REX and bee contact studies to estimate exposure to terrestrial invertebrates – **CAUTION:** This is ***NOT*** an exhaustive list.

Is contact expected to be the most sensitive route of exposure (*e.g.*, if the most toxic route of exposure is through ingestion, what can a bee contact study tell you? Are more appropriate data, *e.g.*, dietary data, available from ECOTOX)?

Is the chemical expected to be equally toxic to all insect life stages (*e.g.*, if the chemical affects molting, larvae may be particularly sensitive to it, while adults may not be affected by the chemical at all).

Is there some specific reason(s) – based on its mode of action or available data - to suspect that some insect taxa may be more sensitive to a chemical than bees?

Is the toxicity from a dab of the chemical on the thorax of a bee representative of the toxicity due to a more uniform distribution of the chemical over the exposed parts of the entire insect?

And related to this, how representative is a bee to insects with large surface areas per volume (*e.g.*, butterflies and moths)?

Method to estimate terrestrial insect exposure:

For terrestrial invertebrates, normally the only submitted data we have are LD_{50} values for honeybees based on acute contact (a dab of the chemical on the thorax of a honeybee); sometimes we have LD_{50} values from an oral dose of the chemical. Occasionally we may have open literature (ECOTOX) data for dietary exposure, *etc*., for different insect species.

One potential way to estimate exposure (modified from methods originally in Metolachlor salmonid assessment) is:

1) Estimate residue concentrations on fruits/seeds/pods/large insects using T-REX (version 1.2.3) for the particular use(s) being assessed (the EEC values are reported in 'ppm', which is equal to 'µg a.i./g of insect'). The EEC for fruits/seeds/pods/**large insects** should be from one of the non-body-weight-adjusted tables, that is, from a "dietary"-based table in TREX output. To bound the risk, use the broadleaf plant/small insect EEC from a dietary table. The resulting RQ should be approximately 9 times as high, assuming the same body weight and LD50 data.

If no other toxicity data are available for insects, use honey bees as a surrogate for terrestrial insects; otherwise use most sensitive terrestrial insect.

Estimate the residue for a bee (µg a.i./bee) using an adult honey bee weight of 0.128 g (i.e., multiply the EEC for seeds and pods in T-REX by ‘0.128'). Which equals the exposure in µg a.i./bee.

If toxicity data are available from more sensitive non-bee insect species, use the weight for an individual of that species (in grams) as the multiplier.

Another way to think about it:

> Based upon an average fresh weight per honey bee of 128 milligrams, the LD_{50} of honey bees (:g/bee) can be multiplied by 7.8 to determine the ppm toxicity. (Mayer, D. & C. Johansen. 1990. *Pollinator Protection: A Bee & Pesticide Handbook*.Wicwas Press. Cheshire, Conn. p. 161)
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> µg/g = ppm
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> µg/bee = µg/128 mg = µg/0.128 g = 7.8 µg/g = 7.8 ppm
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> To convert ppm to µg/bee, the ppm value would be divided by 7.8.