Greenpeace's system for evaluating pesticide residues

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Pesticide residues in food are evaluated by Greenpeace on a comprehensive toxicological basis upholding the precautionary principle. Greenpeace's assessments are thus at the same time independent of legal maximum amounts, which have changed greatly and often been inadequate in the last few years[i]. A division is made into a three-way 'traffic light' system which non-specialists will find easy to understand. The assessment system takes the following aspects into account.

- Children's special sensitivity to chronically toxic pesticidal substances using the Acceptable Daily Intake (ADI)[ii] as a basis, with account taken of higher than standard amounts consumed. This is tantamount to an additional safety factor.
- Children's special sensitivity to acutely toxic pesticidal substances using as the Acute Reference Dose (ARfD)[iii] as a basis, with account taken of the standard amounts consumed for children aged between two and under five years old recommended by the German federal institute for risk assessment (BfR).
- Contamination by several pesticides in a sample and possible additive (cocktail) effects.
- Current legal maximum amounts being exceeded while keeping to good agricultural practice.

Assessed green

Detectable residues are below 0.01 mg/kg (meaning as a rule that no pesticide residues can be detected). Food assessed green as a rule meets the EU's requirements for pesticide residues in the production of baby food and guidelines that are normal for organic farming.

Assessed yellow

Pesticide residues detectable in concentrations equal to or over 0.01 mg/kg and below the concentrations when assessed as being in the red category.

Assessed red

A product is evaluated with red if it fulfils one of the four criteria below.

1. Chronic toxicity

The yardsticks for evaluating chronic toxicity are the ADI figures laid down by the BfR[iv] for individual pesticidal substances (if they are not laid down by the BfR, then the ADI figures laid down by other international institutions - the EU, WHO or FAO, in that order).

The daily intake in Greenpeace's assessment approach is not that for an adult weighing 60 kilogrammes but for the body of a child weighing 13.5 kilogrammes.

The resultant acceptable daily consumption (ADC) for a product should be at least 500 grammes[v]. This amount has been set high so as to incorporate a safety factor taking into account children's higher sensitivity and, in part at least, the presence of substances which are not detected in the laboratory but may nonetheless be ingested and broken down in the body. ADI figures are moreover not standardised at all, sometimes varying considerably depending on the source. This variation should – at least in part – be taken into account by assuming a high amount for consumption.

A product is assessed as 'red' if:

The ADC based on the ADI is below 0.5 kg (body weight per day) for a child weighing 13.5 kilogramme. ADC (body weight per day) = ADI (mg/kg body weight per day) x 13.5 kg body weight residue concentration (mg/kg).

2. Acute toxicity

The yardsticks used for evaluating acute toxicity are the Acute Reference Doses (ARfD[vi]) laid down by the BfR for individual pesticidal substances (if not laid down by the BfR, the ARfD figures laid down by other international institutions - the EU, WHO or FAO, in that order).

Assessment of the acute toxicity of pesticide residues is based on the concentration of the residues found, their acute toxicity (ARfD) and normal amounts consumed (short-term) for an age group of children between two and under five weighing 16.1 kilogrammes. These specific amounts for consumption have been published by the BfR. The pesticide intake is calculated with the methods recommended by the BfR and compared with the permitted limits.

Banasiak et al. (2005) invoke three formulae for calculating short-term amounts ingested. Since the food analysed by Greenpeace is in the main eaten raw, two formulae apply:

Pesticide intake = U x HR x v + (LP – U) x HR

Pesticide intake = LP x HR x v

- LP = short-term amount consumed, i.e. weight of portion stated as 97.5 percentile in kg of food per day using VELS data (BfR 2005)[1];
- HR = residue (concentration) detected in sample of a pesticidal substance in mg/kg.
- U = mass of edible part of a product (unit weight) in kg, Hüther et al (2004)[2]
- v = variability factor in BfR / Banasiak et al. (2005)[3], since a portion consumed could, depending on its size, have a higher residue than a mixed sample. Thus grapes on the outside of a bunch, for example, may be more contaminated with pesticide than those on the inside. Grapes hanging at the bottom of a vine may be more contaminated than those at the top. In a mixed sample the differences disappear, but a child eating 10 grapes from a single bunch is exposed differently.

Analytic fluctuations are not taken into account.

A detailed description of the method of calculation with examples is to be found in Greenpeace's publication *Einschätzung der acuten Toxizität von Pestizidrückständen in frischem Obst und Gemüse – Bericht II* (updated short report by Lars Neumeister on Greenpeace's behalf, Hamburg, 14 December 2005).

A sample is assessed with 'red' if the limit, the ARfD, is reached or exceeded by a pesticide residue in a sample.

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1 BfR (2005): *BfR entwickelt neues Verzehrsmodell für Kinder*, BfR Information no. 016/2005, 2 May 2005, Bundesinstitut für Risikobewertung, Berlin [BfR devises new consumption model for children]

2 L. Hüther, U. Prüße, K. Hohgardt (2004): *Mittlere Gewichte von Obst- und Gemüseerzeugnissen – deutsche Daten zur Abschätzung des von Pflanzenschutzmittelresiduesn in food ausgehenden möglichen acuten Risikos*. Gesunde Pflanzen 56:55–60 [mean weight of fruit and vegetable produce - German data on assessing pesticide residues in food assuming possible acute risk]

3 U. Banasiak, H. Heseker, C. Sieke, C. Sommerfeld, C. Vohmann (2005): *Abschätzung der Aufnahme von Pflanzenschutzmittel-residuesn in der Nahrung mit neuen Verzehrsmengen für Kinder* [estimate of intake of pesticide residues in food with new consumption amounts for children], Bundesgesundheitsblatt – Gesundheitsforschung - Gesundheitsschutz 2005 48:84–98, Springer Medizin Verlag

3. Reaching or exceeding Greenpeace's additive limit

The additive limit was introduced as a standard Greenpeace assessment because of the lack of legal limits for multiple contamination despite the EU's intention to introduce these. This model takes into account additive effects of different substances, but not synergistic (mutually reinforcing) or antagonistic (mutually weakening) effects. The additive limit is regarded as reached or exceeded if one of two criteria is met:

a) EU maximum amounts in force in EU are reached
This criterion is applied if a standard EU maximum amount[vii] for a substance has been laid down. In this way the licensing status of the substance is taken heed of. At the same time an evaluation avoids giving too much weight to substances whose maximum amounts are between 0.01 and 0.05 mg/kg on account of lack of harmonisation in the EU.

A calculation is made for each pesticidal substance of the percentage at which the EU maximum amounts in force are reached (e.g. with single measurement figure of 0.7 mg/kg and maximum amounts of 1.0 mg/kg: 70%). In the case of multiple residues these percentage figures are added together. If the total figure is equal to or over 100%, the additive limit is regarded as reached/exceeded.

(Concentration of substance 1 found divided by max amount for substance 1) + (concentration of substance 2 found divided by max amount for 2) + (concentration of substance n found divided by max amount for n) > 1

b) ADI
A calculation is made for each pesticidal substance of the percentage at which the figure for "chronic toxicity“ (see page 1) is reached. In the case of multiple residues these percentages are added together. If the total figure is equal to or over 100%, the additive limit is regarded as reached/exceeded.

4. Reaching or exceeding legal maximum amounts

When the maximum amount in force in Germany for a pesticidal substance is reached or exceeded.

[i] Greenpeace e.V.: *Pestizide am Limit*, Hamburg, 2004

[ii] The Acceptable Daily Intake is used here as a limit for exposure to a pesticide residue in food which is taken in over a long period of time. The world health and food organisations define it as the amount of a substance a consumer, when everything known is taken into account, can ingest daily and over a lifetime without appreciable risk to health. An ADI figure is laid down for each pesticide and stated in milligrammes per kilogramme (mg/kg) of body weight. (BfR / German Federal Institute for Risk Assessment, 2004)

[iii] The ADI is limited in its suitability for evaluating pesticidal substance which display a high toxicity and can have effects damaging to health when ingested just once or over a short period of time. As it is deduced from longer-term studies it may be inadequate in describing an acute danger from residues in food. As well as the ADI figure another exposure limit was therefore introduced in the mid 1990s, the so-called Acute Reference Dose (ARfD). The World Health Organisation defined the ARfD as that amount of a substance which can be ingested via food within a day or a meal without a recognisable risk to health for the consumer resulting. Unlike the ADI figure, an ARfD figure is laid down not for every pesticide but for such substances which in sufficient quantities are liable to damage health when exposed to just once. (BfR, 2004)

[iv] BfR: *Expositionsgrenzwerte für Rückstände von Pflanzenschutzmitteln in Lebensmittel*, BfR, 8 July 2004
http://www.bfr.bund.de/cm/218/expositionsgrenzwerte_fuer_rueckstaende_von_pflanzenschutzmitteln_in_food.pdf
http://www.bfr.bund.de/cm/218/pflanzenschutzmittel_wirkstoffe.pdf

[v] It is desirable that this figure be made a more stringent 1000g/d; this was already in use in the Billa and Global retail chains' pesticide reduction programmes in Austria in 2000.

[vi] The Acute Reference Dose is the estimated amount of a pesticidal substance (or another substance) which can normally be ingested during a meal or a day without meaning a recognisable risk to health for the consumer. The ARfD figure is given in mg of the substance per kg of body weight.
This is as stated in a footnote and elsewhere by the BfR (2004) in *Expositionsgrenzwerte für Rückstände von Pflanzenschutzmitteln in Lebensmitteln*, BfR, 8 July 2004, Berlin

[vii] Overview at http://www.eu.int/comm/food/plant/protection/index_en.htm