PRINCIPLES AND METHODS FOR THE RISK ASSESSMENT OF CHEMICALS IN FOOD

Glossary of terms

Main Sources:

- Environmental Health Criteria Documents:
  - No 70: Principles for the safety assessment of food additives and contaminants in food, WHO 1987
  - No 104: Principles for the toxicological assessment of pesticide residues in food
- Descriptions of selected key generic terms used in chemical hazard/risk assessment


Acceptable Enzyme preparations: Used to describe enzymes that are obtained from edible tissues of animals or plants commonly used as foods or are derived from microorganisms that are traditionally accepted as constituents of foods or are normally used in the preparation of foods. Such enzyme preparations are considered to be acceptable provided that satisfactory chemical and microbiological specifications can be established.

Flavouring agents: Used to describe flavouring agents that are of no safety concern at current levels of intake. If an ADI has been allocated to the agent, it is maintained unless otherwise indicated.

Food additives: Used on some occasions when present uses are not of toxicological concern or when intake is self-limiting for technological or organoleptic reasons.

Acceptable daily intake (ADI)
The ADI of a chemical is the estimate of the amount of a substance in food or drinking-water, expressed on a body-weight basis, that, on the basis of all the known facts at the time of the evaluation, can be ingested daily over a lifetime without appreciable health risk to the consumer. It is expressed in milligrams of the chemical per kilogram of body weight.

(standard adult person = 60 kg)
The ADI is applied to food additives, residues of pesticides and of veterinary drugs in food.

Acceptable daily intake (ADI) “not limited”
A term no longer used by JECFA that has the same meaning as ADI “not specified”.

Acceptable daily intake (ADI) “not specified” - food additives
A term applicable to a food substance of very low toxicity which, on the basis of the available data (chemical, biochemical, toxicological, and other), the total dietary intake of the substance arising from its use at the levels necessary to achieve the desired effect and from its acceptable background in food does not, in the opinion of JECFA, represent a hazard to health. For that reason, and for reasons stated in individual evaluations, the establishment of an acceptable daily intake expressed in numerical form is not deemed necessary. An additive meeting this criterion must be used within the bounds of good manufacturing practice, i.e., it should be technologically efficacious and should be used at the lowest level necessary to achieve this effect, it should not conceal inferior food quality or adulteration, and it should not create a nutritional imbalance.

Acceptable daily intake (ADI) “not specified”—veterinary drugs
Available data on the toxicity and intake of the veterinary drug indicate a large margin of safety for consumption of residues in food when the drug is used according to good practice in the use of veterinary drugs. For that reason, and for the reasons stated in the individual evaluation, the Committee has concluded that use of the veterinary drug does not represent a dietary hazard to human health and that there is no need to specify a numerical ADI.

Acceptable level of treatment
ADIs are expressed in terms of mg per kg of body weight per day. In certain cases, however, food additives are more appropriately limited by their levels of treatment. This situation occurs most frequently with flour treatment agents. It should be noted that the acceptable level of treatment is expressed as mg/kg of the commodity. This should not be confused with an ADI.

Acceptable risk
This is a risk management term. The acceptability of the risk depends on scientific data, social, economic, and political factors, and on the perceived benefits arising from exposure to an agent.

Acute exposure
A short-term exposure to a chemical, usually consisting of a single exposure or dose administered for a period of less than 24 hours.

Acute reference dose (ARfD)
The ARfD of a chemical is the estimate of the amount of a substance in food or drinking water, expressed on a body weight basis, that can be ingested in a period of 24 h or less, without appreciable health risk to the consumer on the basis of all the known facts at the time of evaluation. It is expressed in milligrams of the chemical per kilogram of body weight.

Adverse effect
Change in the morphology, physiology, growth, development, reproduction or life span of an organism, system, or (sub) population that results in an impairment of functional capacity, an impairment of the capacity to compensate for additional stress, or an increase in susceptibility to other influences.
Aggregate exposure
Aggregate exposure refers to the combined exposures to a single chemical across multiple routes (oral, dermal, inhalation) and across multiple pathways (food, drinking water, residential).

Analysis
Detailed examination of anything complex, made in order to understand its nature or to determine its essential features.

Assessment
Evaluation or appraisal of an analysis of facts and the inference of possible consequences concerning a particular object or process.

Assessment factor
Numerical adjustment used to extrapolate from experimentally determined (dose/response) relationships to estimate the agent exposure below which an adverse effect is not likely to occur.
Related terms: safety factor, uncertainty factor.

Benchmark dose (BMD)
A dose of a substance associated with a specified low incidence of risk, generally in the range of 1–10%, of a health effect; or the dose associated with a specified measure or change of a biological effect.

Biomarkers
Indicators of changes or events in human biological systems. Biomarkers of exposure refer to cellular, biochemical, or molecular measures that are obtained from biological media such as human tissues, cells, or fluids and are indicative of exposure to a substance. Biomarkers of effect refer to biological changes that represent an alteration in endogenous body constituents (e.g., depression of cholinesterase levels as an indicator of exposure to pesticides).

Budget method
A screening method used for estimating dietary exposure to a food additive that is based on default maximum consumption amounts of solid food and liquids based on physiological consumption limits and the maximum use levels of the additive.

Chemical concentration
The amount of one substance (e.g., mg of pesticide residue) contained in a given amount of another substance (e.g., kg of food).

Chronic exposure
A continuous or intermittent long-term contact between an agent and a target.
Related term: long-term exposure.

Codex Alimentarius Commission (CAC)
The Commission was formed in 1962 to implement the Joint FAO/WHO Food Standards Programme. The Commission is an intergovernmental body made up of more than 170 Member Nations, the delegates of whom represent their own countries. The Commission's work of harmonizing food standards is carried out through various committees, such as the Codex Committee on Food Additives (CCFA), the Codex Committee on Contaminants in
Food (CCCF), the Codex Committee on Veterinary Drug Residues in Food (CCRVDF), the
Codex Committee on Pesticide Residues. JECFA serves as the advisory body to the Codex
Alimentarius Commission on all scientific matters concerning food additives, food
contaminants, naturally occurring toxicants and on residues of veterinary drugs in food.
JMPR serves as the advisory body to the Codex Alimentarius Commission on all scientific
matters concerning pesticide residues.

Composite sample
Often prepared as a representative mixture of several different (usually bulk) samples, and
from which the laboratory sample is taken (IUPAC Compendium of Chemical Terminology;
second edition, 1997).

Concentration
Amount of a material or agent dissolved or contained in unit quantity in a given medium or
system.

Concentration–effect relationship
Relationship between the exposure, expressed in concentration, of a given organism, system
or (sub) population to an agent in a specific pattern during a given time and the magnitude of
a continuously-graded effect to that organism, system or (sub) population.
Related terms: dose-response relationship.

Conceptus
All products of conception derived from and including the fertilized ovum at any time during
pregnancy, including the embryo or fetus and embryonic membranes.

Conditional acceptable daily intake (ADI)
A term no longer used by JECFA to signify a range above the “unconditional ADI” which
may signify an acceptable intake when special problems, different patterns of dietary intake,
and special groups of the population that may require consideration are taken into account.

Confidence interval
A range of values which bracket a point estimate; e.g., there is a 95% probability that the true
value is contained in the 95% confidence interval. [AIHA, 2000: Risk Assessment Principles
for the Industrial Hygienist]

Conservative estimate of dietary exposure
A conservative estimate of dietary exposure is one that errs on the side of caution. It is
prepared by using the high end of a range of food chemical concentration levels and/or food
consumption (or alternately using a default maximum limit for the concentration in food).
When considering nutrient intakes, if exposure below a certain level is undesirable, a
conservative estimate of exposure would employ the low end of a range of concentration
levels and/or food consumption.

Consumer days
The summation over each member of a survey population of the number of days in which the
consumer of a food reported consuming the food of interest. For example, in a survey of 5
days length with a population of 1000, the theoretical maximum number of consumer days
would be 5000.
Consumption cluster diets
See GEMS/Food consumption cluster diets

Contaminant
Any substance not intentionally added to food, which is present in such food as a result of the production (including operations carried out in crop husbandry, animal husbandry, and veterinary medicine), manufacture, processing, preparation, treatment, packaging, transport or holding of such food or as a result of environmental contamination. The term does not include insect fragments, rodent hairs and other extraneous matter.

Cumulative exposure
The sum of exposures to two or more food chemicals that have a common mechanism of toxicity.

Developmental toxicity
Any adverse effects induced prior to attainment of adult life, including effects induced or manifested in the embryonic or fetal period and those induced or manifested postnatally (before sexual maturity).

Dietary exposure assessment
The qualitative and/or quantitative evaluation of the likely intake of chemicals (including nutrients) via food, beverages, drinking water, and food supplements. Related term: intake assessment.

Dietary record
See food record.

Dose
Total amount of an agent administered to, taken up, or absorbed by an organism, system or (sub)population.

Dose–effect relationship
Relationship between the total amount of an agent administered to, taken up or absorbed by an organism, system or (sub)population and the magnitude of a continuously-graded effect to that organism, system or (sub)population. Related terms: dose-response relationship, concentration-effect relationship.

Dose-related effect
Any effect to an organism, system or (sub) population as a result of the quantity of an agent administered to, taken up or absorbed by that organism, system or (sub) population.

Dose–response
Relationship between the amount of an agent administered to, taken up or absorbed by an organism, system or (sub) population and the change developed in that organism, system or (sub) population in reaction to the agent.

Dose–response assessment
Analysis of the relationship between the total amount of an agent administered to, taken up or absorbed by an organism, system or (sub)population and the changes developed in that organism, system or (sub)population in reaction to that agent, and inferences derived from
such an analysis with respect to the entire population. Dose-Response Assessment is the second of four steps in risk assessment.

**Dose–response curve**
Graphical presentation of a dose-response relationship.

**Dose–response relationship**
Relationship between the amount of an agent administered to, taken up or absorbed by an organism, system or (sub) population and the change developed in that organism, system or (sub) population in reaction to the agent.

Related term: dose-effect relationship.

**Duplicate diets**
A method for estimating dietary intakes that involves the preparation and analysis of identical portions of foods and beverages consumed by an individual.

**Effect**
A biological change in an organism, organ, or tissue. (EHC 70 and 104)

or

Change in the state or dynamics of an organism, system or (sub) population caused by the exposure to an agent. (IPCS/OECD terminology)

**Effect assessment**
Combination of analysis and inference of possible consequences of the exposure to a particular agent based on knowledge of the dose-effect relationship associated with that agent in a specific target organism, system or (sub) population.

**Elimination (in metabolism)**
The expelling of a substance or other material from the body (or a defined part thereof), usually by a process of extrusion or exclusion, but sometimes through metabolic transformation.

**Embry/o-fetotoxicity**
Any toxic effect on the conceptus resulting from prenatal exposure, including structural or functional abnormalities or postnatal manifestation of such effects.

**Embryonic period**
The period from conception to the end of major organogenesis. Generally, the organ systems are identifiable at the end of this period.

**End-point**
Qualitative/quantitative expression of a specific factor with which a risk may be associated as determined through an appropriate risk assessment.

**Enterohepatic circulation**
Intestinal reabsorption of material that has been excreted through the bile followed by transfer back to the liver, making it available for biliary excretion again.

**Error (gross, random, systematic)**
Any discrepancy between a computed, observed, or measured quantity and the true, specified, or theoretically correct value of that quantity. (1) Gross errors refer to unintentional/unpredictable errors while generating the analytical result. Errors of this type invalidate the measurement. It is not possible or desirable to statistically evaluate and include the gross errors in the estimation of uncertainty. (2) Random errors are present in all measurements, and cause replicate results to fall on either side of the mean value. The random error of a measurement cannot be compensated for, but increasing the number of observations and training of the analyst may reduce the effects. (3) Systematic errors are those resulting from some bias in the measurement process and are not due to chance. Systematic errors occur in most experiments, but their effects are quite different. The sum of all the systematic errors in an experiment is referred to as the bias.

**Essential nutrient**

Any substance normally consumed as a constituent of food which is needed for growth and development and the maintenance of healthy life and which cannot be synthesized in adequate amounts by the body.

(GENERAL PRINCIPLES FOR THE ADDITION OF ESSENTIAL NUTRIENTS TO FOODS, (CAC/GL 09-1987).

**Estimated acute intake (EAI)**

An estimate of the maximum intake of a veterinary drug residue during one meal or one day, which assumes that residues are present at the highest levels reported in residue trials, as occurring in injection sites.

**Estimated short-term intake (ESTI)**

An alternative term for EAI (see above) used by some authorities.

**Expert judgement**

Opinion of an authoritative person on a particular subject.

**Exposure**

Concentration or amount of a particular agent that reaches a target organism, system or (sub) population in a specific frequency for a defined duration.

**Exposure assessment**

Evaluation of the exposure of an organism, system or (sub) population to an agent (and its derivatives). Exposure Assessment is the third step in the process of Risk Assessment.

**Exposure scenario**

A set of conditions or assumptions about sources, exposure pathways, amount or concentrations of agent(s) involved, and exposed organism, system or (sub) population (i.e. numbers, characteristics, habits) used to aid in the evaluation and quantification of exposure(s) in a given situation.

**Extraneous maximum residue limit (EMRL)**

The EMRL refers to a pesticide residue or a contaminant arising from environmental sources (including former agricultural uses) other than the use of the pesticide or contaminant substance directly or indirectly on the commodity. It is the maximum concentration of a pesticide residue that is recommended by the Codex Alimentarius Commission to be legally
permitted or recognized as acceptable in or on a food, agricultural commodity or animal feed.
The concentration is expressed in milligrams of pesticide residue or contaminant per kilogram of the commodity. (CAC, 1993, amended 2001).

**Fetal period**
The period from the end of embryogenesis to the completion of pregnancy.

**Food**
In the Codex context means any substance, whether processed, semi-processed or raw, which is intended for human consumption, and includes drink, chewing gum and any substance which has been used in the manufacture, preparation or treatment of “food” but does not include cosmetics or tobacco or substances used only as drugs.

**Food additive**
In the Codex context means any substance not normally consumed as a food by itself and not normally used as a typical ingredient of the food, whether or not it has nutritive value, the intentional addition of which to food for a technological (including organoleptic) purpose in the manufacture, processing, preparation, treatment, packing, packaging, transport or holding of such food results, or may be reasonably expected to result, (directly or indirectly) in it or its by-products becoming a component of or otherwise affecting the characteristics of such foods. The term does not include “contaminants” or substances added to food for maintaining or improving nutritional qualities.

**Food allergy**
A form of food intolerance in which there is evidence of an abnormal immunological reaction to the food. “Immediate allergic reactions” are those which occur within minutes to hours after ingestion of the offending food, while reactions beginning several hours to days after food exposure are characterized as “delayed allergic reactions”.

**Food balance sheet (FBS)**
Gross estimates of national per-capita availability of food commodities derived from a country's annual food production plus imports minus exports. Food waste, refuse, losses from spoilage and other sources of waste are not taken into account.

**Food composition data**
Data on the composition of foods, mainly on nutrients but also non-nutrients (e.g., phytochemicals) and contaminants (e.g. acrylamides). As examples, nutrient composition data are often compiled into national and regional food composition databases, and GEMS/Food maintains an international database on contaminants in foods.

**Food consumption**
For assessing dietary chemical hazards, food consumption is an estimate of the quantity of a food or group of foods (including beverages and drinking water) consumed by a specified population or individual. Food consumption is expressed in grams of food per person per day.

**Food diary**
See food record.

**Food frequency questionnaire (FFQ)**
The food frequency questionnaire (FFQ) is a retrospective method asking respondents to report their usual frequency of consumption of each food from a list of foods for a specific period (several months or a year). Food lists vary by the purpose of the study and study population. Frequency of consumption categories also vary by questionnaire but usually include per day, week, or month. Semi quantitative FFQ: In this type of FFQ, portion size information is collected; portion sizes are specified as standardized portions or choice (range of portions). Non-quantitative FFQ: Portion size information not collected.

**Food habit questionnaire**
A method for collecting information about an individual's beliefs or practices related to food/beverage consumption (e.g., perceptions about foods, food likes and dislikes, methods of preparation).

**Food intolerance**
A reproducible, unpleasant reaction to a food or food ingredient, including reactions due to immunological effects, biochemical factors such as enzyme deficiencies, and anaphylactoid reactions that often include histamine release.

**Food record (food diary)**
Food records are used to record food intake at the time of consumption, over a number of days that are not necessarily sequential. Most studies ask respondents to enter the information on hard copy form, although tape-recording, bar-coding, and electronic weighing also have been used to collect descriptive and quantity information. Weighed FR: The respondent weighs on a small scale all food and beverages consumed. Estimated FR: The respondent estimates all food consumed using household measures or portion size estimating aides.

**Foods for Special Dietary Uses**
Foods which are specially processed or formulated to satisfy particular dietary requirements which exist because of a particular physical or physiological condition and/or specific diseases and disorders and which are presented as such. The composition of these foodstuffs must differ significantly from the composition of ordinary foods of comparable nature, if such ordinary foods exist (GENERAL STANDARD FOR THE LABELLING OF AND CLAIMS FOR PREPACKAGED FOODS FOR SPECIAL DIETARY USES (CODEX STAN 146 1985))

**GEMS/Food**
WHO's Global Environment Monitoring System/Food Contamination Monitoring and Assessment Programme, which maintains databases on contaminant levels in foods and estimates of dietary exposure to food chemicals.

**GEMS/Food consumption cluster diets**
GEMS/Food Consumption Cluster Diets are per capita consumption of raw and semi-processed agricultural commodities expressed in grams per person per day for distinct groups of the world's population that share similar dietary patterns. Based on FAO Food Balance Sheet data, the diets were generated using a cluster analysis, which assigned countries to one of the 13 cluster diets.

**GEMS/Food regional diets**
GEMS/Food Regional Diets are per capita consumption of raw and semi-processed agricultural commodities expressed in grams per person per day for regional and cultural
groups of the world. The diets were generated using FAO Food Balance Sheet data from
selected representative countries for each the 5 regions. The GEMS/Food Regional Diets
have now been replaced by the GEMS/Food Consumption Cluster Diets.

Good Agricultural Practice (GAP)
Good Agricultural Practice (GAP) in the use of pesticide includes the nationally authorized
safe uses of pesticides under actual conditions necessary for effective and reliable pest
control. It encompasses a range of levels of pesticide applications up to the highest authorized
use, applied in a manner which leaves a residue which is the smallest amount practicable.
Authorized safe uses are determined at the national level and include nationally registered or
recommended uses, which take into account public and occupational health and
environmental safety considerations. Actual conditions include any stage in the production,
storage, transport, distribution and processing of food commodities and animal feed.

Good Practice in the Use of Veterinary Drugs (GPVD)
GVP is the official recommended or authorized usage including withdrawal periods,
approved by national authorities, of veterinary drugs under practical conditions (see Good
experimental field practice).

Group acceptable daily intake (Group ADI)
An acceptable daily intake established for a group of compounds that display similar toxic
effects or share a common toxic metabolite, thus limiting their cumulative intake.

Guidance value
Value, such as concentration in air or water, which is derived after allocation of the reference
dose among the different possible media (routes) of exposure. The aim of the guidance value
is to provide quantitative information from risk assessment to the risk managers to enable
them to make decisions.

Hazard
Inherent property of an agent or situation having the potential to cause adverse effects when
an organism, system or (sub) population is exposed to that agent.

Hazard assessment
A process designed to determine the possible adverse effects of an agent or situation to which
an organism, system or (sub) population could be exposed. The process includes hazard
identification and hazard characterization. The process focuses on the hazard in contrast to
risk assessment where exposure assessment is a distinct additional step.

Hazard characterization
The qualitative and, wherever possible, quantitative description of the inherent properties of
an agent or situation having the potential to cause adverse effects. This should, where
possible, include a dose-response assessment and its attendant uncertainties. Hazard
characterization is the second stage in the process of Hazard Assessment, and the second step
in Risk Assessment.

Hazard identification
The identification of the type and nature of adverse effects that an agent has as inherent
capacity to cause in an organism, system or (sub) population. Hazard identification is the first
stage in hazard assessment and the first step in the process of Risk Assessment.
**Highest residue (HR)**

Highest residue in composite sample of edible portion found in the supervised trials used for estimating the maximum residue level.

The HR is the highest residue level (expressed as mg/kg) in a composite sample of the edible portion of a food commodity when a pesticide has been used according to maximum GAP conditions. The HR is estimated as the highest of the residue values (one from each trial) from supervised trials conducted according to maximum GAP conditions, and includes residue components defined by the JMPR for estimation of dietary intake.

**Highest residue - processing (HR-P)**

Highest residue in a processed commodity calculated by multiplying the highest residue in the raw commodity by the processing factor

**International estimated daily intake (IEDI)**

The IEDI is a prediction of the long-term daily intake of a pesticide residue on the basis of the assumptions of average daily food consumption per person and median residues from supervised trials, allowing for residues in the edible portion of a commodity and including residue components defined by the JMPR for estimation of dietary intake. Changes in residue levels resulting from preparation, cooking, or commercial processing are included. When information is available, dietary intake of residues resulting from other sources should be included. The IEDI is expressed in milligrams of residue per person.

**International estimated short-term intake (IESTI)**

The IESTI is a prediction of the short-term intake of a pesticide residue on the basis of the assumptions of high daily food consumption per person and highest residues from supervised trials, allowing for residues in the edible portion of a commodity and including residue components defined by the JMPR for estimation of dietary intake. The IESTI is expressed in milligrams of residue per kg body weight.

At its 1999 Meeting, JMPR performed acute dietary exposure assessments for the first time, by calculating International Estimates of Short-Term Intake (IESTI). In the IESTI methodology, the estimates are performed for each crop individually, as it is assumed that it is unlikely that an individual will consume, within a meal or 24 hours, two different commodities in large portion weights. Furthermore, the presence on those commodities of the same pesticide at the highest residue level is considered even less likely.

**International Numbering System (INS)**

The International Numbering System for food additives (INS) has been prepared by the Codex Committee for Food Additives and Contaminants (CCFAC) for the purpose of providing an agreed international numerical system for identifying food additives in ingredient lists as an alternative to the declaration of the specific name.

**Irreducible level (of a food contaminant)**

That concentration of a substance which cannot be eliminated from a food without involving the discarding of that food altogether, severely compromising the ultimate availability of major food supplies.

**Joint FAO/WHO Expert Committee on Food Additives (JECFA)**
JECFA is the abbreviated title of the Joint FAO/WHO Expert Committee on Food Additives, which has been meeting since 1956. JECFA has been engaged in collecting and evaluating scientific data on food additives and making recommendations on safe levels of use. This has been accomplished (a) by elaborating specifications for the identity and purity of individual food additives that have been toxicologically tested and are in commerce, and (b) by evaluating toxicological data on these food additives and estimating acceptable intakes by humans. In 1972 the scope of the evaluations was extended to include contaminants in food, while in 1987 the scope was extended even further to include residues of veterinary drugs in food. When evaluating the latter compounds, maximum residue limits are recommended based upon acceptable intakes estimated by the Committee and data relating to good practice in the use of veterinary drugs.

JECFA is a technical committee of specialists acting in their individual capacities. Each JECFA is a separately constituted committee, and when either the term “JECFA” or “the Committee” is used, it is meant to imply the common policy or combined output of the separate meetings over the years.

Joint FAO/WHO Meeting on Pesticide Residues (JMPR)

JMPR is the abbreviated title for the Joint Meeting of the FAO Panel of Experts on Pesticide Residues in Food and the Environment and the WHO Core Assessment Group which have been meeting since 1963. Their meetings are normally convened annually. The FAO Panel of Experts is responsible for reviewing residue and analytical aspects of the pesticides considered, including data on their metabolism, fate in the environment, and use patterns and for estimating the maximum residue levels and supervised trials median residue levels that might occur as a result of the use of the pesticide according to good agricultural practice. The WHO Core Assessment Group is responsible for reviewing toxicological and related data on the pesticides and, when possible, for estimating acceptable daily intakes (ADIs) and long-term dietary intakes of residues. As necessary, acute reference doses (ARfDs) for pesticides are estimated along with appropriate estimates of short-term dietary intake.

JMPR is a technical committee of JMPR specialists acting in their individual capacities. Each is a separately-constituted committee, and when either the term “JMPR” or “the Meeting” is used, it is meant to imply the common policy or combined output of the separate Meetings over the years.

Large portion size

A food consumption amount that represents the 97.5th percentile consumption (eaters only) of a food that is derived from individual consumer days in a food consumption survey. This is useful in calculating acute dietary exposures.

Limited by Good Manufacturing Practice (LGMP)

This statement refers to the limitation of a food additive in specified foods. It means that the additive in question is self-limiting in food for technological, organoleptic, or other reasons.

Limit of detection (LOD)

The minimum concentration of a component in a dietary sample that can be qualitatively detected, but cannot be quantitatively determined, under a pre-established set of analytical conditions.

Limit of quantification (LOQ)
The minimum concentration of a component that can be determined quantitatively with acceptable accuracy and consistency. It often approximates to a value of three times the limit of detection.

**Long-term toxicity study**
A study in which animals are observed during the whole life span (or the major part of the life span) and in which exposure to the test material takes place over the whole observation time or a substantial part thereof. The term chronic toxicity study is used sometimes as a synonym for “long-term toxicity study”.

**Lowest-observed-adverse-effect level (LOAEL)**
Lowest concentration or amount of a substance, found by experiment or observation, which causes an adverse alteration of morphology, functional capacity, growth, development or life span of the target organism distinguishable from normal (control) organisms of the same species and strain under the same defined conditions of exposure.

**Lowest-observed-effect level (LOEL)**
The lowest concentration or dose of a substance, found by experiment or observation, that causes any alteration of morphology, functional capacity, growth, development, or lifespan of the target organisms distinguishable from normal (control) organisms of the same species and strain under the same defined conditions of exposure.

**Margin of exposure (MOE)**
Ratio of the no-observed-adverse-effect level (NOAEL) or benchmark dose lower confidence limit (BMDL) for the critical effect to the theoretical, predicted, or estimated exposure dose or concentration.

**Margin of safety**
For some experts the Margin of Safety has the same meaning as the Margin of Exposure, while for others, the Margin of Safety means the margin between the reference dose and the actual exposure dose or concentration.

**Maximum level (ML) (for contaminants, naturally occurring toxicants, nutrients)**
The maximum concentration of a substance recommended by the Codex Alimentarius Commission (CAC) to be legally permitted in a given commodity.

**Maximum level (ML) (for food additives)**
The maximum level (ML) of a food additive for specific foods or food categories is assumed in this report to be the level of permission of use given in food standards for the additive in that food or food category.

**Maximum residue limit (MRL) (veterinary drugs)**
*JECFA*
The maximum concentration of residue resulting from the use of a veterinary drug (expressed in mg/kg or mg/kg on a fresh weight basis) that is acceptable in or on a food. It is based on the type and amount of residue considered to be without toxicological hazard for human health as expressed by the Acceptable Daily Intake (ADI), or on the basis of a temporary ADI

*It should be noted that all three terms are frequently abbreviated using the same acronym MRL irrespective of the different meaning and context in which they are used.*
that utilizes an additional safety factor. It also takes into account other relevant public health
risks as well as food technological aspects and estimated food intakes. When establishing an
MRL, consideration is also given to residues that occur in food of plant origin and/or the
environment. Furthermore, the MRL may be reduced to be consistent with good practices in
the use of veterinary drugs and to the extent that practical analytical methods are available.
MRLs are expressed in terms of mg/kg tissue or mg/L milk. The MRLs elaborated by JECFA
are “recommended MRLs” that are forwarded to the Codex Committee on Residues of
Veterinary Drugs in Foods (CCRVDF) for consideration. (JECFA)

Codex
The maximum concentration of residue resulting from the use of a veterinary drug (expressed
in mg/kg or µg/kg on a fresh weight basis) that is recommended by the Codex Alimentarius
Commission to be legally permitted or recognized as acceptable in or on a food. It is based on
the type and amount of residue considered to be without any toxicological hazard for human
health as expressed by the Acceptable Daily Intake (ADI), or on the basis of a temporary ADI
that utilizes an additional safety factor. It also takes into account other relevant public health
risks as well as food technological aspects and estimated food intakes.

Maximum residue limit (MRL) (for pesticides) *
The maximum concentration of a pesticide residue (expressed as mg/kg), recommended by
the Codex Alimentarius Commission to be legally permitted in or on food commodities and
animal feed. MRLs are based on good agricultural practice data and food derived from
commodities that comply with the respective MRLs are intended to be toxicologically
acceptable. Consideration of the various dietary residue intake estimates and determinations,
both at the national and international level in comparison with the Acceptable Daily Intake,
should indicate that foods complying with Codex MRLs are safe for human consumption.

Maximum residue level for pesticides *
The maximum residue level is estimated by the JMPR as the maximum concentration of
residues (expressed as mg/kg) which may occur in a food or feed commodity following Good
Agricultural Practices. The estimated maximum residue level is considered by the JMPR to
be suitable for establishing Codex MRLs and is considered by the Codex Committee on
Pesticide Residues as basis when recommending the Codex MRLs.

Maximum residue limit (MRL) “not specified”
Available data on the identity and concentration of residues of the veterinary drug in animal
tissues indicate a large margin of safety for consumption of residues in food when the drug is
used according to good practice in the use of veterinary drugs. For that reason, and for the
reasons stated in the individual evaluation, the Committee has concluded that the presence of
drug residues in the named animal product does not present a health concern and that there is
no need to specify a numerical MRL.

Maximum tolerable daily intake (MTDI)
See PMTDI.

* It should be noted that all three terms are frequently abbreviated using the same acronym MRL
irrespective of the different meaning and context in which they are used.
**Maximum tolerated dose (MTD)**
A term in common use in carcinogenicity testing meaning a dose that does not shorten life expectancy nor produce signs of toxicity other than those due to cancer (operationally, the MTD has been set as the maximum dose level at which a substance induces a decrement in weight gain of no greater than 10% in a subchronic toxicity test).

**Measurement end-point**
Measurable (ecological) characteristic that is related to the valued characteristic chosen as an assessment point.

**Model diets**
A type of screening method used in dietary exposure assessments that assumes fixed default consumption levels, usually for categories of foods and beverages. Model diets can be based on hypothetical consumption data assuming maximum consumption amounts for broad food groups (e.g., the budget method, TAMDI) or can be derived from national food supply or consumption data (e.g., GEMS/Food regional diets or total diet studies).

**Monitoring data**
Continuous or repeated observation, measurement, and evaluation of health and/or environmental or technical data for defined purposes, according to prearranged schedules in space and time, using comparable methods for sensing and data collection. Evaluation requires comparison with appropriate reference values based on knowledge of the probable relationship between ambient exposures and adverse effects. NARROWER TERM biological monitoring, environmental monitoring

**No ADI allocated**
Terminology used by JECFA in situations where an ADI is not established for a substance under consideration because (a) insufficient safety information is available; (b) no information is available on its food use; or (c) specifications for identity and purity have not been developed.

There are various reasons for not allocating an ADI, ranging from a lack of information to data on adverse effects that call for advice that a food additive or veterinary drug should not be used at all. The report should be consulted to learn the reasons that an ADI was not allocated.

**No-observed-effect level (NOEL)**
Greatest concentration or amount of a substance, found by experiment or observation, that causes no alterations of morphology, functional capacity, growth, development or life span of the target organisms distinguishable from those observed in normal (control) organisms of the same species and strain under the same defined conditions of exposure.

**No-observed-adverse-effect level (NOAEL)**
The greatest concentration or amount of a substance, found by experiment or observation, which causes no detectable adverse alteration of morphology, functional capacity, growth, development or life span of the target organism under defined conditions of exposure.

**Novel food**
A food or food ingredient produced from raw materials not normally used for human
consumption or food that is severely modified by the introduction of new processes not
previously used in the production of food.

**Nutrient**
A nutrient means any substance normally consumed as a constituent of food:

(a) which provides energy; or

(b) which is needed for growth and development and maintenance of healthy life; or

(c) a deficit of which will cause characteristic bio-chemical or physiological changes to
occur.

(GENERAL PRINCIPLES FOR THE ADDITION OF ESSENTIAL NUTRIENTS TO
FOODS, (CAC/GL 09-1987)

**Pesticide**
Any substance or mixture of substances intended for preventing, destroying or controlling
any pest, including vectors of human or animal disease, unwanted species of plants or
animals causing harm during or otherwise interfering with the production, processing, storage,
transport or marketing of food, agricultural commodities, wood and wood products or animal
feedstuffs, or substances which may be administered to animals for the control of insects,
arachnids or other pests in or on their bodies. The term includes substances intended for use
as a plant growth regulator, defoliant, desiccant or agent for thinning fruit or preventing the
premature fall of fruit, and substances applied to crops either before or after harvest to protect
the commodity from deterioration during storage or transport (FAO, 2003).

**Pesticide residue**
A pesticide residue is any specified substance in food, agricultural commodities, or animal
feed resulting from the use of a pesticide. The term includes any derivatives of a pesticide,
such as conversion products, metabolites, reaction products, and impurities that are
considered to be of toxicological significance.

**Post-regulation dietary exposure assessment**
Calculation of dietary exposure based on the chemical levels found in foods following
implementation of regulatory limits or levels.

**Poundage data**
Estimates of the amount of a food chemical available for use in food manufacturing in a
country during a specific period of time (usually one year). The total poundage is sometimes
divided by the total population size in order to obtain an estimate of per capita availability of
a specific chemical substance.

**Pre-regulation dietary exposure assessment**
Calculation of dietary exposure based on the highest levels at which the chemical is proposed
for use [e.g., Proposed Maximum Levels (MLs) or manufacturers' use levels, the highest
residue levels from trial (HR), or the supervised trial median residue levels (STMR)].

**Primary food commodity**
For the purposes of the Codex Alimentarius, the term “primary food commodity” means “the
product in or nearly in its natural state intended for processing into food for sale to the
consumer or as a food without further processing. It includes irradiated primary food
commodities and products after removal of certain parts of the plant or parts of animal
commodity (RAC)” means the same as “primary food commodity.”

**Probabilistic analysis**

Any analysis that uses mathematical probability. The output may reflect frequency of
occurrence, the likelihood of a set of possible outcomes, or both as separate dimensions.

**Processing aid**

Any substance or material, not including apparatus or utensils, and not consumed as a food
ingredient by itself, intentionally used in the processing of raw materials, foods or its
ingredients, to fulfil a certain technological purpose during treatment or processing and which
may result in the non-intentional but unavoidable presence of residues or derivatives in the
final product.

**Processing factor**

The processing factor for a specified pesticide residue, commodity and food process is the
residue level in the processed product divided by the residue level in the starting commodity,
usually a raw agricultural commodity (FAO, 2002a).

The processing factor is the residue level in the processed commodity divided by the residue
level in the initial commodity.

**Provisional maximum tolerable daily intake (PMTDI)**

The reference value, established by JECFA, used to indicate the safe level of intake of a
contaminant with no cumulative properties. Its value represents permissible human exposure
as a result of the natural occurrence of the substance in food and in drinking water.

In the case of trace elements that are both essential nutrients and unavoidable constituents of
food, a range is expressed, the lower value representing the level of essentiality and the upper
value the PMTDI.

The tolerable intake is generally referred to as 'provisional' since there is often a paucity of
data on the consequences of human exposure at low levels, and new data may result in a
change to the tolerable level.

Related term: tolerable daily intake (TDI)

**Provisional tolerable weekly intake (PTWI)**

The end-point used by JECFA for food contaminants such as heavy metals with cumulative
properties. Its value represents permissible human weekly exposure to those contaminants
unavoidably associated with the consumption of otherwise wholesome and nutritious foods.

**Provisional tolerable monthly intake (PTMI)**

An endpoint used for a food contaminant with cumulative properties that has a very long
half-life in the human body. Its value represents permissible human monthly exposure to a
contaminant unavoidably associated with otherwise wholesome and nutritious foods.

**Quality assurance**

Quality assurance is defined as a set of activities whose purpose is to demonstrate that an
entity meets all quality requirements. These activities are carried out in order to inspire the
confidence of both customers and managers, confidence that all quality requirements are being met.

**Quality control**

Quality control is defined as a set of activities or techniques whose purpose is to ensure that all quality requirements are being met. In order to achieve this purpose, processes are monitored and performance problems are solved.

**Reference dose**

An estimate of the daily exposure dose that is likely to be without deleterious effect even if continued exposure occurs over a lifetime.

Related term: Acceptable daily intake, tolerable daily intake.

**Regional diets**

See GEMS/Food regional diets

**Reproductive effects**

To test for the effects of exposure to low levels of chemicals exceeding the life span of one generation, tests have been developed covering 'several reproductive cycles. In the three-generation test, the animals are exposed through three complete reproductive cycles (starting with the F0 generation at weaning). These tests, which include exposure in-utero and through the milk, have been used in particular for assessing toxic effects related to reproduction.

**Response**

Change developed in the state or dynamics of an organism, system or (sub) population in reaction to exposure to an agent.

**Risk**

The probability of an adverse effect in an organism, system or (sub) population caused under specified circumstances by exposure to an agent.

**Risk analysis**

A process for controlling situations where an organism, system or (sub) population could be exposed to a hazard. The Risk Analysis process consists of three components: risk assessment, risk management and risk communication.

**Risk assessment**

A process intended to calculate or estimate the risk to a given target organism, system or (sub)population, including the identification of attendant uncertainties, following exposure to a particular agent, taking into account the inherent characteristics of the agent of concern as well as the characteristics of the specific target system. The Risk Assessment process includes four steps: hazard identification, hazard characterisation (related term: dose-response assessment), exposure assessment, and risk characterization. It is the first component in a risk analysis process.

**Risk characterization**

The qualitative and, wherever possible, quantitative determination, including attendant uncertainties, of the probability of occurrence of known and potential adverse effects of an agent in a given organism, system or (sub)population, under defined exposure conditions. Risk Characterisation is the fourth step in the Risk Assessment process.
**Risk communication**
Interactive exchange of information about (health or environmental) risks among risk assessors, managers, news media, interested groups and the general public.

**Risk estimation**
Quantification of the probability, including attendant uncertainties, that specific adverse effects will occur in an organism, system or (sub)population due to actual or predicted exposure.

**Risk evaluation**
Establishment of a qualitative or quantitative relationship between risks and benefits of exposure to an agent, involving the complex process of determining the significance of the identified hazards and estimated risks to the system concerned or affected by the exposure, as well as the significance of the benefits brought about by the agent.
It is an element of risk management. Risk Evaluation is synonymous with Risk-Benefit evaluation.

**Risk management**
Decision-making process involving considerations of political, social, economic, and technical factors with relevant risk assessment information relating to a hazard so as to develop, analyse, and compare regulatory and non-regulatory options and to select and implement appropriate regulatory response to that hazard. Risk management comprises three elements: risk evaluation; emission and exposure control; risk monitoring.

**Risk monitoring**
Process of following up the decisions and actions within risk management in order to ascertain that risk containment or reduction with respect to a particular hazard is assured. Risk monitoring is an element of risk management.

**Safety**
Practical certainty that adverse effects will not result from exposure to an agent under defined circumstances. It is the reciprocal of risk.

**Safety assessment**

**Safety factor**
A composite (reductive) factor applied by the risk assessment experts to the no-observed-adverse-effect (NOAEL) level or other reference point, such as benchmark dose (BMD) or benchmark dose upper confidence limit (BMDL), to derive a reference dose that is considered safe or without appreciable risk, such as an acceptable daily intake (ADI) or tolerable daily intake (TDI) (the NOAEL or other reference point is divided by the safety factor to calculate the reference dose).
The value of the safety factor depends on the nature of the toxic effect, the size and type of population to be protected, and the quality of the toxicological information available.
Related term: Assessment factor, uncertainty factor.
1  **Sampling procedure (protocol)**
2  Operational requirements and/or instructions relating to the use of a particular sample plan
3  (i.e., the instructions for the implementation of the plan).

5  **Screening methods - dietary exposure**
6  Methods used as the first step in estimating the dietary exposure to a food chemical in order
7  to target those chemicals that might pose a health concern. Screening methods use
8  conservative assumptions for both food consumption and chemical concentration. If the
9  estimated exposure exceeds its toxicological reference value, a more accurate method of
10  dietary exposure assessment is used; if it is below the reference value, no further assessment
11  is conducted.

13  **Sensitivity analysis**
14  A technique that tests the sensitivity of an output variable to the possible variation in the
15  input variables of a given mathematical model. The purpose of sensitivity analysis is to
16  quantify the influence of input variables on the output variable and develop bounds on the
17  model output.

19  **Short-term toxicity study**
20  An animal study (sometimes called a subacute or subchronic study) in which the effects
21  produced by the test material, when administered in repeated doses (or continuously in food
22  or drinking-water) over a period of about 90 days, are studied.

24  **Standard portion sizes**
25  Quantities (weights) assigned to individual foods (e.g., glass of juice, cookie, and banana)
26  that represent amounts that are typically consumed. These values can be used as default
27  values in food consumption surveys and for calculating dietary exposure.

29  **Statistical uncertainty**
30  See uncertainty

32  **Stratified sampling**
33  A stratified sampling method selects values at regular intervals throughout each distribution.
34  Calculating the result using the average or median value for each distribution may be thought
35  of as the simplest example of a stratified sampling process, where each distribution has a
36  single stratum.

38  **Supervised trials**
39  Scientific studies in which pesticides are applied to crops or animals according to specified
40  conditions intended to reflect commercial practice after which harvested crops or tissues of
41  slaughtered animals are analyzed for pesticide residues. Usually specified conditions are those
42  which approximate existing or proposed GAP.

44  **Supervised trials for estimating maximum residue levels**
45  Scientific studies in which pesticides are applied to crops or animals according to specified
46  conditions intended to reflect commercial practice after which harvested crops or tissues of
47  slaughtered animals are analysed for pesticide residues (FAO, 2002a).

49  **Supervised trials median residue (STMR)**
The supervised trials median residue (STMR) is the expected residue level in the food commodity (expressed in milligrams of residue per kilogram of commodity) when a pesticide has been used according to maximum GAP conditions. The STMR is estimated as the median of the residue values (one from each trial) from supervised trials conducted according to maximum GAP conditions and includes residue components defined by the JMPR for estimation of dietary intake. For some commodities, such as banana, STMR levels may be determined directly from levels measured in the edible portion when data are available.

The STMR is the expected residue level (expressed as mg/kg) in the edible portion of a food commodity when a pesticide has been used according to maximum GAP conditions. The STMR is estimated as the median of the residue values (one from each trial) from supervised trials conducted according to maximum GAP conditions (FAO, 2002a).

Supervised trials median residue – processed (STMR-P)

The STMR-P is the expected residue in a processed commodity calculated by multiplying the STMR of the raw agricultural commodity by the corresponding processing factor, or derived directly from a series of processing trials. The STMR-P is expressed in units of mg/kg (FAO, 2002a).

The supervised trials median residue - processing (STMR-P) is the expected residue level in the food commodity (expressed in milligrams of residue per kilogram of commodity) when a pesticide has been used according to maximum GAP conditions and the commodity is processed according to the main practice used to prepare the food prior to consumption.

Susceptibility factors

Characteristics thought to increase the susceptibility of an individual to adverse health outcomes.

Temporary ADI

Used when data are sufficient to conclude that use of the substance is safe over the relatively short period of time required to generate and evaluate further safety data, but are insufficient to conclude that use of the substance is safe over a lifetime. A higher-than-normal safety factor is used when establishing a temporary ADI and an expiration date is established by which time appropriate data to resolve the safety issue should be submitted for evaluation. The temporary ADI is listed in units of mg per kg of body weight.

Temporary MRL

Used when a temporary ADI has been established and/or when it has been found necessary to provide time to generate and evaluate further data on the nature and quantitation of residues. Temporary MRLs are expressed in terms of mg/kg tissue or mg/l milk.

“Tentative” specifications

JECFA uses the term “tentative” only in cases where data on the purity and identity of the substance (food additive) are required. The assignment “tentative” will require submission and re-evaluation of data within a specified period of time (usually two years).

Teratogen

An agent which, when administered prenatally, induces permanent abnormalities in structure.

Teratogenicity
The property (or potential) to produce structural malformations or defects in an embryo or fetus.

**Test portion**
Quantity of material, of proper size for measurement of the concentration or other property of interest, removed from the test sample.

**Theoretical maximum daily intake (TMDI)**
The TMDI is a prediction of the maximum daily intake of e.g. a pesticide residue, assuming that residues are present at the MRLs and that average daily consumption of foods per person e.g. as represented by GEMS/Food diets. The TMDI can be calculated for the various regional or consumption cluster diets and is expressed in milligrams of residue per person.

**Threshold**
Dose or exposure concentration of an agent below that a stated effect is not observed or expected to occur.

**Threshold dose**
The dose at which an effect just begins to occur, that is, at a dose immediately below the threshold dose the effect will not occur, and immediately above the threshold dose the effect will occur. For a given chemical there can be multiple threshold doses, in essence one for each definable effect. For a given effect there may be different threshold doses in different individuals. Further, the same individual may vary from time to time as to his or her threshold dose for any effect. However, given the present state in the development of science, for certain chemicals and certain toxic effects, a threshold dose may not be demonstrable. The threshold dose will fall between the experimentally determined no-observed-effect level (NOEL) and the lowest-observed-effect level (LOEL). Of importance is that when using the NOEL or LOEL, it should be specified which effect is being measured, in what population, and what is the route of administration. In situations for which the effect of concern is considered to be adverse, the terminology often used is that of a no-observed-adverse-effect level (NOAEL) or lowest-observed-adverse-effect level (LOAEL), again specifying the effect, the population, and the route of administration. Both the NOEL and LOEL (as well as the NOAEL and LOAEL) have been used by different scientific groups as a surrogate for the threshold dose in the performance of risk assessments.

**Tolerable daily intake (TDI)**
Analogous to Acceptable Daily Intake. The term Tolerable is used for agents which are not deliberately added such as contaminants in food.
Note that JECFA uses the term Provisional Maximum Tolerable Daily Intake (PMTDI)

**Tolerable intake**
Estimated maximum amount of an agent, expressed on a body mass basis, to which each individual in a (sub) population may be exposed over a specified period without appreciable risk.

**% TOS (total organic solids)**
Used when estimating dietary exposure to enzyme preparations.
% TOS = 100 - (A + W + D) where A = % ash, W = % water, and D = % diluent and carrier.
The estimated dietary exposure is expressed in terms of mg TOS per kg of body weight.
Toxicity
The toxicity of a compound is its potential to cause injury (adverse reaction) to a living organism.

Toxicological reference values
See ADI, TDI, ARfD, PMTDI, PTWI, PTMI

Transplacental carcinogenesis
The appearance of neoplasia in the progeny of females exposed to chemical agents during pregnancy.

Uncertainty
Imperfect knowledge concerning the present or future state of an organism, system or (sub)population under consideration.

Uncertainty represents a lack of knowledge about factors affecting exposure or risk and can lead to inaccurate or biased estimates of exposure or risk. The types of uncertainty include: scenario uncertainty, parameter uncertainty and model uncertainty.

Uncertainty analysis
A process in which the sources of uncertainty in an estimate are identified, and an estimate made of the magnitude and direction of the resulting error. (1) qualitative: utilizes descriptive methods; (2) semi-quantitative: uses simple mathematical techniques such as sensitivity analysis; (3) quantitative: uses complex mathematical techniques such as Monte Carlo analysis. [AIHA, 2000: Risk Assessment Principles for the Industrial Hygienist]

A detailed examination of the systematic and random errors of a measurement or estimate; an analytical process to provide information regarding the uncertainty. [SRA, 1999: Glossary of Risk Analysis Terms] [USDOE, 2000: RAIS Glossary]

Uncertainty factor
Reductive factor by which an observed or estimated no-observed-adverse effect level (NOAEL), or other reference point such as benchmark dose (BMD) or benchmark dose upper confidence limit (BMDL), is divided to arrive at a reference dose or standard that is considered safe or without appreciable risk.

Related terms: assessment factor, safety factor.

Unit weight
This represents the typical weight of a commodity unit (e.g., a single apple, a single banana) that are used in the calculation of acute dietary exposure estimates (IESTI).

Validation
Process by which the reliability and relevance of a particular approach, method, process or assessment is established for a defined purpose. Different parties define “Reliability” as establishing the reproducibility of the outcome of the approach, method, process or assessment over time. “Relevance” is defined as establishing the meaningfulness and usefulness of the approach, method, process or assessment for the defined purpose.

Variability
Observable diversity in biological sensitivity or response and in exposure parameters.
Variability arises from true heterogeneity across people, places or time, and can affect the precision of exposure estimates and the degree to which they can be generalized. The types of variability include: spatial variability, temporal variability, and inter-individual variability. [USEPA, 1997b: Exposure Factors Handbook]

**Veterinary drug**
A veterinary drug means any substance applied or administer to any food-producing animal, such as meat or milk-producing animals, poultry, fish or bees, whether for therapeutic, prophylactic or diagnostic purposes, or for modification of physiological functions or behaviour.

**Veterinary Drug Residues**
Any specified substances in or on food resulting from the use of a veterinary drug. These are the parent compounds and/or their metabolites in any edible portion of the animal product, and include residues of associated impurities of the veterinary drug concerned.

**Withdrawal period**
The interval between the time of the last administration of a veterinary drug and the time when the animal can be safely slaughtered for food, or milk or eggs can be safely consumed.