ENSURING GLOBAL FOOD SAFETY

EXPLORING GLOBAL HARMONIZATION

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Ensuring Global Food Safety

Exploring Global Harmonization

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Foreword

The production, processing, distribution, retail, packaging and labeling of foodstuffs are governed by a vast number of laws, regulations, codes of practice and guidance. Most food safety legislation and regulations were devised in the first decades after the Second World War, at times when analytical methods were much less advanced than today. More recent legislation and regulations often have been developed in response of media scares. Today's reality is that there are differences in regulations between countries that force the food community to check the safety over and over again, depending on where the products are produced, from where they or their ingredients originate, or to where they are exported. In addition to wasting time and money, this also too often leads to severe measures such as the destruction of huge quantities of food, despite lacking any scientific justification, to protect consumers, while a large part of the human population suffers from undernourishment. This book provides examples and discusses possible means of improvement of the current situation in the field of food regulations. It strongly supports the idea of the necessity to establish an integral system of globally accepted food safety protocols. Actually, this idea was launched by the Global Harmonization Initiative (GHI), a network of scientific organizations and individual scientists that was initiated to help eliminate differences in regulations and legislation. This book represents a step forward towards the harmonization of food safety regulations and legislation worldwide.

The intention of this book is to bundle the extensive information on food regulations through history and over all continents into a comprehensive reference; and it presents, complete, up-to-date information on contemporary food safety issues related to the global food supply chain. Various questions and issues relating to food production frequently raised in the supply chain from farming to retail are covered, including control of microbiological risks, approaches to managing low level contaminants in foods, processing issues, applications of antibiotics in food, traditional and organic foods in the scope of safety and nutrition, carcinogenicity and toxicity issues, and finally, the issue of balance between benefits and safety risk. Possibilities for global harmonization of test protocols and analytical methods are also discussed, while the interest in further research into novel methods and ingredients and novel food processing technologies against regulatory hurdles is argued.

Combining scientific, technological, and legal aspects, over 30 carefully selected scientists and food safety professionals from academia, industry, and government across the world have contributed unique expertise and knowledge ensuring the safety and quality of the food supply for consumers.

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Preface

Food safety is generally recognized as the biological, chemical or physical status of a food that will permit its consumption without incurring excessive risk of injury, morbidity or mortality. It is also true that assessing food safety risk is frequently steeped in either or both political and normative considerations. National governments promote and promulgate food safety laws, regulations and legislation that can be in sharp contrast to those of other countries. These disparities frequently give rise to onerous trade barriers that masquerade as public health protection. Science and certainly scientific consensus on the status of the food, from a food safety perspective, may be overlooked during the rule-making process.

International differences in food safety regulations are disruptive to trade and frequently cause confusion among consumers as to the public health status of a food. Food deemed safe by an exporting nation may be regarded as unsafe by an importing nation. This debate often results in the seizure and destruction of food without a clear scientific basis or justification. Likewise novel food processing and preservation technologies or novel food ingredients are scrutinized for safety using protocols, procedures and standards that differ by country. These measures are taken to protect consumers from exposure to food that may adversely affect their health.

It is difficult to conceive, generally, that a food considered safe for one population would be unsafe for another. Yet and because of differences in food use and preparation among countries, food safety regulations frequently have a basis in the local history and tradition rather than science. Harmonization of food safety regulations would potentially reduce the legal, but scientifically unjustified, destruction of food. Likewise harmonization of legislation and standards may result in eliminating the duplication in the need to prove the safety of novel foods and food ingredients, and consequently the high costs, to satisfy local authorities.

The Global Harmonization Initiative (GHI) is a non-governmental organization that seeks to obtain consensus among individual scientists, globally, on those contentious issues that require resolution. Consensus documents and white papers developed by GHI may be used as powerful tools in the discussions between stakeholders and are intended to promote the development of regulations based on sound science. The authors that have contributed to this work have described many of the reasons why regulations differ and what difficulties must be overcome to resolve such differences. The book provides a detailed insight into food safety regulations around the world and discusses methods to determine the safety of foods, ingredients and food-contact materials. It also addresses food contaminants, including the impact and implications for food safety of those that may be present in very low levels. Furthermore, it provides abstracts of additional reading materials accessible through the publisher's website about integrating risk assessment and cost benefit analysis, food additives and other

substances added to foods, and benefits and risks of organic food in relation to harmonization of food safety regulations.

Considering the abundance of pre-existing literature on the topic and the complexity of the subject, this book does not cover genetically modified food.

The editors are immensely grateful to the authors who contributed tremendous effort and time to create this volume. In addition, we thank Nancy Maragioglio and Carrie Bolger of Elsevier for their support and patience with us, the editors, during the development of this book.

Christine Boisrobert, Aleksandra Stjepanovic, Sangsuk Oh and Huub Lelieveld, August 2009.

Acronyms and Abbreviations

2-AAF: 2-acetylaminofluorene.
25(OH)D: 25-hydroxyvitamin D.
3-MC: 3-methylcholantene.
4-AAF: 4-acetylaminofluorene.
AB: Alamar Blue.
AB: Appellate Body.
ACFCR: ASEAN Common Food Control Requirements.
ADA: American Dietetic Association.
ADFCA: Abu Dhabi Food Control Authority.
ADI: Acceptable Daily Intake.
ADME: Absorption, Distribution, Metabolism and Excretion.
AFB_1: Aflatoxin B_1.
AFM: Atomic Force Microscope.
AFNOR: Association Française de Normalisation (*French*).
AFSC: Australian Food Standards Code.
AIDS: Acquired Immune Deficiency Syndrome.
AK: Adenylate Kinase.
ALARA: As Low As Reasonably Achievable.
ALOP: Appropriate Level of Protection.
ALS: Amyotrophic Lateral Sclerosis.
AMA: American Medical Association.
AMPA: α-amino-3-hydroxy-5-methyl-4-isoxazole propionate.
ANSI: American National Standards Institute.
ANZCERTA: Australia New Zealand Closer Economic Relations Trade Agreement.
ANZFA: Australia New Zealand Food Authority (*renamed* FSANZ).
AOAC: Association of Analytical Communities (*formerly* Association of Official Analytical Chemists).
APEC: Asia-Pacific Economic Cooperation.
AQIS: Australian Quarantine and Inspection Service.
AQSIQ: General Administration of Quality Supervision, Inspection and Quarantine of PRC.
ARfD: Acute Reference Dose.
ARLs: ASEAN Reference Laboratories.
ASEAN: Association of Southeast Asian Nations.
ATP: Adenosine Triphosphate.
AU: African Union.
B(a)P: Benzo(a)pyrene.
B(e)P: Benzo(e)pyrene.
BHA: Butylated Hydroxyanisole.
BHT: Butylated Hydroxytoluene.
BIS: Bureau of Indian Standards.
BLEB: Buffered Listeria Enrichment Broth.
BMC: Bone Mineral Content.
BMD: Bone Mineral Density.
BMELV: Federal Ministry of Food, Agriculture and Consumer Protection (Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz, *German*).
BNF: British Nutrition Foundation.
bp: base pair.
BRC: British Retail Consortium.
BSE: Bovine Spongiform Encephalopathy.
BSI: British Standards Institution.
BVL: Federal Office of Consumer Protection and Food Safety (Bundesamt für Verbraucherschutz und Lebensmittelsicherheit, *German*).
bw: body weight.
CAC: Codex Alimentarius Commission.

CACCLA: Codex Alimentarius Coordinating Committee for Latin America.
CACM: Central American Common Market.
CAFTA: Council of Food Technology Associations.
CAP: Chloramphenicol.
CARICOM: Caribbean Community and Common Market.
CASCO: Committee on Conformity Assessment.
CAST: Council for Agricultural Science and Technology.
CBA: Cost-Benefit Analysis.
CBOs: Community-Based Organizations.
CCFAC: Codex Committee on Food Additives and Contaminants.
CCFH: Codex Committee on Food Hygiene.
CCFL: Codex Committee on Food Labelling.
CCFNSDU: Codex Committee on Nutrition and Foods for Special Dietary Uses.
CCP: Critical Control Point.
CDC: Centers for Disease Control and Prevention.
CEDI: Cumulative Estimated Daily Intake.
CEDR: European Council for Agricultural Law (Comité Européen de Droit Rural, *French*).
CEF: EFSA Panel on food contact materials, enzymes, flavourings and processing aids.
CEN: European Committee for Standardization (Comité Européen de Normalisation, *French*).
CEO: Chief Executive Officer.
CEPI: Confederation of European Paper Industries.
CETEA-ITAL: Packaging Technology Center – Institute of Food Technology.
CF: Consumption Factor.
CFIA: Canadian Food Inspection Agency.
CFR: Code of Federal Regulations.
CFSAN: Center for Food Safety and Applied Nutrition.
CFSI: Caribbean Food Safety Initiative.
CFTRI: Central Food Technological Research Institute.
CFU: Colony-Forming Unit.
CHO: Chinese Hamster Ovary.
CIA: Central Intelligence Agency.
CIAA: Confederation of the Food and Drink Industries of the EU (Confédération des Industries Agro-Alimentaires de l' UE, *French*).
CIES: The Food Business Forum (Comité International d'Entreprises à Succursales, *French*)
CMC: Common Market Council (Consejo del Mercado Común, *Spanish*).
COAG: Council of Australian Governments.
CoE: Council of Europe.
COPAIA: Pan American Commission for Food Safety (Comisión Panamericana de Inocuidad de los Alimentos, *Spanish).*
CP: Cyclophosphamide.
CRS: Chinese Restaurant Syndrome.
CSREES: Cooperative State Research, Education, and Extension Service.
CUT: Come-Up Time.
CYP: Cytochrome P450
CytK: Cytotoxin K.
DAFF: Department of Agriculture, Fisheries and Forestry.
DC: Dietary Concentration.
D-E: Deficiency-Excess.
DEFT: Direct Epifluorescent Filter Technique.
DEH: Department of Environment and Heritage.
DG: Directorate General (Directorat Général, *French*)
DG SANCO: Directorate General for Health and Consumers (Directorat Général de Santé et Protection des Consommateurs, *French).*
DIG: Digoxigenin.
DM: Dry Matter.
DMN: Dimethylnitrosamine.
DMSO: Dimethyl Sulfoxide.
DNA: Deoxyribonucleic Acid.
DON: Deoxynivalenol.
DP: Degree of Polymerization.
DRF: Simulant D Reduction Factor.
DSB: Dispute Settlement Body.
dsDNA: Double-stranded DNA.

DSHEA: Dietary Supplement Health and Education Act.
DV: Daily Value.
EAR: Estimated Average Requirement.
EC: European Commission.
EC Treaty: European (Economic) Community Treaty (of 1957)
ECCS: Electrolytic Chromium Coated Steel *also see* TFS.
EDI: Estimated Daily Intake.
EDTA: Ethylenediaminetetraacetic acid.
EEC: European Economic Community.
EFFoST: European Federation of Food Science and Technology.
EFLA: European Food Law Association.
EFSA: European Food Safety Authority.
EFTA: European Free Trade Association.
EHEDG: European Hygienic Engineering and Design Group.
EIA: Enzyme Immunoassay.
ELIFA: Enzyme-Linked Immunofiltration Assay.
ELISA: Enzyme-Linked Immunosorbent Assay.
ELOSA: Enzyme-Linked Oligosorbent Assay.
ENM: Engineered Nano Materials.
EPA: Environmental Protection Agency.
EPHX1: Epoxide Hydrolase 1.
ERIC: Enterobacterial Repetitive Intergenic Consensus.
ERP: Expert Review Panel.
ERS: Economic Research Service.
EtOH: Ethanol.
EU: European Union.
EuCheMS-FCD: European Association for Chemical and Molecular Sciences-Food Chemistry Division.
EVM: Expert Group on Vitamins and Minerals.
FAO: Food and Agriculture Organization.
FASEB: Federation of American Societies for Experimental Biology.
FCCP: Carbonyl cyanide 4-(trifluoromethoxy) phenylhydrazone.
FCD Act: Foodstuffs, Cosmetics and Disinfectants Act.
FCM: Food Contact Material.
FCN: Food Contact Notification.
FCS: Food Contact Substance.
FCS: Food Control System.
FDA: Food and Drug Administration.
FDAMA: Food and Drug Administration Modernization Act.
FD&C Act: Federal Food, Drug and Cosmetic Act (*also* FFDCA, FDCA).
FFDCA: Federal Food, Drug and Cosmetic Act (*also* FDCA, FD&C).
FFR: Food Fortification Regulation.
FLAG: Food Legislation Advisory Group.
FMC: Food Microbiology Subcommittee.
FNB: Food and Nutrition Board.
FRF: Fat Reduction Factor.
FSANZ: Food Standards Australia New Zealand (*formerly* ANZFA).
FSC: Food Standards Committee.
FSD: Food Supplements Directive.
FSIS: Food Safety and Inspection Service.
FSO: Food Safety Objective.
FSSAI: Food Safety and Standards Authority of India.
f_T: Food-type distribution factor.
FT-IR: Fourier Transform Infrared.
FVO: Food and Veterinary Office.
GA: Glutamic Acid.
GABA: Gamma-Aminobutyric Acid.
GAPs: Good Agricultural Practices.
GATT: General Agreement on Tariffs and Trade.
GC: Gas Chromatography.
GCC: Gulf Cooperation Council.
GC/MS: Gas Chromatography/Mass Spectrometry.
GCS: g-glutamylcysteine synthetase.
GDP: Gross Domestic Product.
GFL: General Food Law.
GFSI: Global Food Safety Initiative.
GHI: Global Harmonization Initiative.
GHPs: Good Hygienic Practices (*also* Good Hygiene Practices).
GI: Gastrointestinal.
GLPs: Good Laboratory Practices.
GM: Genetically Modified.

GMO: Genetically Modified Organism.
GMC: Common Market Group (Grupo Mercado Común, *Spanish*).
GMP: Disodium 5′-Guanosine Monophosphate.
GMPs: Good Manufacturing Practices.
GRAS: Generally Recognized As Safe.
GSFA: General Standard for Food Additives.
GSH: Glutathione.
HAA: Heterocyclic Aromatic Amine.
HACCP: Hazard Analysis Critical Control Point.
HBL: Hemolysin BL.
HCN: Hydrogen cyanide (hydrocyanic acid).
HDL: High-Density Lipoprotein.
HEATOX: Heat-generated food toxicants, identification, characterization and risk minimization.
HFFA: Health/Functional Food Act.
HFFs: Health/Functional Foods.
HHP: High Hydrostatic Pressure.
HHS: Department of Health and Human Services.
HMPA: Hexamethylphosphoramide.
HPP: High Pressure Processing.
HPP: Hydrolyzed Protein Product.
HPRT: Hypoxanthine Phosphoribosyltransferase
HPS: Health Physics Society.
HT-2: HT-2 toxin.
IARC: International Agency for Research on Cancer.
ICC: International Association for Cereal Science and Technology (*formerly* International Association for Cereal Chemistry).
ICMSF: International Commission on Microbiological Specifications for Foods.
IDB: Inter-American Development Bank.
IDF: International Dairy Federation.
IEC: International Electrotechnical Commission.
IFIC: International Food Information Council.
IFS: International Food Standard.
IFT: Institute of Food Technologists.
Ig: Immunoglobulin.
IHR: International Health Regulations.
IMACE: International Margarine Association of the Countries of Europe.
IMF: International Monetary Fund.
IMP: Disodium 5′-Inosine Monophosphate.
INFOSAN: International Food Safety Authorities Network.
INTI: National Institute of Industrial Technology.
INTN: National Institute of Technology and Standardization.
INU: Intended Normal Use.
IOM: Institute of Medicine.
IPCC: Intergovernmental Panel on Climate Change.
IPCS: International Programme on Chemical Safety.
IQ: 2-amino-3-methylimidazo[4,5-*f*]quinoline.
IPPC: International Plant Protection Convention.
IRAM: Argentine Standardization Institute (Instituto Argentino de Normalización y Certificación, *formerly* Instituto Argentino de Racionalización de Materiales, *Spanish*).
ISI: Indian Standards Institution.
ISO: International Organization for Standardization.
ISR: International Sanitary Regulations.
ITU: International Telecommunication Union.
IUFoST: International Union of Food Science and Technology.
IVO: Iran Veterinary Organization.
JECFA: Joint FAO/WHO Expert Committee on Food Additives.
JEMRA: Joint FAO/WHO Expert Meetings on Microbiological Risk Assessment.
JETRO: Japan External Trade Organization.
JFDA: Jordan Food and Drug Administration.
JHAVC: Japan Hygienic Association of Vinylidene Chloride.
JHOSPA: Japan Hygienic Olefin and Styrene Plastics Association.
JMPR: Joint FAO/WHO Meetings on Pesticide Residues.
JRC: Joint Research Centre.
KFDA: Korea Food and Drug Administration.
KFT: Karl Fischer Titration.

LATU: Technological Laboratory of Uruguay (Laboratorio Tecnológico del Uruguay, *Spanish*).
LbL: Layer-by-Layer
LC-MS-MS: Liquid Chromatography-Mass Spectrometry-Mass Spectrometry.
LDL: Low-Density Lipoprotein.
LEB: Listeria Enrichment Broth.
L-GA: L-Glutamic Acid.
LNT: Linear Non-Threshold.
LOAEL: Lowest-Observed-Adverse-Effect-Level.
LOD: Limit of Detection.
LOQ: Limit of Quantitation.
LPM: Lithium Chloride-Phenylethanol-Moxalactam.
LT: Linear Threshold.
M/S: ratio (mass of food stuff contained/contact surface area of FCM)
MALDI-MS: Matrix-Assisted Laser Desorption/Ionization Mass Spectrometry.
MC: Microbiological Criteria.
MeIQ: 2-amino-3,4-dimethylimidazo[4,5-*f*] quinoline.
MeIQX: 2-amino-3,8-dimethylimidazo[4,5-*f*] quinoline.
MERCOUSUL: Common Market of the South (Mercado Commum do Sul, *Portuguese*).
MERCOSUR: Common Market of the South (Mercado Común del Sur, *Spanish*).
MDG: Millennium Development Goal.
MED.: Minimum Effective Dose.
mGST-1: microsomal Glutathione-S-Transferase.
MHLW: Ministry of Health, Labour and Welfare.
ML: Maximum Level.
MLA: McBride Listeria Agar.
MN: Micronuclei.
MoA: Ministry of Agriculture (India).
MOA: Ministry of Agriculture (Japan).
MoC: Ministry of Commerce.
MoCA: Ministry of Consumer Affairs.
MoFPI: Ministry of Food Processing Industries.
MoHFW: Ministry of Health and Family Welfare.
MOHWF: Ministry of Health, Welfare and Family Affairs.
MOU: Memorandum of Understanding.
MOXA: Modified Oxford Agar.
MPA: Medroxyprogesterone acetate.
MPN: Most Probable Number.
MPPO: Modified Polyphenylene Oxide.
MRC: Medical Research Council.
MRL: Maximum Residue Limit.
MRPL: Minimum Required Performance Limit.
mRNA: Messenger Ribonucleic Acid.
MRSA: Methicillin-resistant *Staphylococcus aureus*.
M/S: ratio (mass of foodstuff contained/contact surface area of FCM).
MSG: Mono-Sodium Glutamate.
MTR: Maximum Tolerable Risk.
NAFTA: North American Free Trade Agreement.
NASA: National Aeronautics and Space Administration.
NAT: *N*-acetyl transferase.
NAT 1: *N*-acetyl transferase 1.
NCFST: National Center for Food Safety and Technology.
NCTR: National Center for Toxicological Research.
ND: Not Detected/Not Detectable.
NEPA: National Environmental Policy Act.
NFA: National Food Authority.
NFP: Nutrition Facts Panel.
NGFIS: Netherlands Government Food Inspection Service.
NGOs: Non-Governmental Organizations.
NHE: Non-Hemolytic Enterotoxin.
NHMRC: National Health and Medical Research Council.
NIAS: Non-Intentionally Added Substances.
NIOSH: National Institute for Occupational Safety and Health.
NIP: Nutrition Information Panel.
NIR: Near Infrared.
NLEA: Nutrition Labeling and Education Act.
NMDA: N-methyl-D-aspartate.
NMSP: Nanoscale Materials Stewardship Program.
NNI: National Nanotechnology Initiative.
NOAEL: No-Observed-Adverse-Effect-Level.
NOEL: No-Observed-Effect-Level.

NordVal: Nordic System for Validation of Alternative Microbiological Method.
NRC: National Research Council.
NRCS: National Regulator for Compulsory Specifications.
nRDA: New Recommended Daily Allowance.
NRV: Nutrient Reference Value.
NSW: New South Wales.
NTP: National Toxicology Program.
OAS: Organization of American States.
OD: Oven Drying.
OECD: Organisation for Economic Co-operation and Development.
OIE: World Organisation for Animal Health (*formerly* Office International des Epizooties, *French*).
OLF: Other Legitimate Factor.
OMA: Official Methods of Analysis.
OML: Overall Migration Limit (expressed in mg/kg or mg/dm^2) (EU and MERCOSUR (=LMT, Límite de Migración Total, *Spanish*)).
OSHA: Occupational Safety and Health Administration.
OTA: Ochratoxin A.
OWCs: Organic Wastewater Contaminants.
OXA: Oxford Agar.
PA: Polyamide.
PAHO: Pan American Health Organization.
PALCAM: Polymyxin Acriflavine Lithium chloride Ceftazidime Aesculin Mannitol.
PAS: Publicly Available Specification.
PATP: Pressure Assisted Thermal Processing.
PC: Polycarbonate.
PCBs: Polychlorinated biphenyls.
PCDDs: Polychlorinated dibenzodioxins.
PCDFs: Polychlorinated dibenzofurans.
PCR: Polymerase Chain Reaction.
PE: Polyethylene.
PEF: Pulsed Electric Fields.
PEMBA: Polymyxin pyruvate egg-yolk mannitol bromothymol blue agar.
PEN: Project on Emerging Nanotechnologies.
PET: Polyethylene Terephthalate.
PFA: Prevention of Food Adulteration Act.
PFAC: Pure Food Advisory Committee.
PFGE: Pulsed Field Gel Electrophoresis.
PhIP: 2-amino-1-methyl-6-phenylimidazo [4,5-*b*]pyridine.
PLA: Polylactic Acid.
PMMA: Polymethyl Metracrylate.
PMP: Poly(4-methyl-1-pentene).
PO: Performance Objective.
POPs: Persistent Organic Pollutants.
PP: Polypropylene.
ppb: parts per billion (1 in 10^9).
PPCPs: Pharmaceuticals and Personal Care Products.
ppm: parts per million (1 in 10^6).
ppt: parts per trillion (1 in 10^{12}).
PRC: People's Republic of China.
PRPs: Prerequisite Programs.
PS: Polystyrene.
PTDI: Provisional Tolerable Daily Intake.
PTH: Parathyroid Hormone.
PTI: Provisional Tolerable Intake.
PTMI: Provisional Tolerable Monthly Intake.
PTWI: Provisional Tolerable Weekly Intake.
PVA: Polyvinyl Alcohol.
PVC: Polyvinyl Chloride.
PVDC: Polyvinylidene Chloride.
QM: Quantity in Material (limit on the residual quantity of a substance left in the finished material expressed in mg/kg) (EU and MERCOSUR (=LC, Límite de Composición, *Spanish*)).
QMA: Quantity in Material per surface Area (limit on the residual quantity of a substance left in the finished material expressed as mg per 6 dm^2 of the surface in contact with the food) (EU and MERCOSUR (=LCA, Límite de Composición por Area de superficie de contacto, *Spanish*)).
QMA(T): group concentration limit (limit on the residual quantity left in the finished material expressed as mg of total of moiety or substance(s) indicated per 6 dm^2 of the surface in contact with the food) (EU and MERCOSUR (=LCA(T), Límite de

Composición grupal por Area de superficie de contacto, *Spanish*)).
QM(T): group concentration limit (limit on the residual quantity left in the finished material expressed as total of moiety or substance(s) indicated, in mg/kg) (EU and MERCOSUR (=LC(T), Límite de Composición grupal, *Spanish*)).
QMRA: Quantitative Microbiological Risk Assessment.
RAPD: Randomly Amplified Polymorphic DNA.
RASFF: Rapid Alert System for Food and Feed.
RD: Reference Drying.
R&D: Research and Development.
RDAs: Recommended Daily Allowances (*also* Recommended Dietary Allowances).
RDIs: Reference Daily Intakes (*also* Recommended Daily Intakes).
RF: Russian Federation.
RFLP: Restriction Fragment Length Polymorphism.
RIA: Radioimmunoassay.
RIVM: National Institute for Public Health and the Environment (Rijksinstituut voor Volksgezondheid en Milieu, *Dutch*).
RNA: Ribonucleic Acid.
ROS: Reactive Oxygen Species.
RPHA: Reverse Passive Haemagglutination.
RPLA: Reverse Passive Latex Agglutination.
rRNA: Ribosomal Ribonucleic Acid.
RTE: Ready-To-Eat.
RTQ: Real-Time Quantitative.
S/M: ratio (contact surface area of FCM/mass of foodstuff or simulant
SABS: South African Bureau of Standards.
SAIC: State Administration for Industry and Commerce.
SAIF: Surface Adhesion Immunofluorescence.
SARS: Severe Acute Respiratory Syndrome
SCENIHR: Scientific Committee on Emerging and Newly Identified Health Risks.
SCGE: Single Cell Gel Electrophoresis.
SEM: Semicarbazide.
SF: Sampling Frequency.
SFDA: Saudi Food and Drug Authority.
SFDA: State Food and Drug Administration.
SGT 3: MERCOSUR Working Sub-Group 3 (Sub-Grupo de Trabajo 3, *Spanish*)
SIG: Special Interest Group.
S/M: ratio (contact surface area of FCM/mass of foodstuff or simulant).
SML: Specific Migration Limit (expressed in mg/kg) (EU and MERCOSUR (=LME, Límite de Migración Especifica, *Spanish*)).
SML(T): Group Migration Limit (expressed as total of moiety or substance(s) indicated, in mg/kg) (EU and MERCOSUR (=LME(T), Límite de Migración grupal, *Spanish*)).
SPC: Standard Plate Count.
SPM: Scanning Probe Microscopy.
S-PMF: Soft Palm Mid-Fraction.
SPS: Sanitary and Phytosanitary Measures.
SULs: Safe Upper Limits.
SULT: Sulfotransferase.
SVRs: Surface-to-Volume Ratios.
T-2: T-2 toxin.
TAA: Total Antioxidant Activity.
TB: Tuberculosis.
TBS: Tanzania Bureau of Standards.
TBT: Technical Barriers to Trade.
TC: Technical Committee.
TCDD: 2,3,7,8-tetrachlorodibenzo-para-dioxin.
TDI: Tolerable Daily Intake.
TD-NMR: Time-Domain Nuclear Magnetic Resonance.
TEQ: Toxic Equivalent.
TFA: *Trans* Fatty Acids.
TFDA: Tanzania Food and Drugs Authority.
TFS: Tin-Free Steel *also see* ECCS.
TIE: Toxicologically Insignificant Exposure.
TMI: Tolerable Monthly Intake.
TNase: Thermostable (heat-resistant) nuclease.
TNC: Transnational Corporation.
TOR: Threshold of Regulation.
TP: Total Polyphenol.
TRF: Total Reduction Factor.
Trp-P-1: 3-amino-1,4-dimethyl-5H-pyrido [4,3-*b*]indole.

Trp-P-2: 3-amino-1-methyl-5H-pyrido [4,3-*b*]indole.
TRIPS: Trade-Related Aspects of Intellectual Property Rights.
TTC: Threshold of Toxicological Concern.
TTMRA: Trans-Tasman Mutual Recognition Arrangement.
UAE: United Arab Emirates.
UBSL: Universally Banned Substances List.
UDPGT: UDP-glucuronosyl transferase.
UF: Uncertainty Factor.
UGT: Glucuronosyltransferase.
UK: United Kingdom.
UN: United Nations.
UNECA: United Nations Economic Commission for Africa.
UNFPA: United Nations Population Fund (*formerly* United Nations Fund for Population Activities).
UNIDO: United Nations Industrial Development Organization.
UNWTO: United Nations World Tourism Organization.
URAA: Uruguay Round Agreement on Agriculture.
US/USA: United States (of America).
USC: United States Code.
USDA: United States Department of Agriculture.
US RDAs: US Recommended Daily Allowances.
UV: Ultraviolet.
UVB: Ultraviolet B.
UVM: University of Vermont.
VCM: Vinyl Chloride Monomer.
WC: Water Content.
WEF: World Economic Forum.
WFS: World Food Summit.
WG: Working Group.
WHO: World Health Organization.
WTO: World Trade Organization.

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