iMIS Food - Chemical Hazards

Chemical Component	Food Product	Legislation	Comments
FOOD CONTACT MATERIALS (FCMs)			
Bisphenols (e.g., BPA, BPS, BPF)	Foods in contact with polycarbonate plastics or epoxy resins (e.g., canned foods, reusable beverage bottles).	· **Reg. (EC) No 1935/2004:** Framework for FCMs. · **Reg. (EU) No 10/2011:** Specific rules for plastic FCMs, including migration limits for BPA (currently under revision for stricter limits or ban in many FCMs). · **Reg. (EU) 2018/213:** Specific rules on BPA in varnishes and coatings intended to come into contact with food.	BPA is an endocrine disruptor. Migration into food is a concern. Trend towards replacing BPA in many applications.
Phthalates (e.g., DEHP, DBP, BBP, DINP, DIDP)	Foods in contact with soft PVC or other plastics containing phthalates (e.g., packaging, tubing, conveyor belts, gaskets).	· **Reg. (EC) No 1935/2004:** Framework for FCMs. · **Reg. (EU) No 10/2011:** Sets specific migration limits (SMLs) for certain phthalates in plastic FCMs. · **REACH** (Reg. (EC) No 1907/2006): Restricts certain phthalates in consumer articles.	Used as plasticizers. Some are endocrine disruptors and can leach into fatty foods.
Per- and Polyfluoroalkyl Substances (PFAS) from FCMs	Foods in contact with grease-resistant paper and board (e.g., fast food wrappers, microwave popcorn bags), non-stick cookware.	· **Reg. (EC) No 1935/2004:** Framework for FCMs. Specific national measures exist in some EU countries. EU-wide harmonized limits for PFAS in FCMs are under development.	"Forever chemicals" that are persistent. Concerns about bioaccumulation and various health effects. Migration from FCMs is one exposure route.
Mineral Oil Hydrocarbons (MOSH & MOAH) from FCMs	Foods in contact with packaging made from recycled paper/cardboard, printing inks, adhesives, or lubricants used in FCM manufacturing.	· **Reg. (EC) No 1935/2004:** Framework for FCMs. No specific EU-wide SMLs for MOSH/MOAH from FCMs yet, but under active discussion. · **Recommendation (EU) 2017/84:** Monitoring of mineral oil hydrocarbons in food and in materials and articles intended to come into contact with food.	MOSH can accumulate in the body. MOAH are potentially carcinogenic and genotoxic. Migration from packaging, especially recycled cardboard, is a key concern.

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Other FCM substances (e.g., NIAS, printing inks, adhesives)	Any packaged or processed food.	· **Reg. (EC) No 1935/2004:** General safety requirements. · **Reg. (EU) No 10/2011:** For plastics. · **Reg. (EC) No 2023/2006:** Good Manufacturing Practice for FCMs. · Specific measures for other materials (e.g., ceramics, regenerated cellulose film).	Includes Non-Intentionally Added Substances (NIAS). Safety assessment is crucial. Printing inks and adhesives should not transfer harmful substances.
NATURALLY OCCURRING TOXINS			
Allergens (Proteins causing immune reactions)	Cereals containing gluten, crustaceans, eggs, fish, peanuts, soybeans, milk, nuts, celery, mustard, sesame seeds, sulphites, lupin, and molluscs.	· **Reg. (EU) No 1169/2011:** Mandatory labelling of the 14 major allergens.	Can cause severe reactions, including anaphylaxis. Strict avoidance and clear labelling are essential. Cross-contamination is a major challenge.
Mycotoxins (Produced by Fungi)	Cereals, nuts, spices, fruits, coffee, milk (for Aflatoxin M1), etc.	· **Reg. (EU) 2023/915:** Sets MLs for various mycotoxins (e.g., aflatoxins, ochratoxin A, patulin, *Fusarium* toxins) in different foodstuffs.	Toxic compounds produced by moulds. Can be carcinogenic, nephrotoxic, hepatotoxic, immunotoxic, etc. Control through GAP, GHP, and appropriate storage.
Plant Toxins (e.g., glycoalkaloids, cyanogenic glycosides, pyrrolizidine alkaloids, erucic acid, tropane alkaloids, Δ9-THC)	Potatoes, cassava, linseeds, honey, comfrey, borage, poppy seeds, hemp products, certain vegetables and fruits.	· **Reg. (EU) 2023/915:** Sets MLs for erucic acid, tropane alkaloids, hydrocyanic acid, pyrrolizidine alkaloids, opium alkaloids, and Δ9-THC equivalents in specific foods.	Natural defence mechanisms of plants. Can cause various toxic effects. Proper selection, preparation (e.g., peeling, cooking), and processing can reduce levels.
Marine Phycotoxins & Biotoxins (e.g., saxitoxins, domoic acid, okadaic acid group, yessotoxins, azaspiracids, ciguatoxins)	Shellfish (mussels, oysters, scallops, clams), certain fish (for ciguatoxins).	· **Reg. (EC) No 853/2004:** Specific hygiene rules for food of animal origin, including max limits for marine biotoxins in live bivalve molluscs. · **Reg. (EU) 2019/627:** Uniform practical arrangements for the performance of official controls on products of animal origin.	Produced by certain algae. Accumulate in filter-feeding shellfish or fish. Can cause severe neurological, gastrointestinal, or amnesic poisoning. Monitoring of harvesting areas is crucial.
PROCESSING BY-PRODUCTS			

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Acrylamide	High-carbohydrate foods cooked at high temperatures (e.g., French fries, potato crisps, bread, biscuits, coffee).	· **Reg. (EU) 2017/2158:** Establishes mitigation measures and benchmark levels for the reduction of acrylamide in food. (Benchmark levels are not maximum limits).	Formed from sugars and asparagine during high-temperature cooking (>120°C). Probable human carcinogen. Mitigation strategies focus on recipe and process adjustments.
Furans and **Alkylfurans**	Heat-treated foods (e.g., coffee, canned/jarred foods, baby foods).	· **Recommendation (EU) 2022/495:** Monitoring of furan and alkylfurans in food. No specific EU maximum limits yet.	Formed during thermal processing. Furan is a possible human carcinogen. Research ongoing into formation and mitigation.
Polycyclic Aromatic Hydrocarbons (PAHs), including Benzo(a)pyrene	Foods smoked, dried, grilled, roasted, or barbecued. Oils and fats, cereals. Contamination from environmental sources also.	· **Reg. (EU) 2023/915:** Sets MLs for benzo(a)pyrene and the sum of 4 PAHs (PAH4) in various foodstuffs, including oils, smoked products, cocoa, baby foods, and spices.	Formed during incomplete combustion of organic matter. Some PAHs are genotoxic carcinogens. Control of smoking/drying processes and minimizing environmental contamination are key.
3-MCPD esters and **Glycidyl esters** (GE)	Refined vegetable oils and fats, and foods containing them (e.g., margarine, bakery products, infant formula).	· **Reg. (EU) 2023/915:** Sets MLs for glycidyl fatty acid esters (expressed as glycidol) and for the sum of 3-MCPD and 3-MCPD fatty acid esters (expressed as 3-MCPD) in vegetable oils and fats, fish oils, and infant formulae.	Formed during the refining of vegetable oils at high temperatures. Glycidol is genotoxic and carcinogenic. 3-MCPD is a suspected carcinogen and can affect kidneys and male fertility.
Nitrosamines (e.g., NDMA)	Cured meats treated with nitrites, beer, malt, some processed fish, rubber products (e.g. teats).	· **Reg. (EU) 2023/915:** Sets MLs for sum of N-nitrosodimethylamine (NDMA) and N-nitrosodiethylamine (NDEA) in certain foods. Nitrites/nitrates as additives are regulated by **Reg. (EC) No 1333/2008.**	Formed from nitrites/nitrates and amines. Many are potent carcinogens. Levels in food have decreased due to changes in processing methods (e.g., addition of ascorbic acid).
Ethyl carbamate (Urethane)	Fermented foods and beverages (e.g., stone fruit spirits, bread, soy sauce).	· **Recommendation (EU) 2016/22:** Prevention and reduction of ethyl carbamate contamination in stone fruit spirits. No harmonized EU maximum limits in all foods.	Naturally formed during fermentation or storage from precursors. Genotoxic carcinogen.

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Benzene	Beverages containing benzoate salts and ascorbic acid (vitamin C), especially when exposed to heat or light. Some packaging materials.	No specific EU MLs for benzene in most foods; often managed under general safety provisions of **Reg. (EC) No 178/2002.** Limits exist for drinking water.	Known human carcinogen. Formation in beverages is a concern. Reformulation by industry has reduced levels.
ENVIRONMENTAL CONTAMINANTS			
Heavy Metals (Lead, Cadmium, Mercury, Arsenic, Tin)	Fish and seafood (Hg, As), cereals, vegetables, rice (As, Cd, Pb), offal (Cd), canned foods (Sn), game meat (Pb), drinking water.	· **Reg. (EU) 2023/915:** Sets MLs for lead, cadmium, mercury, inorganic arsenic, and tin in a wide range of foodstuffs.	Toxic and can accumulate in the body. Sources include industrial pollution, agricultural practices, and natural occurrence. Various adverse health effects (neurological, kidney damage, cancer).
Dioxins (PCDDs, PCDFs) **Polychlorinated Biphenyls** (PCBs) **Dioxin-like PCBs** (dl-PCBs)	Fatty fish, meat, dairy products, eggs, and animal feed.	· **Reg. (EU) 2023/915:** Sets MLs for the sum of dioxins, sum of dioxins and dl-PCBs, and for non-dioxin-like PCBs (NDL-PCBs) in various foods of animal origin and some vegetable oils.	Persistent organic pollutants (POPs) that bioaccumulate in the food chain. Carcinogenic, endocrine disrupting, neurotoxic, and immunotoxic effects.
Per- and Polyfluoroalkyl Substances (PFAS)	Drinking water, fish, shellfish, meat, eggs, dairy products, fruits and vegetables grown in contaminated areas.	· **Reg. (EU) 2023/915:** Sets MLs for the sum of PFOS, PFOA, PFNA, and PFHxS, and for sum of these four PFAS, in certain foods of animal origin (eggs, fish meat, meat of wild game, offal). Drinking water directives also set limits.	"Forever chemicals" from industrial uses and firefighting foams, contaminating soil and water. Bioaccumulative with various adverse health effects.
Nitrates and **Nitrites**	Leafy green vegetables (e.g., spinach, lettuce), root vegetables (e.g., beetroot), drinking water (from fertilizers), cured meats (as additives).	· **Reg. (EU) 2023/915:** Sets MLs for nitrates in certain vegetables (e.g., spinach, lettuce, rucola) and processed cereal-based foods and baby foods. · **Reg. (EC) No 1333/2008:** Regulates use of nitrites (E249-E250) and nitrates (E251-E252) as food additives.	Nitrates naturally occur in plants. High levels can be converted to nitrites in the body, which can lead to methaemoglobinaemia ("blue baby syndrome") and formation of carcinogenic nitrosamines.

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Pesticide Residues	Fruits, vegetables, cereals, tea, spices, animal products (from feed or direct treatment).	· **Reg. (EC) No 396/2005**: Sets MRLs for pesticides in or on food and feed of plant and animal origin.	Residues of substances used to protect plants from pests/diseases. MRLs are set to protect consumers and reflect Good Agricultural Practice (GAP).
Perchlorate	Fruits and vegetables (due to contaminated irrigation water or fertilizers), drinking water.	· **Reg. (EU) 2023/915:** Sets MLs for perchlorate in certain fruits, vegetables, teas, herbal infusions, and infant formulae.	Can interfere with thyroid hormone production. Contamination sources include some fertilizers, industrial activities, and hypochlorite solutions.
Persistent Organic Pollutants (POPs) other than Dioxins/PCBs (e.g., some banned pesticides like DDT, PBDEs)	Fatty fish, meat, dairy products.	Stockholm Convention and related EU legislation (e.g., **Reg. (EU) 2019/1021** on POPs) aim to eliminate or restrict production and use. Some MRLs via **Reg. (EC) No 396/2005** for legacy pesticides. · **Reg. (EU) 2023/915** for Dioxins/PCBs. Specific limits for PBDEs in food are not broadly set in EU but are monitored.	Bioaccumulative, toxic, and persist in the environment. Include some flame retardants (PBDEs) and older pesticides. Various health effects.
VETERINARY DRUG RESIDUES			
Antibiotics	Meat, milk, eggs, honey, farmed fish.	· **Reg. (EU) 2019/6:** On veterinary medicinal products. · **Reg. (EU) No 37/2010:** Establishes MRLs for pharmacologically active substances in foodstuffs of animal origin.	Used to treat/prevent animal diseases. Residues can contribute to antimicrobial resistance (AMR) and cause allergic reactions in sensitive individuals. Withdrawal periods must be observed.
Hormones and Growth Promoters (e.g., anabolic steroids, beta-agonists)	Meat and meat products.	· **Council Directive 96/22/EC:** Prohibits the use of certain substances having a hormonal or thyrostatic action and beta-agonists in farm animals (with some therapeutic exceptions). · **Reg. (EU) 2019/6** and **Reg. (EU) No 37/2010** for authorized substances.	Illegal use for growth promotion is a concern due to potential health risks for consumers (e.g., endocrine disruption, cancer). Strict monitoring programs are in place in the EU.
Other Veterinary Drugs (e.g., anthelmintics, coccidiostats)	Meat, milk, eggs, honey.	· **Reg. (EU) 2019/6:** On veterinary medicinal products. · **Reg. (EU) No 37/2010:** Establishes MRLs.	Residues must not exceed MRLs to ensure consumer safety.

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PROCESSING ENVIRONMENT			
Cleaning and Disinfectant Residues (e.g., QACs, chlorates)	Any food product, especially those in direct contact with food surfaces (e.g., fresh produce, RTE foods, dairy).	· **Reg. (EC) No 852/2004:** General hygiene rules. · **Biocidal Products Regulation** (Reg. (EU) No 528/2012) for active substances. · MRLs for some residues (e.g., chlorate) are set via **Reg. (EC) No 396/2005** as if they were pesticides.	Residues can result from improper use or inadequate rinsing. Can be toxic or form undesirable by-products. Good Hygiene Practices (GHP) are essential.
Lubricants (Industrial, non-food grade)	Processed foods where machinery is used.	· **Reg. (EC) No 1935/2004** may apply if considered FCMs. · **Good Manufacturing Practice** (Reg. (EC) No 2023/2006). Use of food-grade (H1) lubricants is industry best practice where incidental contact is possible.	Contamination from non-food-grade lubricants can introduce harmful substances. Food-grade lubricants are designed for incidental contact. Proper equipment maintenance is key.
Unapproved or Misused Food Additives (e.g., illegal dyes like Sudan Red, undeclared allergens used as additives, excessive levels of permitted additives)	Various foods, especially imported products, spices, confectionery, processed foods.	· **Reg. (EC) No 1333/2008:** On food additives (positive list, conditions of use, MLs). · **Reg. (EU) No 1169/2011:** Labelling, including for allergens.	Deliberate adulteration or incorrect use of additives can pose serious health risks. Includes use of banned substances or permitted ones above legal limits or in unauthorised foods.