

iMIS Food - Chemical Hazards Table			
Chemical Component	Food Product	Legislation	Comments
Food Contact Materials			
Bisphenols (Bisphenol A (BPA), BPS, BPF)	Food contact materials (epoxy resins in cans, polycarbonate plastics), can leach into food.	Reg. (EU) 10/2011 sets migration limits for phthalates in food contact plastics Reg. (EU) 2024/3190 establishes specific requirements concerning BPA in food contact materials	BPA can be used in the production of polycarbonate plastics and epoxy resins often used in can linings, however, some of them are known to be endocrine disruptors.
Phthalates (DEHP, DBP, BBP, DINP, DIDP)	Food contact materials (packaging, processing equipment).	REACH (Reg. (EC) 1907/2006) restricts certain phthalates in articles Reg.(EU) 10/2011 sets migration limits for phthalates in food contact plastics	Phthalates are plasticizers used to make plastics flexible. Some phthalates are endocrine disruptors and can leach into food from packaging or processing equipment (e.g. autoclaving or heating of filled packaging).
Naturally Present			
Allergens (Proteins or Glycoproteins)	14 major allergens are specifically regulated in the EU: * Cereals containing gluten * Crustaceans * Eggs * Fish * Peanuts * Soybeans * Milk * Nuts * Celery * Mustard * Sesame seeds * Sulphur dioxide and sulphites * Lupin * Molluscs	Labelling according to Reg. (EU) 1169/2011	Proteins triggering IgE-mediated reactions. Severity: mild to anaphylaxis. Strict avoidance is crucial. Food businesses must prevent cross-contact and label clearly.
Plant toxins (Pyrrolizidine, Alkaloids, Glycosides, Δ9-THC)	Vegetables and fruit and derived foods.	Maximum levels are set according to Reg.(EU) 2023/915	Plant toxins are natural defense mechanisms. They have various toxic effects, including liver damage, neurological problems, digestive issues, and others. Proper food selection, preparation (cooking, soaking, peeling), and processing are crucial to minimize risks. Toxin levels vary based on plant variety, growing conditions, and storage.
Processing and Production Contaminants			
PAHs & Benzo(a)pyrene (Polycyclic aromatic hydrocarbons)	Oils/fats, smoked meat products , aromas etc.	Maximum levels are set according to Reg.(EU) 2023/915	Formed during combustion processes such as baking, roasting, and barbecuing, are carcinogenic and can induce cancer in the lungs and digestive tract.
3-monochloropropane-1,2-diol (3-MCPD)	Hydrolyzed plant-based oil, soy sauce (e.g. ketjap).	Maximum levels are set according to Reg. (EU) 2023/915	Formed during food processing, particularly the acid hydrolysis of vegetable oils. A process contaminant. High levels of 3-MCPD have raised concerns about potential adverse health effects.
Mineral oils (MOSH, MOAH,MOH)	Processed meats (e.g., bacon, ham, salami), leafy green vegetables, some drinking water.	No specific regulation, ongoing discussion on setting MRLs	Mineral oil contamination sources: food contact materials (inks, adhesives, recycled paper/cardboard), processing aids (lubricants), and environmental contamination. MOAH are a concern due to potential genotoxicity/carcinogenicity. MOSH accumulate in human tissues; long-term effects are unclear. Prevention: functional barriers, food-grade lubricants, controlling contamination.
Dimer and polymerized triglycerides (DPTG)	Refined vegetable oils and fats.	Commodities Act Decree on the Preparation and Treatment of Foodstuffs (Dutch Legislation) stipulates that the DPTG content must be lower than 16 %	DPTG are formed during the refining process of vegetable oils and fats, particularly at high temperatures. They are considered process contaminants.
Free fatty acids (FFA)	Chemical ComponentFood ProductLegislationComments Free Fatty Acids (FFAs) Oils and fats (e.g., olive, palm, fish, animal fats), foods containing fats that have undergone hydrolysis.	No general EU limits for FFAs in all foods. Quality standards for specific oils (e.g., olive oil - Reg. (EU) 2022/2104) often include limits	Formed by hydrolysis of triglycerides (fats) due to enzymes, heat, moisture, or microbes. High levels indicate rancidity, poor quality, or improper storage. Very high levels of oxidized FFAs can have negative health effects. Lowers smoke point.
Components of fat oxidation (Aldehydes, Ketones, Hydroperoxides, Epoxides etc.)	Oils and fats (especially unsaturated oils), fried foods, processed foods containing fats, and susceptible to rancidity.	No specific regulation, some products have specific standards (e.g. olive oil)	Fat oxidation, initiated by heat, light, oxygen, and metals, is a chain reaction producing compounds that cause rancidity. While not inherently unsafe, some oxidation products are potentially toxic at high levels. Control: antioxidants, proper storage, and processing.
Products of Caramelization and Maillard (Diacetyl, Furans, Maltol, 5-HMF, Acetylformoin, Furanones, Pyrazines, etc.)	Heated sugar-containing foods, especially those with low moisture content and subjected to high temperatures (e.g., caramel, candies, baked goods, roasted coffee, some sauces, browned onions, toasted bread).	No specific EU regulations set maximum limits for all caramelization products in all foods. Certain caramel colors (food additives) are regulated (Reg. (EC) 1333/2008).	Caramelization and Maillard are non-enzymatic browning of sugars when heated. It produces a complex mixture of volatile and non-volatile compounds, contributing to characteristic flavors and colors. While many caramelization and Maillards products are desirable, some (e.g., furans, 5-HMF, acrylamide) are of potential concern at high levels. Controlling temperature and heating time is crucial.
Furans and Alkylfurans	Heat-treated foods, especially those containing carbohydrates, amino acids, or unsaturated fatty acids	Recommendation (EU) 2022/495 to monitor the presence in food	Furans are formed during thermal processing (e.g., cooking, roasting, canning) via multiple pathways, including Maillard reaction, caramelization, and degradation of ascorbic acid (vitamin C), and oxidation of polyunsaturated fatty acids. Furan itself is classified as a possible human carcinogen (IARC Group 2B)

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Acrylamide	Foods cooked at high temperatures, particularly starchy foods (e.g. potato chips and French fries, bread crusts, breakfast cereals, and coffee).	Reg. (EU) 2017/2158: establishing mitigation measures and benchmark levels for the reduction of the presence of acrylamide in food	Acrylamide is a process contaminant formed in certain foods during high-temperature cooking (above 120°C), especially when starchy foods are fried, baked, or roasted. It is a potential carcinogen.
Lubricants (Mineral oil-based - synthetic and food-grade)	Potentially any processed food, especially those produced using machinery with moving parts (e.g., meat, baked goods, canned foods, dairy products, beverages).	Food grade lubricants should follow NSF International standards, categorized as H1, H2, or H3.	Concern is with non-food-grade lubricants containing toxic components. Food-grade (H1) lubricants are designed for incidental contact. Prevention: use H1 lubricants, maintain equipment, and implement HACCP.
Cleaning and Disinfectants Residues (QACs/Quats, Chlorine-based compounds)	Potentially any food, especially those processed in facilities where these chemicals are used. Higher risk with foods that have direct contact with surfaces (e.g., fruits, vegetables, meat, ready-to-eat foods).	Reg. (EC) 852/2004: On the hygiene of foodstuffs. Requires food businesses to implement procedures to prevent contamination, including from cleaning and disinfection chemicals	Residues occur from inadequate rinsing, improper dilution, or non-approved chemicals. Some cleaning agents can form undesirable by-products with food. Prevention: follow instructions, rinse thoroughly, use food-safe chemicals, and implement HACCP and GMP.
Refrigerants (CFCs, HCFCs, Ammonia etc.)	Potentially any chilled or frozen food, especially those stored or processed in facilities with refrigeration systems.	Reg. (EC) 852/2004: On the hygiene of foodstuffs. Requires food businesses to implement procedures to prevent contamination, including from refrigerants.	Leaks cause food contamination and worker risks. Prevention: maintenance, leak detection, correct installation, and compliance.
Azo dyes and similar colourants	Illegal use may occur in various foods to enhance color e.g. spices and oils	Reg.(EC) 1333/2008 sets permitted azo dyes an maximum levels	Only permitted azo dyes (e.g., tartrazine) are allowed in food, with maximum levels set by the regulation. Non-permitted azo dyes are strictly forbidden. Importing party's certificates of analysis are mandatory, and member states conduct random sampling.
GMOs	GM crops (soy, corn, etc.), processed foods, animal feed.	Reg. (EC) 1829/2003 (authorization), Reg. (EC) 1830/2003 (labeling) Directive 2001/18/EC (environmental release).	Require pre-market safety assessment. Mandatory labeling above 0.9% threshold (if not adventitious). Focus on consumer choice and traceability.
Primary Production and Environment Contaminants			
Pesticides (Herbicides, Fungicides, Insecticides)	Vegetables, spices and herbs.	The maximum amount, acceptance, and usage of pesticides are regulated in Regulation (EC) 396/2005	Pesticides protect crops from pests, diseases, and weeds. MRLs, based on toxicological data and dietary intake, are set for consumer safety but are trading standards reflecting Good Agricultural Practices (GAP).
Mycotoxins	Vegetables, spices and herbs.	Maximum levels are set according to Reg. (EU) 2023/915	Mycotoxins are toxic compounds produced by certain fungi that can grow on crops. Maximum levels (MLs), based on toxicological data and dietary intake, are set for consumer safety
PAHs & Benzo(a)pyrene (Polycyclic aromatic hydrocarbons)	Oils/fats, smoked meat products , aromas etc.	Maximum levels are set according to Reg. (EU) 2023/915	Formed during combustion processes such as baking, roasting, and barbecuing, are carcinogenic and can induce cancer in the lungs and digestive tract.
Dioxins Polychlorinated dibenzodioxins (PCDD's), Polychlorinated dibenzofurans PCDF and 2,3,7,8-Tetrachlorodibenzodioxin (TCDD)	Accumulate in meat (via contaminated feed), poultry, fish (especially fatty fish like herring and salmon), vegetables, oils/fats, dairy products, and eggs.	Maximum levels are set according to Reg. (EU) 2023/915	Formed from chlorinated precursors during heating with low oxygen levels. These compounds are carcinogenic to both humans and animals above a certain threshold.
Polychlorinated biphenyls (PCBs and dioxin-like PCBs)	Accumulate in meat (via contaminated feed), poultry, fish (especially fatty fish like herring and salmon), vegetables, oils/fats, dairy products, and eggs.	Maximum levels are set according to Reg. (EU) 2023/915	Carcinogenic and can cause skin disorders, reproductive toxicity, and liver diseases. Used in various products (ink, paint) and are highly persistent, and require high-temperature incineration (typically >1000°C, often >1200°C) for destruction. They are insoluble in water.
Polybrominated diphenyl ethers (PBDEs)	Contaminate fish through water.	REACH Reg. (EC) 1907/2006 - PBDEs are listed as Substances of Very High Concern (SVHCs) which can lead to restrictions on their use in articles, some of which may come into contact with food	Persistent, bioaccumulative flame retardants (many banned/restricted). Endocrine, neurodevelopmental, reproductive, and potential cancer risks. Food contamination (mainly fish) from environmental persistence.
Organotin Compounds (Tributyltin (TBT), Triphenyltin (TPT), Dibutyltin (DBT) etc.)	Seafood (especially shellfish, as TBT and TPT were used in antifouling paints on ships), food in contact with PVC materials stabilized with organotins (historically, less common now due to restrictions).	Reg. (EC) 782/2003 prohibits the use of organotin compounds in ships	Highly toxic, persistent, prohibited use in Europe.
Heavy metals Lead (Pb), Cadmium (Cd), Tin (Ti), mercury (Hg), Arsenic (As)	Vegetables, spices, herbs, herbs (heavy metals might contaminate food through air, water and soil).	Maximum levels are set according to Reg. (EU) 2023/915	Heavy metals are naturally occurring elements that can be toxic to humans and animals even at low levels. They can accumulate in the body over time, posing health risks. Food contamination is a major route of exposure, often due to environmental pollution or natural presence in soil and water.

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Nitrate/nitrite	Processed meats (e.g., bacon, ham, salami), leafy green vegetables, some drinking water.	Maximum levels for nitrates are set according to Regulation (EU) 2023/915 *Regulation (EC) 1333/2008 establishes use of nitrites and nitrates as food additives and their maximum levels	Nitrates are naturally present in vegetables and can also be used as fertilizers, leading to contamination of drinking water. Nitrites are used as food preservatives in processed meats to prevent bacterial growth and maintain color. High intake of nitrates/nitrites can be a health concern, particularly for infants.
Polyfluoroalkyl Substances (PFAS)	Drinking water, fish, meat, eggs, dairy, some produce, food packaging.	Maximum levels are set according to Reg. (EU) 2023/915	"Forever chemicals." Bioaccumulate. Linked to immune, liver, thyroid, developmental problems, cancer. Control: monitoring, regulation, remediation.
Veterinary drugs: Residues (Antibiotics, Antimicrobials, etc.)	Meat and meat products from animals treated with these substances (primarily beef, but potentially also pork, poultry, and other livestock). Milk and dairy products could also be affected if administered to dairy cows.	Regulation (EU) 2019/6: Veterinary medicinal products (authorization, use, withdrawal periods) * Regulation (EU) No 37/2010: MRLs (if established)	Veterinary drugs are used to treat and prevent diseases in food-producing animals. Residues can remain in animal products. Maximum residue limits (MRLs) are set to ensure food safety.
Veterinary drugs: Hormones	Meat and meat products from animals treated with these substances (primarily beef, but potentially also pork, poultry, and other livestock). Milk and dairy products could also be affected if administered to dairy cows.	Regulation (EU) 2019/6: Veterinary medicinal products (authorization, use, withdrawal periods) * Regulation (EU) 37/2010: MRLs (if established)	Hormones can be used therapeutically in food-producing animals under strict veterinary supervision and with adherence to withdrawal periods to ensure residues are below MRLs.
Veterinary drugs: Growth Promoters <u>Anabolic steroids</u> , categorized into three groups: estrogenic-, androgenic- and progestogenic steroids. <u>Synthetic steroids</u> : ethinylestradiol, diethylstilbestrol (DES), trenbolone, and Medroxyprogesterone acetate (MPA) <u>Beta-agonists</u> : clenbuterol, salbutamol and brombuterol	Meat and meat products from animals treated with these substances (primarily beef, but potentially also pork, poultry, and other livestock). Milk and dairy products could also be affected if administered to dairy cows.	Prohibited in the EU for growth promotion in food-producing animals: Council Directive 96/22/EC	Used to increase animal growth and feed efficiency, but residues in meat pose health risks (endocrine disruption, developmental problems, cancer). The EU has a strict "no-hormone" policy for meat; monitoring detects illegal use.