

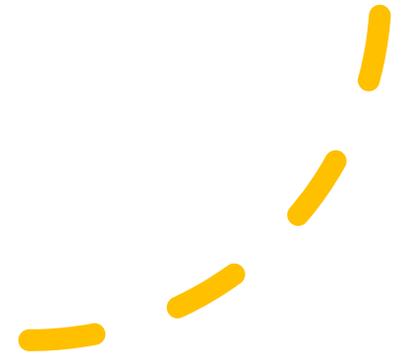
Chemical & Radiological Hazards



Hazard

Definition of 'hazard'

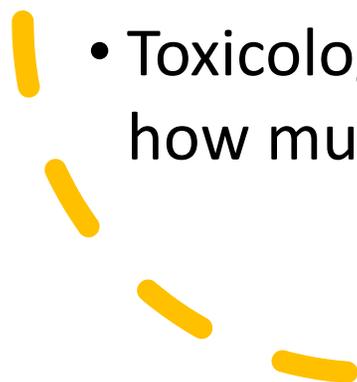
- A biological, chemical or physical agent that is reasonably likely to cause illness or injury in the absence of its control





Chemical Hazards

- Reactions may occur immediately or may accumulate in the body over time
 - acute reactions → immediate
 - chronic reactions → may occur years later
- Toxicological studies determine which ones are 'safe' and how much is 'safe'?



Laws and Regulations

In the US, the FDA, EPA and USDA enforce provisions of laws and regulations to assure that foods are safe and free of adulterants

- FDA = Food & Drug Administration
- EPA = Environmental Protection Agency
- USDA = U.S. Department of Agriculture





Guidance for industry (FDA)

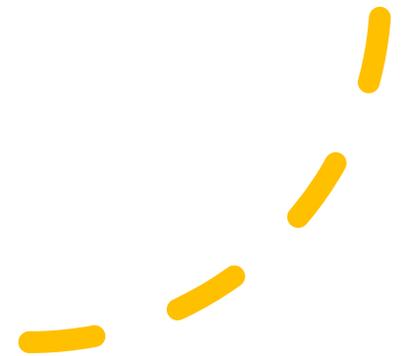
- Chemical, Metals, Natural Toxins & Pesticides Guidance Documents & Regulations

<https://www.fda.gov/food/guidanceregulation/guidancedocumentsregulatoryinformation/chemicalcontaminantsmetalsnaturaltoxinspesticides/default.htm>



Chemical Hazards

- Naturally-occurring chemicals
- Intentionally added chemicals
- Unintentionally added chemicals



Naturally- occurring chemical hazards



Allergens



Mold toxins



Shellfish toxins



Mushroom toxins

Top 8 Allergens

- Peanuts
- Tree nuts
- Eggs
- Milk
- Shellfish
- Fin fish
- Soy
- Wheat



Allergens

- Proteins that induce an allergic reaction
- Symptoms range from mild rashes to trouble breathing to anaphylaxis and, rarely, death
- 3.5-4% of adults have a true food allergy
- Different from 'insensitivities' and 'intolerances'



Allergens and Food Safety

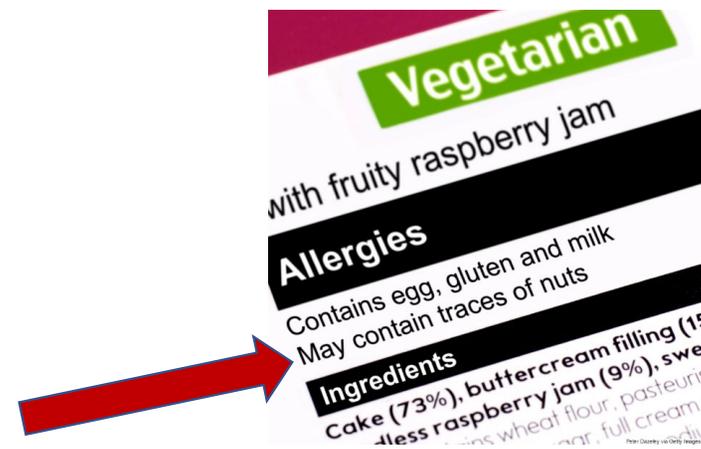
- Control of allergenic ingredients and prevention of cross-contact are essential for food safety
- Concerns:
 - Incorrect formulation
 - Incorrect label
- Food Allergy Labeling

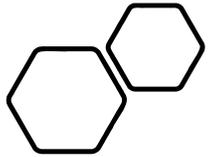


Protein 0g	
Vitamin A 0%	• Vitamin C 2%
Calcium 0%	• Iron 0%
* Percent Daily Values are based on a 2,000 calorie diet.	

Ingredients: Enriched flour (flour, malted barley, niacin, reduced iron, thiamin mononitrate, riboflavin, folic acid), sugar, partially hydrogenated cottonseed oil, high fructose corn syrup, whey, eggs, vanilla, natural and artificial flavoring, salt, leavening (sodium acid pyrophosphate, monocalcium phosphate), lecithin mono and diglycerides.

Contains: Wheat, Milk, Egg, and Soy.



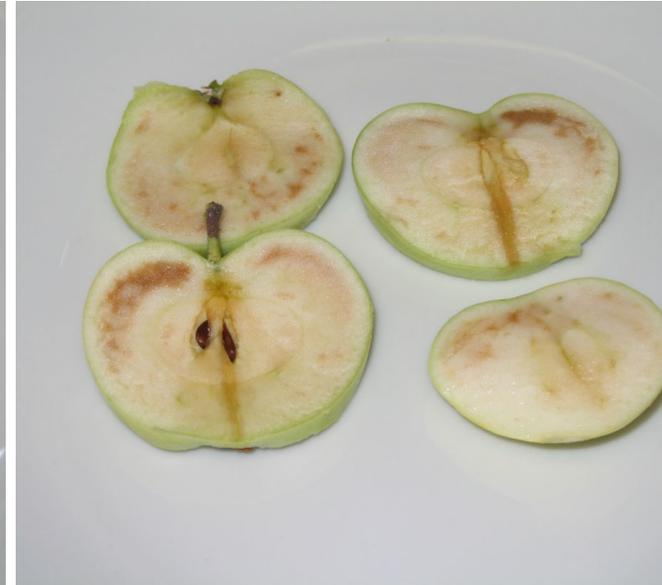


Naturally Occurring
Chemical Hazards

Mold toxins

Mycotoxins

- Patulin (apples)
 - Action level: 50 $\mu\text{g}/\text{kg}$ (ppb) in apple juice
- Ochratoxin (grapes)
- Aflatoxin (peanuts, tree nuts and corn)
 - Action level: 20 $\mu\text{g}/\text{kg}$ (ppb)
- Fumonisin (corn)



Mold in Cannabis

- Cultivation:

- Botrytis (gray mold, bud rot)
- Powdery Mildew
- Fusarium
- **Aspergillus**

- Fungicides and horticultural oils, bicarbonates and biological controls → chemical hazards?

- **Aspergillus spp.** – bigger issue if cannabis is smoked

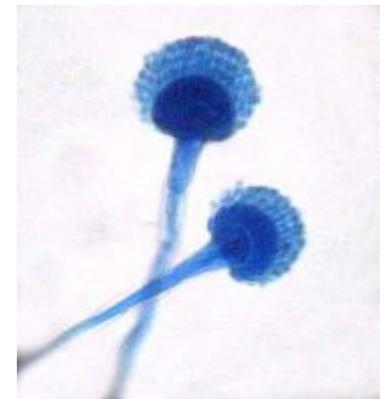
- A. fumigatus (lung infections)
- A. flavus (lung infection **and aflatoxin**)
- A. niger (lung infection)
- A. terreus (lung infection, emerging pathogen)

- What to test for? Each state has different requirements



A. flavus

Photo courtesy of USDA ARS & Peggy Greb.

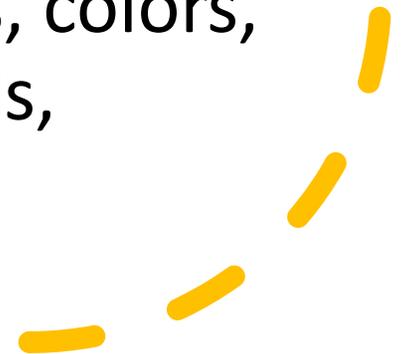


Aspergillus species niger

Photo: Carlos de Paz, Flickr

Intentionally Added Chemicals

- Safe when used appropriately, but can be hazardous if used improperly
- Regulations control the level of use and maximum allowable residues of certain chemicals in foods
- Examples: preservatives, colors, nutrients, processing aids, 'active ingredients'





Intentionally Added Chemicals

- Preservatives
 - Sodium nitrite
 - Sulfites
 - Sodium benzoate
- Colors
 - FD&C Yellow # 5
- Nutrients
 - Vitamin A
- Active Ingredients
 - THC, CBD

Unintentionally Added Chemicals

- Substances that are necessary in the production of food, or cannot be avoided with cGMPs
- FDA establishes tolerances or action levels for specific commodities
 - Examples: Environmental (heavy metals), Packaging (Bisphenol A)



Unintentionally Added Chemicals

- Pesticides
- Sanitizers
- Packaging components
 - Ink on packaging materials
 - Lead from liquid graduated droppers
- Cross contaminants



Control measures for chemical hazards

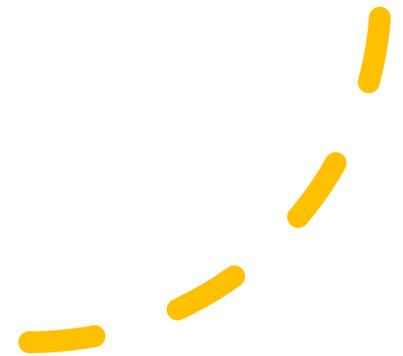
Know your supplier

- Pesticide controls
- Toxic chemicals in packaging materials
- Where produce was grown



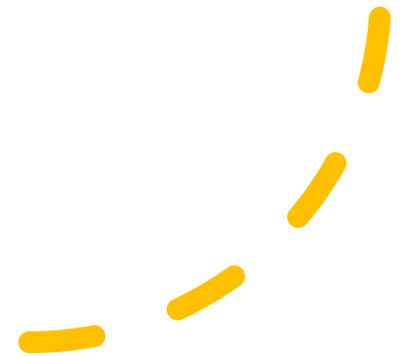
Incoming Materials

- Specifications
- Letter of guarantee
- Certificate of Analysis
- Periodic sampling and testing
- Audit of suppliers



Receiving

- Inspect vehicle for:
 - signs of contamination (odor, spills)
 - presence of moldy materials
 - damage to containers



Allergen Control Measures

Minimize cross-contact by:

- Separate storage
- Equipment design
- Careful and thorough cleaning
- Controlling traffic patterns
- Design of equipment and systems
- Careful control of product labeling
- Formula/Ingredient controls
- Control of rework
- Schedule of production
- Color codes (utensils, tools, people)
- Adequate training of employees



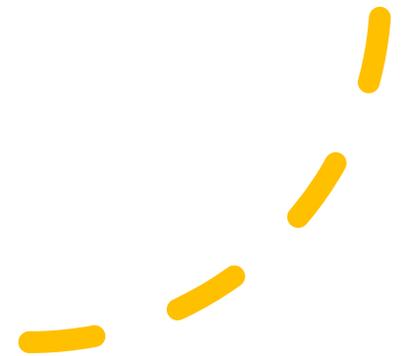
Storage of Chemicals

- Prevent cross-contamination
- Tightly sealed, properly labeled containers
- Physically separate enclosures



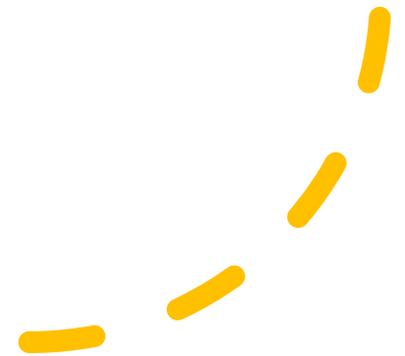
Chemicals in Processing

- Use only approved chemicals
- Control chemicals at point of use
- Trained food handlers



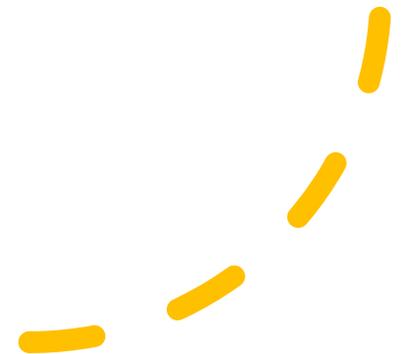
Chemical Residues

- Cleaning & sanitizing procedures must prevent harmful chemical residues on food contact surfaces



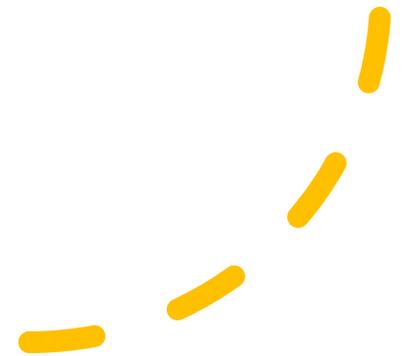
Pesticide Usage

- Labels of pesticides used should be kept on file
- Pesticide usage records
- Limit poison baits to outside plant
- Control storage



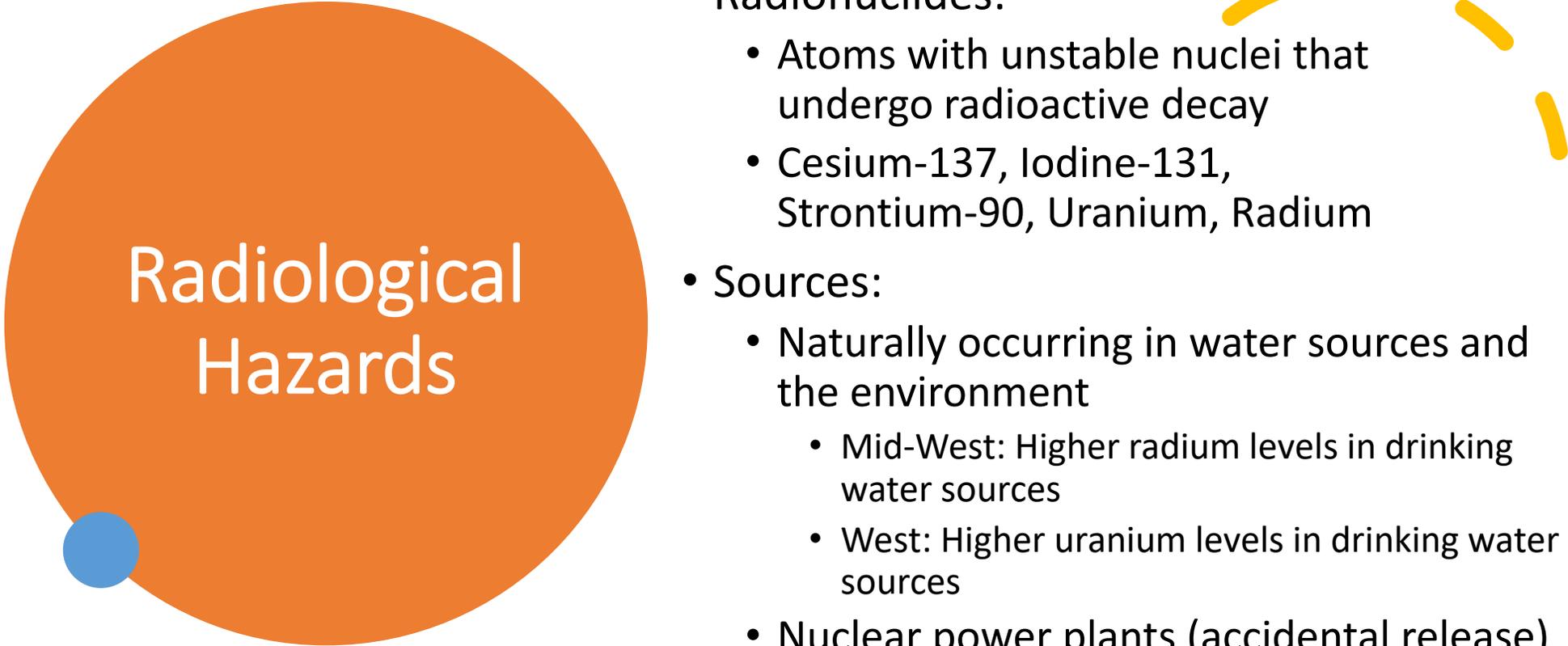
Prior to Shipment

- Inspect vehicles
 - prior to loading
 - after loading



Radiological Hazards

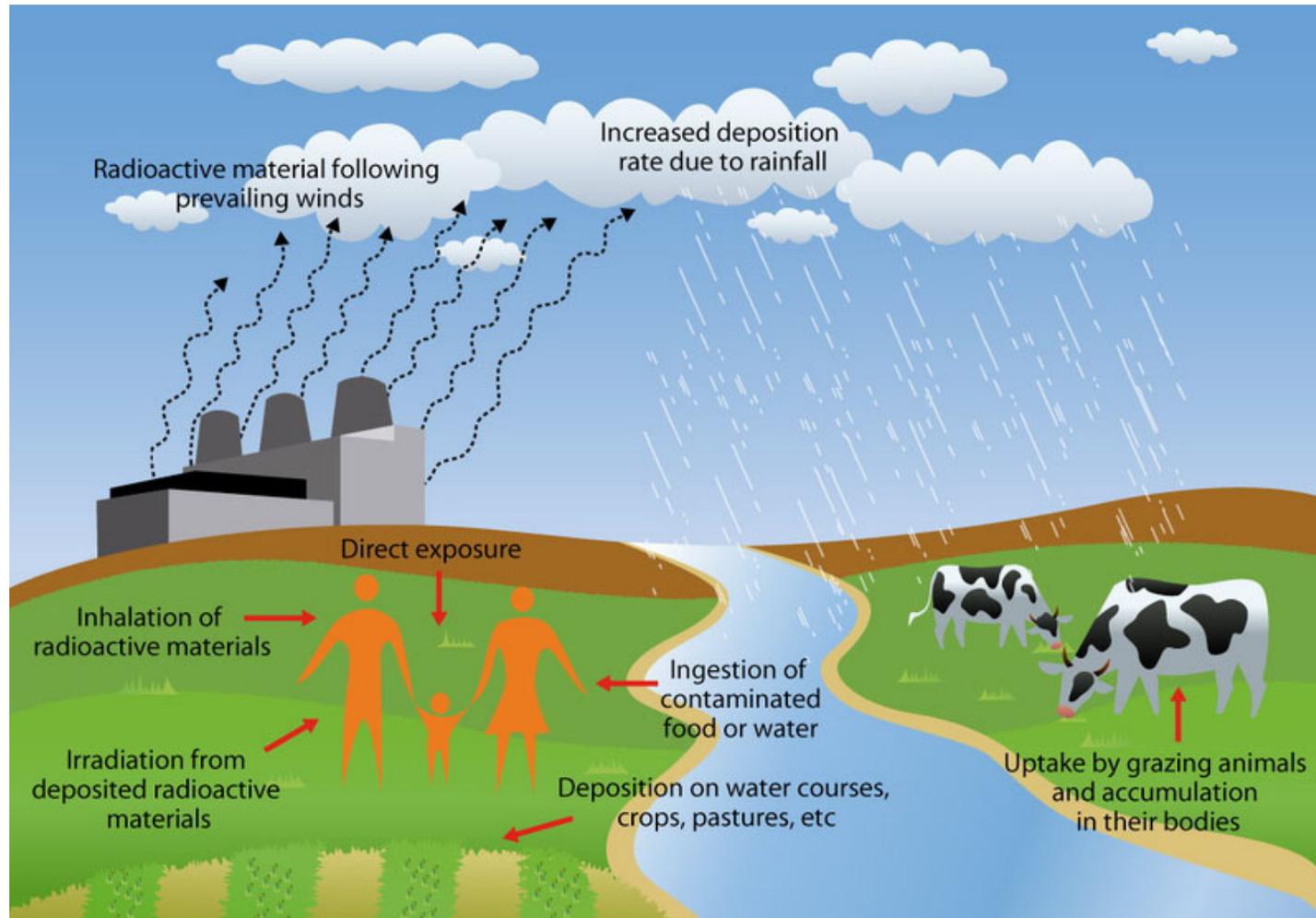




Radiological Hazards

- Radionuclides:
 - Atoms with unstable nuclei that undergo radioactive decay
 - Cesium-137, Iodine-131, Strontium-90, Uranium, Radium
- Sources:
 - Naturally occurring in water sources and the environment
 - Mid-West: Higher radium levels in drinking water sources
 - West: Higher uranium levels in drinking water sources
 - Nuclear power plants (accidental release)
 - Food (after contamination event)

Radiological Hazards



Radiological Hazards

- Health effects:
 - High dose: Radiation sickness
 - Low dose, prolonged exposure: Increased cancer risk
 - Food unlikely source of adverse health effects
 - High-dose contamination after most nuclear incidents unlikely
 - Scrubbing, brushing, peeling can reduce contamination; cooking generally cannot



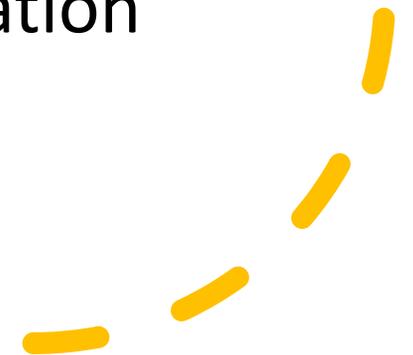
Radiological Hazards

- Regulatory Considerations
 - EPA's Radionuclides Rule regulates some radioactive contaminants in drinking water
 - FDA's CPG 560.750 gives guidance levels for radionuclide activity concentration in domestic and imported food
 - FDA determines adulteration on a case-by-case basis
 - Codex Guideline Levels for Radionuclides in Foods
 - Applicable to nuclear or radiological emergencies



Radiological Hazards

- Control measures
 - Awareness
 - Supplier controls
 - Storage and transportation





Questions?

Comments??