



Module -3

TYPE OF HAZARDS Chemical Hazards

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Chemical hazards



Toxic chemical: defined as temporary or permanent harm or death to humans and animals.

Hazardous chemical: that can harm humans and other animals by being flammable or explosives or irritating or damaging the skin or lungs, interfering oxygen uptake, inducing allergic reactions.



Toxic agents

The three major potential toxic agents are

mutagens: nitrous acid-cause mutations or changes in DNA.

Teratogens: harm the fetus or embryo. Eg: arsenic, benzene, chlorine, chloroform, chromium, DDT, lead, mercury, PCBs, thalidomide, vinyl chloride.

carcinogens: types of radiations, viruses cause cancer. eg: arsenic, vinyl chloride, chromium, PCBs, tobacco smoke

Evaluation of Chemical Hazards

Toxicology : Science that studies the harmful effects of chemicals on humans, wildlife and ecosystem, that cause toxicity and evaluate ways to prevent the hazards.

Or

A basic concept of toxicology is that any synthetic or natural chemical can be harmful if ingested in a large quantity.

Toxicity: a measure of harmful substance causing injury, illness, or death.

Toxicity also depends on *genetic makeup*, which determines an individual's sensitivity to a particular toxin. Some individuals are sensitive to a number of toxins—a condition known as ***multiple chemical sensitivity (MCS)***

DAY to DAY life - Chemicals

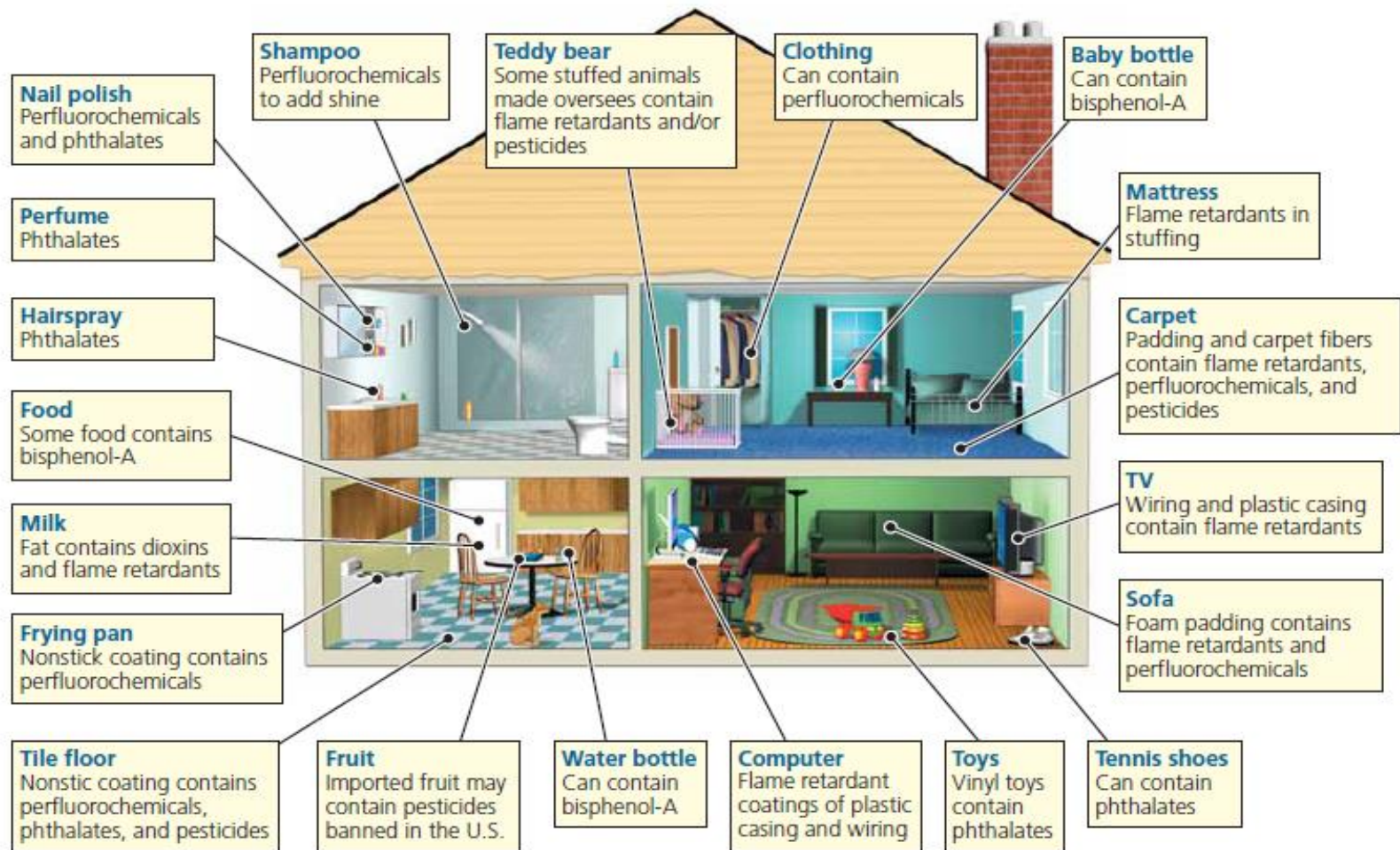


Figure 14-10 Science: some potentially harmful chemicals found in most homes. Most people have traces of these chemicals in their blood and body tissues. We do not know the long-term effects of exposure to low levels of such chemicals. (Data from U.S. Environmental Protection Agency, Centers for Disease Control and Prevention, and New York State Department of Health)

Five Factors – Determine Toxicity

Factor 1: solubility –

- water soluble toxins can easily enter cells in our bodies.
- Fat soluble toxins can penetrate the membranes surrounding cells because the membranes allow the oil soluble chemicals to pass through them.

Factor 2: resistance to break down: Eg: DDT- long effects in humans and wildlife.

Factor 3: Bioaccumulation- even low concentration of toxic Concentration in the environment.

Factor 4: Biomagnification:

Factor 5: chemical interaction Eg. Vitamin E & A can interact to reduce harmful effects.

Age Group

For example,

Infants and young children are more susceptible to the effects of toxic substances than are adults for three major reasons.

First, children breathe more air, drink more water, and eat more food per unit of body weight than do adults.

Second, they are exposed to toxins in dust and soil when they put their fingers, toys, or other objects in their mouths, as they frequently do.

Third, children usually have less well-developed immune systems and body detoxification processes than adults have.

EPA

In 2003, the U.S. Environmental Protection Agency (EPA) proposed that in determining the risk of exposure to cancer-causing chemicals, regulators should assume that children face a risk 10 times higher than that faced by adults.

Some health scientists contend that these guidelines are too weak.

They suggest that, to be on the safe side, we should assume that this risk for children is 100 times that of adults

Difficult to Estimate

Examples of toxicants include certain pesticides, radioactive

isotopes, heavy metals such as mercury and lead, industrial chemicals such as PCBs (polychlorinated biphenyls), and flame retardants such as PBDEs (polybrominated diphenyl ethers).

Estimating the levels and effects of human exposure to chemicals is very difficult.

because of the numerous and often poorly understood factors involved in it.

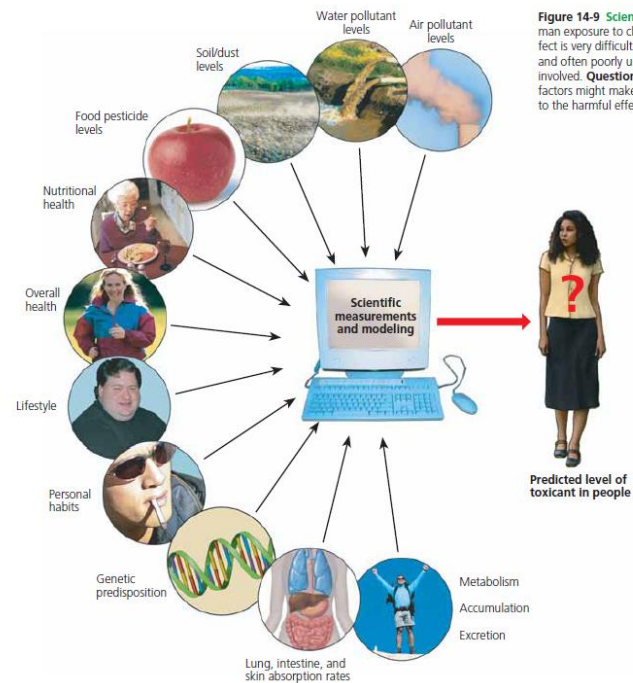


Figure 14-9 Science: estimating human exposure to chemicals and their effect is very difficult because of the many and often poorly understood variables involved. **Question:** What three of these factors might make you more vulnerable to the harmful effects of chemicals?



POPs	Usage
Alpha hexachlorocyclohexane	Pesticide, produced as byproduct of lindane
Beta hexachlorocyclohexane	Pesticide, produced as byproduct of lindane
Chlordecone	Pesticide, agricultural use
Hexabromobiphenyl ether	Flame retardant
Hexabromodiphenyl ether and heptabromodiphenyl ether	Flame retardant, recycling of articles containing these chemicals is allowed
Lindane (Gamma hexachlorocyclohexane)	Pesticide, for control of head lice and scabies as second line treatment
Pentachlorobenzene	Pesticide, unintentionally produced POPs
Perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride	Industrial chemical: Photo-imaging, photo-resis and anti-reflective coatings for semi-conductor and liquid crystal display (LCD) industries, etching agent for compound semi-conductors at ceramic filters, aviation hydraulic fluids, metal plating (hard metal plating and decorative plating), certain medical devices (such as ethyle tetrafluoroethylene copolymer (ETFE) layers an radio-opaque ETFE production, in-vitro diagnosis medical devices, and CCD colour filters)

FACT SHEET

Sources of the Persistent Organic Pollutants (POPs) listed under the Stockholm Convention

Persistent Organic Pollutant	Potential Main Sources
Pesticides	
Aldrin, Chlordane, DDT, Toxaphene, Dieldrin, Endrin, Heptachlor, Hexachlorobenzene (HCB)*, Mirex ▲ Alpha-hexachlorocyclohexane (alpha-HCH)*, Beta-hexachlorocyclohexane (beta-HCH)*, Lindane, Chlordecone, Pentachlorophenol (PCP), Endosulfan	<ul style="list-style-type: none"> • Insecticides • Herbicides • Rodenticides • Bactericides • Fungicides • Larvicides
Industrial Chemicals	
Polychlorinated biphenyl (PCB)*,▲	<ul style="list-style-type: none"> • Heat exchange fluids in electrical equipment e.g. Transformers and Capacitors • Lubricants, Paints, Inks, Adhesives
Brominated Flame Retardants: Hexabromobiphenyl (HBB), Tetra-and penta-bromodiphenyl ether & Hexa-and hepta- bromodiphenyl ether (PBDE), Hexabromocyclododecane (HBCD)	<ul style="list-style-type: none"> • Plastics in electrical and electronic equipment • Polystyrene in transport and construction • Foams for furniture • Textile coating e.g upholstery, furniture, curtains, apparel
Fluorinated Flame Retardants: Perfluorooctane sulfonic acid (PFOS■ /Sulfluramide and PFOS-F)	<ul style="list-style-type: none"> • Firefighting foams • Oil drilling operations • Chrome plating industry • Aviation hydraulic fluids • Surface treatment of synthetic carpets • Textiles and leather
Unintentionally produced POPs (UPOPs)	
Polychlorinated dibenzo-p-dioxins (PCDD), Polychlorinated dibenzofurans (PCDF) Polychlorinated naphthalenes (PCNs), Hexachlorobutadiene (HCBD), Pentachlorobenzene (PeCB) ▲,■	<ul style="list-style-type: none"> • Waste Incineration • Metal Production • Heat and Power Generation • Production of Mineral Products • Transport

NOTES: Blue Text - Original Dirty Dozen POPs, Orange Text - Newly Listed POP
 * Also produced unintentionally,
 ▲ Also used in fire retardants
 ■ Also used as a pesticide

List – Permitted & Prohibited

Active ingredient	Permitted since	Usage prohibited since
Hexachlorobenzene (HCB)	1962	11/07/1980
Toxaphene	1957	27/04/1982
Endrin	1957 (since 1971. Used as rodenticide)	29/05/1989
Aldrin	1958	1972
Dieldrin	1958	1972
Heptachlor	1956	July 1973
Hexachlorocyclohexane (HCH) ^a	1944	1972
DDT	1944	1972 (in agriculture)
Lindane	1944	July 2001
Chlordane	Data before 1995. Not known	1971 (in agriculture)
Mirex	Never allowed in the Croatian plant protection	

^aAlpha-hexachlorocyclohexane, beta-hexachlorocyclohexane are on the list since 2009

IARC MONOGRAPHS ON THE IDENTIFICATION OF CARCINOGENIC HAZARDS TO HUMANS

Sr. No.	IARC Classification	POPs
1	Group 1: The agent (mixture) is carcinogenic to humans	<ul style="list-style-type: none"> 2,3,7,8-Tetrachlorodibenzo-para-dioxin (TCDD)
2	Group 2A: The agent (mixture) is probably carcinogenic to humans	<ul style="list-style-type: none"> Mixtures of polychlorinated biphenyls (PCB)
3	Group 2B: The agent (mixture) is possibly carcinogenic to humans	<ul style="list-style-type: none"> Chlordane DDT Heptachlor Hexachlorobenzene Mirex Toxaphene (mixtures of Polychlorinated camphenes)
4	Group 3: The agent (mixture or exposure circumstance) is unclassifiable as to carcinogenicity in humans	<ul style="list-style-type: none"> Aldrin, Dieldrin and Endrin Polychlorinated dibenzo-para-dioxins (other than TCDD) Polychlorinated dibenzofuran

Source: http://www.chem.unep.ch/gpa_trial/02healt.htm

Thank You