

**APES CHAPTER 17 NOTES (MRS. BAUCK):
HUMAN HEALTH AND ENVIRONMENTAL RISKS**

MODULE 56: Human Diseases

- I. Disease Background Info
 - A. overall definitions
 - 1) **disease**—*an impaired function of the body, manifested by specific symptoms*
 - 2) **infectious disease**—*illness caused by specific pathogens*
 - 3) **acute disease**—*quick onset*
 - 4) **chronic disease**—*ongoing, slow onset*
 - 5) **epidemic**—*when a pathogen causes a rapid increase in the manifestation of a disease*
 - 6) **pandemic**—*an epidemic occurring over a large region*
 - 7) **emergent infectious disease**—*infectious disease that has not been previously described or common for at least 20 years*
 - 8) *life expectancy*—*the average life span of a newborn*
 - 9) *longevity*—*lifespan or lifetime of an individual*
 - B. U.S. public health
 - 1) **Center for Disease Control and Prevention** www.cdc.gov
 - 2) CDC's Disease Listings: <https://www.cdc.gov/diseasesconditions/index.html>
 - C. public health in other countries
 - 1) Ministry of Health-type structures
 - 2) U.N. **World Health Organization (WHO)**

From <http://www.who.int/about/en/>

“The World Health Organization is the United Nations specialized agency for health. It was established on 7 April 1948. *WHO's objective, as set out in its Constitution, is the attainment by all peoples of the highest possible level of health. Health is defined in WHO's Constitution as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.*

WHO is governed by 193 Member States through the World Health Assembly.”

- 3) WHO's World Health report <https://www.who.int/whr/en/>

- D. Developed vs. Developing Countries: a review
 - 1) *Demographic Transition*—*causal link between modernization and decline in birth and death rates*
 - Phase I – “primitive stability” with high CBR and high CDR
 - Phase II – epidemiologic transition; declining CDR
 - Phase III – significant population growth; declining CBR from declining fertility rates
 - Phase IV – “modern stability” with low CBR and CDR
 - Phase V – negative growth
 - 2) *epidemiologic transition*—*pattern of changes in mortality factors; declining CDR from modernization*
 - 3) CBR = crude birth rate = # births per 1000, per year
 - 4) CDR = crude death rate = # deaths per 1000, per year
-

II. Risk Factors for Disease

A. the risk of being poor:

- 1) *according to WHO, poverty is the world's greatest killer*
- 2) WHO leading risk factors:

(* = developed country issue	x = developing country issue	X = both)
<i>Overweight/obesity *</i>	<i>Child underweight x</i>	<i>High blood glucose X</i>
<i>High blood pressure *</i>	<i>Unsafe water, sanitation, hygiene x</i>	<i>High cholesterol X</i>
<i>Tobacco consumption *</i>	<i>Indoor smoke from solid fuels x</i>	<i>Alcohol use X</i>
<i>Insufficient physical activity*</i>	<i>Unsafe sex x</i>	
	<i>Low fruit/veg consumption x</i>	

B. factors associated with poverty that lead to increased environmental hazards

- 1) decreased education and less ability to read, understand, and communicate medical information
- 2) reduced nutrition
- 3) infrequent governmental sponsorship of national health programs
- 4) lack of safe drinking water
- 5) indoor air pollution from burning fuel

C. wealth is an advantage

- 1) *generally, wealth is directly proportional to health*
- 2) access to medical care
- 3) education

D. priorities: health care may suffer due to...

- 1) spending on the military
- 2) development of power sources
- 3) distribution of wealth within a country

E. Risk and Infectious Diseases

- 1) *epidemiology*—a branch of medical science that deals with the incidence, distribution, and control of disease in a population
- 2) *major risk pathway: contamination of food and water*
 - a) not limited to developing countries
 - b) food processing and distribution systems in developed countries are highly vulnerable
 - c) rapid processing and shipping, often distant from where these products are consumed, increase the risk of large-scale food poisoning and water contamination

III. Historically Important Infectious Diseases

A. **plague**—*bacterial infection from Yersinia pestis*

- 1) also called *bubonic plague*, Black Plague, Black Death
- 2) transmitted by fleas, typically from small animals like mice and rats
- 3) modern antibiotics are effective
- 4) mid 1300s: ~25% of European population died
- 5) <https://www.who.int/csr/disease/plague/en/>

B. **malaria**—*tropical disease caused by parasitic protists from the genus Plasmodium*

- 1) pathway of infection
 - a) parasite incubates in the gut of the *Anopheles* mosquito
 - b) migrates to salivary gland, transmitted to humans by bites

- c) reproduces in the human liver
 - d) released into human bloodstream; multiply & destroy red blood cells
 - e) a mosquito bites an infected person to acquire the parasite
- 2) <https://www.who.int/news-room/fact-sheets/detail/malaria>

C. **tuberculosis (TB)**—*bacterial infection of the lungs from Mycobacterium tuberculosis*

- 1) drug-resistance is a problem
- 2) highly contagious
- 3) https://www.who.int/health-topics/tuberculosis#tab=tab_1

D. *diarrhea diseases* – an issue in developing countries then and now

- 1) life-threatening bacterial intestinal infections
- 2) often simple to cure if clean water and basic oral rehydration medicines are available
- 3) can be spread through person-to-person contact, and/or contaminated drinking or food supplies (*E. coli*, *Campylobacter*)
- 4) more severe forms
 - a) epidemic dysentery: *Shigella*
 - b) cholera: *Vibrio*
 - c) typhoid fever: *Salmonella*
- 5) <https://www.who.int/news-room/fact-sheets/detail/diarrhoeal-disease>

E. Other tropical diseases

- 1) yellow fever - Flavivirus
- 2) dengue fever - Flavivirus
- 3) Japanese encephalitis - Flavivirus
- 4) Zika – Flavivirus, from Aedes mosquito
- 5) lymphatic filariasis (elephantiasis) - from parasitic worms
- 6) African trypanosomiasis (sleeping sickness) – Trypanosoma protozoan
- 7) leprosy - Mycobacterium leprae

IV. Emergent Infectious Diseases

A. **emergent infectious disease**—*infectious disease that has not been previously described or common for at least 20 years*

B. **Ebola (Ebola hemorrhagic fever), Ebola virus disease - EVD**

- 1) major outbreak 2014-2016
- 2) migrates from wild animals to people (fruit bats – natural vector)
- 3) <https://www.who.int/news-room/fact-sheets/detail/ebola-virus-disease>

“Ebola is introduced into the human population through close contact with the blood, secretions, organs or other bodily fluids of infected animals such as chimpanzees, gorillas, fruit bats, monkeys, forest antelope and porcupines found ill or dead or in the rainforest. Ebola then spreads through human-to-human transmission via direct contact (through broken skin or mucous membranes) with the blood, secretions, organs or other bodily fluids of infected people, and with surfaces and materials (e.g. bedding, clothing) contaminated with these fluids... People remain infectious as long as their blood contains the virus.”

C. **Mad Cow Disease (bovine spongiform encephalopathy or BSE)**

- 1) *beneficial proteins called **prions** can mutate into deadly pathogens*
- 2) nervous system damage results in loss of coordination and death of the cow
- 3) tainted meat is difficult to sterilize from the pathogen

- 4) humans who eat tainted meat can develop a related disease and die, but the prion can lay dormant for years before manifesting
- 5) <https://www.fda.gov/animal-veterinary/animal-health-literacy/all-about-bse-mad-cow-disease>

D. West Nile Virus

- 1) mosquito-borne disease
- 2) can cause encephalitis (inflammation of the brain)
- 3) mosquito becomes infected by biting a bird which carries the virus
- 4) <https://www.who.int/news-room/fact-sheets/detail/west-nile-virus>

E. HIV/AIDS (Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome)

- 1) transmitted through unprotected sex, using contaminated needles, and blood transfusions
- 2) can be transmitted from mother to fetus
- 3) new drugs are effective but can be expensive
- 4) <https://www.who.int/news-room/fact-sheets/detail/hiv-aids>

F. Swine Flu (Swine Influenza)

- 1) mainly H1N1 virus
- 2) migrates from pigs to people
- 3) <https://www.cdc.gov/flu/swineflu/>

G. Bird Flu (Bird Influenza)

- 1) mainly H5N1 virus
- 2) migrates from birds to people
- 3) [https://www.who.int/news-room/fact-sheets/detail/influenza-\(avian-and-other-zoonotic\)](https://www.who.int/news-room/fact-sheets/detail/influenza-(avian-and-other-zoonotic))

H. SARS – Severe Acute Respiratory Syndrome

- 1) Outbreak 2002-2003
- 2) <https://www.who.int/ith/diseases/sars/en/>

I. SARS-CoV-2

- 1) causes Coronavirus Disease 2019, COVID-19
- 2) global pandemic
- 3) WaWaMu Stats on YouTube has many great videos

<https://www.cdc.gov/coronavirus/2019-ncov/cdcresponse/about-COVID-19.html>

<https://www.who.int/emergencies/diseases/novel-coronavirus-2019>



V. Challenges to Human Health

A. Worldwide

- 1) Pathogens can develop resistance to medications
- 2) Disease can spread across the globe in as little as 24 hours

B. Developed countries

- 1) Some people stop their medications when they feel better, before the full dose is consumed
- 2) Use and overuse of antibacterial soap and hand sanitizer
- 3) Not enough exercise, healthier diet, decreased tobacco use, etc.

- C. Developing countries
 - 1) access to clean water
 - 2) proper sanitation
 - 3) prenatal care
 - 4) improved nutrition

MODULE 57: Toxicology and Chemical Risks

- I. Environmental hazards
 - A. *cultural hazards*—associated with chosen behaviors such as drug use, smoking, alcohol consumption, food choices, sexual activity (STDs, HIV, etc.), sun exposure, exercise, criminal behavior, risky hobbies, etc.
 - B. *biological hazards*—*biological agents* (bacterial, viruses, fungi, parasitic worms, etc.) that cause infection and death
 - C. *physical hazards*—*earthquakes, floods, hurricanes, tornadoes, volcanic eruptions, forest fires, landslides, avalanches, monsoons, tsunamis*, other natural disasters
 - D. *chemical hazards*, from anthropogenic and natural sources
 - 1) CDC NIOSH (National Institute for Occupational Safety and Health) <http://www.cdc.gov/niosh/npg/>
 - 2) exposure and dosage are issues
 - 3) exposure: ingestion, inhalation, absorption through skin, direct contact, etc.
 - 4) *toxicology*—a science that deals with poisons and their effects, and with the problems involved (clinical, industrial, or legal)

- II. Harmful Chemicals (overlap with pesticide section, Ch. 11 extension)
 - A. **neurotoxins**
 - 1) *chemicals that disrupt the nervous system of animals*
 - 2) examples: arsenic, chlorpyrifos (an organophosphate pesticide), DDT (dichlorodiphenyltrichloroethane), ethyl alcohol, fluoride, lead, polybrominated diphenyl ethers (PBDEs), polychlorinated biphenyls (PCBs), manganese, mercury, toluene
 - B. **allergens**
 - 1) *chemicals that cause allergic reactions*
 - 2) “a usually harmless substance capable of triggering a response that starts in the immune system and results in an allergic reaction” (www.aaaai.org)
 - C. **endocrine disruptors**
 - 1) *chemicals that interfere with hormone function in animals*
 - 2) effects, from <https://www.epa.gov/endocrine-disruption/what-endocrine-disruption>
 - a) developmental malformations
 - b) reproduction interference
 - c) increased cancer risk
 - d) disturbances in immune and nervous system function
 - D. **teratogens**
 - 1) *chemicals (agents and conditions) that interfere with fetal development*
 - 2) known teratogens, from <https://www.healthline.com/health/pregnancy/teratogens#4>

E. **carcinogens**

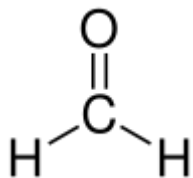
- 1) *chemicals that cause cancer*
- 2) metastasis—the spread of cancer
- 3) **mutagens**—*carcinogens that cause genetic material damage*
- 4) known and probable human carcinogens, from

<https://www.cancer.org/cancer/cancer-causes/general-info/known-and-probable-human-carcinogens.html>

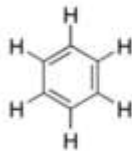
F. Smoking and Vaping

- 1) Tobacco Free Initiative:
http://www.who.int/tobacco/research/youth/health_effects/en/
- 2) Secondhand smoke: The EPA has classified **environmental tobacco smoke (ETS)** as a Class A (known human) carcinogen
- 3) Cigarettes are one of few products which can be sold legally which can harm and even kill you over time if used as intended.
- 4) There are ongoing lawsuits in the U.S. which aim to hold tobacco companies responsible for the effects of smoking on the health of long term smokers.

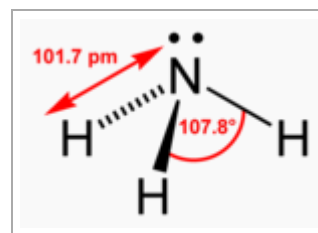
COMMON CHEMICALS IN CIGARETTE SMOKE:



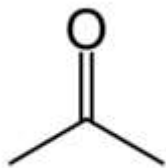
FORMALDEHYDE



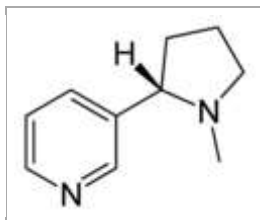
BENZENE (3 ways)



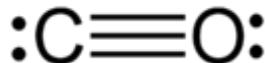
AMMONIA



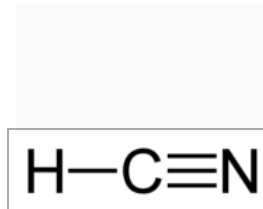
ACETONE
(CH₃COCH₃)



NICOTINE



CARBON MONOXIDE



HYDROGEN CYANIDE

2) vaping issues

- a) <https://www.cdc.gov/features/ecigarettes-young-people/index.html>
- b) <https://www.hopkinsmedicine.org/health/healthy-heart/know-your-risks/5-truths-you-need-to-know-about-vaping>
- c) <https://e-cigarettes.surgeongeneral.gov/>
- d) from <http://www.medicaldiscoverynews.com/shows/264-ecigs.html>

“It is true that e-cigarettes do not contain the over 4,000 chemical compounds created by a burning cigarette. Many of these are toxic and/or carcinogenic. Tar, carbon monoxide, nitrogen oxides, hydrogen cyanide and ammonia are all in regular cigarette smoke.

However, *nicotine itself is dangerous and highly addictive, and with e-cigarettes, smokers may not know how much of it they’re getting. A lack of regulation and quality control means the amount of nicotine in each drag of an e-cigarette is inconsistent. The U.S. Food and Drug Administration determined that since e-cigarettes are not considered a drug delivery device, the agency has no jurisdiction over them.*

Yet the administration issued a health warning about e-cigarettes after its tests show they contain harmful chemicals such as diethylene glycol, a component of antifreeze that's toxic to humans and is banned in food and drugs. There were also detectable levels of a known carcinogen called nitrosamine and other toxic chemicals that users could potentially inhale.”

III. Harmful Chemical Concentrations

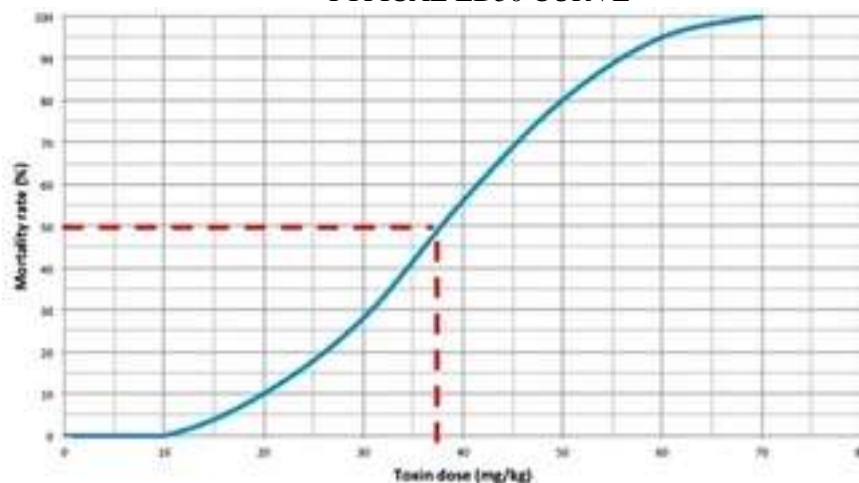
A. Dose-response study

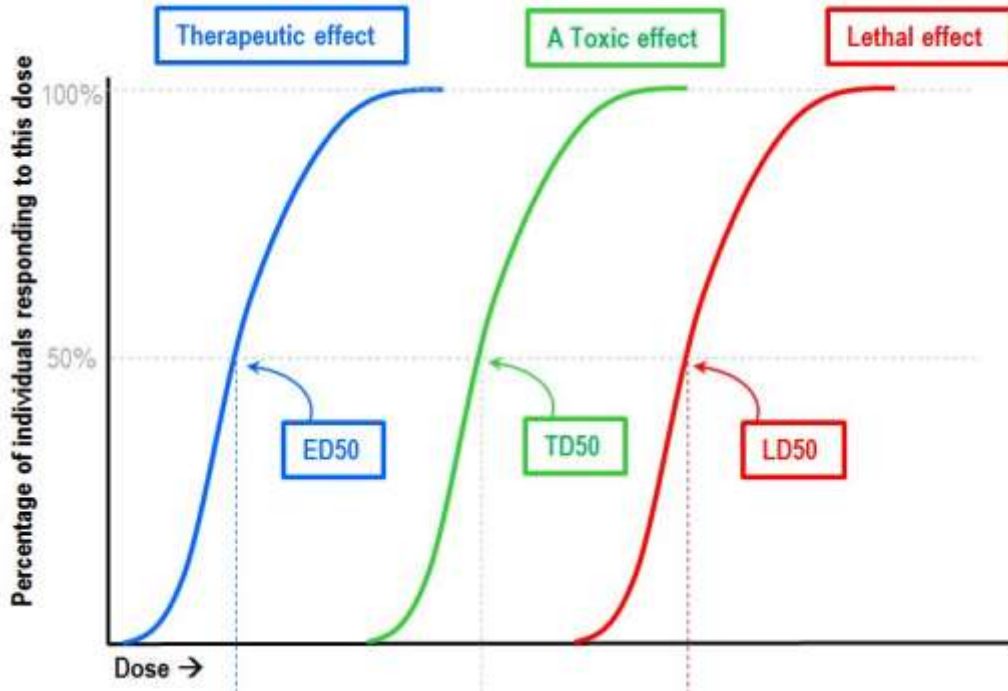
- 1) *a study exposing organisms to different amounts of a chemical; possible responses are observed*
- 2) effects: mortality, behavioral changes, reproductive changes
- 3) describes the change in effect on an organism caused by differing levels of exposure or doses to a stressor - usually a chemical - after a certain time
- 4) may apply to individuals (“the dose makes the poison”: a small amount has no significant effect, a large amount is fatal)
- 5) can apply to populations (how many people or organisms are affected at different levels of exposure).
- 6) can be **chronic study** (*longer exposure*) or **acute study** (*shorter exposure*)

B. LD50, LD-50, or LD₅₀ and related measurements

- 1) **lethal dose 50%** = *a measure of how much of a substance will kill 50% of the test population*
 - a) rodents are typical subjects
 - b) dose must be calculated relative to the size of the animal
 - c) common units = *milligrams of chemical / kilogram of test animal (mg/kg or ppm)*
- 2) **lethal concentration 50% = LC50**
 - a) *a measure of the concentration of a chemical in water (rather than a dose of a chemical) that will kill 50% of the test population*
 - b) often used in environmental studies

TYPICAL LD50 CURVE





Source: Fluoridation Queensland

- 3) **ED50**—median effective dose (dose that produces desired **sublethal** effect in 50% of subjects)
- 4) **TD50**—median toxic dose; greater than half maximum effective concentration (**ED₅₀**) but less than the median lethal dose (**LD₅₀**)

C. Testing standards

- 1) **TSCA: Toxic Substances Control Act of 1976**

<https://www.epa.gov/laws-regulations/summary-toxic-substances-control-act>

“The Toxic Substances Control Act of 1976 provides EPA with authority to require reporting, record-keeping and testing requirements, and restrictions relating to chemical substances and/or mixtures. Certain substances are generally excluded from TSCA, including, among others, food, drugs, cosmetics and pesticides.

TSCA addresses the production, importation, use, and disposal of specific chemicals including polychlorinated biphenyls (PCBs), asbestos, radon and lead-based paint.”

- 2) **FIFRA: Federal Insecticide, Fungicide, and Rodenticide Act of 1947**
(pesticide screening)

<https://www.epa.gov/enforcement/federal-insecticide-fungicide-and-rodenticide-act-fifra-and-federal-facilities>

D. Retrospective vs. Prospective studies

- 1) **retrospective studies**—study of people exposed to an environmental hazard in the past
- 2) **prospective studies**—study of people who might be exposed to an environmental hazard in the future
- 3) **synergistic interaction**—multiple risks occurring together cause more harm than the effects of each considered separately

- E. Factors affecting chemical exposure
 - 1) **routes of exposure**—*the ways an organism comes in contact with an environmental hazard*
 - 2) **solubility**—*how well a chemical dissolves in a liquid, usually water*
 - 3) **bioaccumulation**
 - a) *chemical getting into the food chain at the bottom level*
 - b) *the retention and buildup of a chemical in an organism*
 - 4) **biomagnification**—*the increase in chemical concentration, usually in tissues, as it progresses up the food chain*
 - 5) **persistence**—*how long a chemical remains in the environment*

MODULE 58: Risk Analysis

- I. **Risk Assessment**—*“the characterization of the potential adverse health effects of human exposures to environmental hazards”* (National Research Council)

- A. the EPA pioneered risk assessment (from www.epa.gov)

“In a risk assessment, the extent to which a group of people has been or may be exposed to a certain chemical is determined, and the extent of exposure is then considered in relation to the kind and degree of hazard posed by the chemical, thereby permitting an estimate to be made of the present or potential health risk to the group of people involved.

Risk assessment information is used in the risk management process in deciding how to protect public health. Examples of risk management actions include deciding how much of a chemical a company may discharge into a river; deciding which substances may be stored at a hazardous waste disposal facility; deciding to what extent a hazardous waste site must be cleaned up; setting permit levels for discharge, storage, or transport; establishing levels for air emissions; and determining allowable levels of contamination in drinking water.

Essentially, ***risk assessment provides INFORMATION on the health risk, and risk management is the ACTION taken based on that information.***”

- B. *quantitative risk assessment = (probability of being exposed) x (probability of being harmed if exposed)*
- C. environmental hazards
 - 1) **environmental health**
 - a) *“health and quality of life by preventing or controlling those diseases or deaths that result from interactions between people and their environment”* (from the CDC)
 - b) In this context, the environment is all the biotic and abiotic factors with which humans have contact.
 - 2) **environmental hazards**
 - a) *can cause injury or death*
 - b) *can damage personal or public property*
 - c) *can cause environmental damage or destruction*
 - 3) *risk*—the probability of being affected by a hazard
 - 4) *morbidity*—“a disease or the incidence of disease within a population. Morbidity also refers to adverse effects caused by a treatment.” (from NCI - National Cancer Institute)
 - 5) *mortality* – the incidence of death in a population
 - 6) *vector*—a carrying agent for disease

D. *Integrated Risk Information System (IRIS* from www.epa.gov)

“The Integrated Risk Information System (IRIS), prepared and maintained by the U.S. Environmental Protection Agency (U.S. EPA), is an electronic database containing information on human health effects that may result from exposure to various chemicals in the environment.”

E. four steps of risk assessment from the EPA:

- 1) *Hazard identification (hazard assessment)*
 - a) “gathering and evaluating data on the types of health injury or disease that may be produced by a chemical, and on the conditions of exposure under which injury or disease is produced”
 - b) *epidemiological study*—how illness spreads through a population
 - c) Does exposure to a substance cause an increased likelihood of an adverse effect such as cancer?
- 2) *Dose-response assessment*
 - a) “describing the quantitative relationship between the amount of exposure to a substance and the extent of toxic injury or disease”
 - b) What is the relationship between the dose (amount or concentration of the substance) and the seriousness of the adverse health effect?
- 3) *Exposure assessment*
 - a) “describing the nature and size of the population exposed to a substance and the magnitude and duration of their exposure.”
 - b) How often, how long, and how much are humans exposed to the substance in question?
- 4) *Risk characterization* (transitional step to risk management)
 - a) “the integration of the data and analysis of the first three components of the risk assessment process”
 - b) What is the probability of an individual or population having an adverse health effect based on data from dose response assessment and exposure appraisal?

Risk assessment provides INFORMATION on the health risk, and risk management is the ACTION taken based on that information.

II. Risk Acceptance

- A. **Risk acceptance**—how much risk can be tolerated
- B. Also called **risk retention**

From <https://managementmania.com/>

“Risk Acceptance or risk Retention is one of the strategies of dealing with risks. Acceptance means that we accept the identified risk. We will not take any action because we can accept its impact and probability - we simply risk it... We choose the strategy of risk acceptance when it turns out to be the most economical option to do nothing about it. That is to say that the risk is either so small or so unlikely that we decide to cope with the consequences in case the incident happens.”

III. Risk Management

- A. *taking action: the process of reviewing risk data and making regulatory decisions*
- B. influenced by consideration of costs and benefits and public perception

- C. major components
 - 1) **cost-benefit analysis** – assesses the case for a proposal
 - 2) **risk-benefit analysis** – compares the risk of a situation to the related benefits
 - 3) **public preferences** – public input
 - D. general steps
 - 1) establish the context
 - 2) identification
 - 3) assessment
 - 4) **potential risk treatments** (www.businessdictionary.com)
 - a) *risk avoidance*
 - i. “take steps to remove a hazard
 - ii. engage in alternative activities
 - iii. otherwise end a specific exposure”
 - b) *risk reduction (risk mitigation)* – “systematic reduction in the extent of exposure to a risk and/or the likelihood of its occurrence”
 - c) *risk retention*—self insurance (insurance policies)
 - d) *risk transfer*—insurance policies and warranties shift responsibility to another party, away from the affected individual
 - 5) create the plan
 - 6) implementation
 - 7) review and evaluation of the plan
-

IV. Risk Perception

- A. *a non-expert intuitive judgment about risks which often is not in agreement with the level of risk as judged by experts*
- B. *“outrage factor” is a high perceived risk*
- C. reasons for a distorted risk perception
 - 1) *lack of familiarity with the technology*
 - we tend to have an irrational fear of certain technologies or behaviors even though older, more familiar technology poses a greater risk
 - 2) *public impression of hazards*
 - major accidents or technological disasters are imprinted into public memory
 - we emphasize or downplay risks that suit our economic, political or social interests
 - 3) *extent to which the risk is voluntary*
 - we tolerate or downplay the risks associated with behaviors we choose, while we tend to object to risks we can’t control
 - 4) *overselling of safety*
 - which specific hazards are reported in the news, as well as how they are reported, can produce a biased perspective on their relative risk—giving us an inaccurate picture of the real risks to which we are exposed
 - 5) *morality*
 - we emphasize or downplay risks that suit our moral code of ethics
 - 6) *control*
 - we may have an unrealistic view of our ability to control our fate; we may be able to beat the odds because we’re smarter or luckier than others

7) *fairness*

- we emphasize or downplay risks that suit our economic, political or social interests

D. role of the media

- 1) the media covers the “outrage factors” more than the hazard factors
- 2) *risk communication* should not be left to the mainstream media
- 3) *public concern drives public policy*

V. Philosophies of Risk

A. **Precautionary Principle**

- 1) info from <http://www.sehn.org/state.html#w>

“When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically. In this context, the proponent of an activity, rather than the public, should bear the burden of proof.

The process of applying the Precautionary Principle must be open, informed and democratic and must include potentially affected parties. It must also involve an examination of the full range of alternatives, including no action.”

- 2) The Essence of Precaution:

- a) *When we have a reasonable suspicion of harm, and*
- b) *scientific uncertainty about cause and effect, then*
- c) *we have a duty to take action to prevent harm.*

- 3) Instead of asking the basic risk-assessment question “How much harm is allowable?”, the precautionary approach asks, “How little harm is possible?”

B. **Innocent-until-proven-guilty Principle**

- 1) *a potential hazard should not be considered an actual hazard until there is definitive scientific data to support the claim*
- 2) chemicals can get into the marketplace sooner (this can be good or bad)

VI. International Agreements on Hazardous Chemicals

A. **Stockholm Convention**

From <https://www.unido.org/> (U.N. Industrial Development Organization):

“The Stockholm Convention is a global treaty to protect human health and the environment from persistent organic pollutants (POPs). POPs are chemicals that remain intact in the environment for long periods, become widely distributed geographically, accumulate in the fatty tissue of living organisms and are toxic to humans and wildlife. POPs circulate globally and can cause damage wherever they travel. In implementing the Convention, Governments will take measures to eliminate or reduce the release of POPs into the environment. Over 152 countries ratified the Convention and it entered into force, on 17 May 2004.

The Stockholm Convention is perhaps best understood as having five essential aims:

- Eliminate dangerous POPs, starting with the 12 worst (Dirty Dozen)
<http://chm.pops.int/TheConvention/ThePOPs/The12InitialPOPs/tabid/296/Default.aspx>
- Support the transition to safer alternatives
- Target additional POPs for action
- Cleanup old stockpiles and equipment containing POPs
- Work together for a POPs-free future”

B. REACH

From http://ec.europa.eu/environment/chemicals/reach/reach_en.htm

“REACH aims to improve the protection of human health and the environment through the better and earlier identification of the intrinsic properties of chemical substances. This is done by the *four processes of REACH, namely the registration, evaluation, authorisation and restriction of chemicals*. REACH also aims to enhance innovation and competitiveness of the EU chemicals industry.

‘No data no market’: the REACH Regulation places responsibility on industry to manage the risks from chemicals and to provide safety information on the substances. Manufacturers and importers are required to gather information on the properties of their chemical substances, which will allow their safe handling, and to register the information in a central database in the European Chemicals Agency (ECHA) in Helsinki. The Agency is the central point in the REACH system: it manages the databases necessary to operate the system, co-ordinates the in-depth evaluation of suspicious chemicals and is building up a public database in which consumers and professionals can find hazard information.

The Regulation also calls for the progressive substitution of the most dangerous chemicals (referred to as ‘substances of very high concern’) when suitable alternatives have been identified.”