

Introduction

EOH 356A – Environmental Health I

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1. Sanitarian: a person who applies Environmental Health to manage our surroundings.
([NEHA: National Environmental Health Association](#))

2. Environmental Health: the area of public health that studies how the environment affects human health.
[CDC: Centers for Disease Control and Prevention](#)

(environment <----> humans)

3. Public Health: a group of disciplines devoted to the prevention of disease and the promotion of health from the community perspective.
([APHA: American Public Health Association](#))

4. Health: a state of complete physical, mental, and social well being, and not merely the absence of disease or infirmity. ___
([WHO: World Health Organization](#), 1948)

5. Environment: the sum of all external conditions and influences in human's surroundings, which include biological, chemical, physical, psychological, and sociological hazards.

6. Epidemiology: the study of the distribution and determinants of disease.
 - a) determinants: "causes"
 - b) distribution: rates:

prevalence: $\frac{\# \text{ of existing cases ("sick people")}}{\text{total population}}$

incidence: $\frac{\# \text{ of new cases in a time frame}}{\# \text{ of people exposed}}$
 - c) disease: carcinogenesis: causes cancer
mutagenesis: causes genetic disorders
teratogenesis: causes birth defects

7. Interaction of contaminants:
 - a) synergism: $1 + 1 = 3$
 - b) potentiation: $1 + 0 = 2$
 - c) antagonism: $1 + 1 = 0$

8. Followup:
 - a) [EOHSA: Environmental and Occupational Health Students Association](#) ___
 - b) [CEHA: California Environmental Health Association](#) ___
 - c) [CSUN Department of EOH](#) / [About our Faculty](#)
 - d) [NLM: National Library of Medicine](#)

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Legal concepts

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Legal databases, interview county health dept or Robert Kwong

A. General

1. law: binding requirements imposed by government.
(a general term)
2. rights: a power, privilege, or interest, protected by law.
3. duties: the corresponding responsibility to respect a right.
4. *stare decisis*: "the decision stands"

B. Types of law (by precedence)

5. constitutional: fundamental laws of a government
includes: federal and state constitutions,
city charters
6. statutory: laws passed by vote of legislature or public
includes: statutes, ordinances, referenda
7. administrative: laws written by appointed officials (agencies)
includes: regulations, rules
8. common: laws taken from previous court decisions
includes: tort law = a "private wrong"
separate from statutes
and contracts
(also includes nuisance laws and eminent domain)

C. Other fundamental powers

9. nuisance laws: government may limit use of property
if it harms others or is "unreasonable"
10. eminent domain: government may "take" property if:
for the public interest, and
fair compensation is made
11. police power: government must have power to enforce its own
regulations
12. subpoena: court order for records or witnesses in court

Legal concepts (continued)

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D. Responsibilities

1. malfeasance: unauthorized (wrongful) act by an official.
2. misfeasance: authorized act in an unauthorized manner.
3. nonfeasance: failure to perform duty (without excuse).
4. due process: fairness and completeness of laws
5. equal protection: consistency of law
6. exclusionary rule: evidence must be legally obtained
7. demurrer: admit to facts but challenge legal propriety

E. Approaches:

8. litigation: to settle a dispute in a court of law
9. arbitration: to settle a dispute out of court in a binding settlement with the services a disinterested person
10. negotiation: to settle a dispute out of court in a nonbinding settlement between the interested parties
11. administrative hearings: formal and informal means to gather information and clarify positions

F. Other

12. NEPA: National Environmental Policy Act (1969)
established Council on Environmental Quality:
advise president on environmental issues

projects funded by the federal government require environmental impact statements

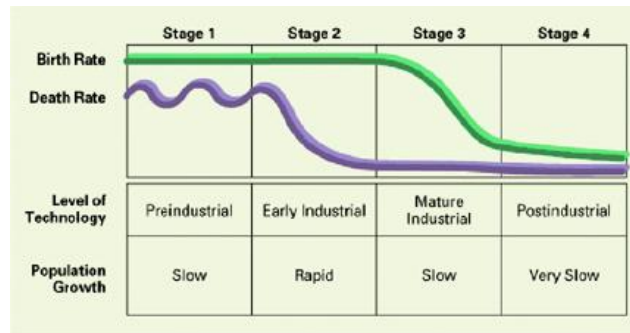
Population and Energy

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A. Population

1. Global: [almost 7 billion](#)
2. Top 5 countries: China, India, former U.S.S.R., U.S., Indonesia
3. 14 Mega-cities (>10 million): Mexico City, Sao Paulo, Buenos Aires, Rio de Janeiro
Tokyo, Osaka, Manila, Seoul, Calcutta, Bombay
Moscow, Cairo, New York, Los Angeles
4. Demographic [transition](#): a theory that economic and technological growth leads to a decline in death rates followed by a decline in birth rates

Figure 1:



B. Energy

5. Greatest use: industrial countries (U.S. is #1).
greatest increase: less developed countries and "centrally planned economies"
6. Non-renewable resources: fossil fuels, nuclear power
7. Renewable resources: solar, organics (e.g., methane), wind, water, geothermal; wood, crop residue, animal dung

Communicable Disease

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1. communicable disease: transmission of an agent (or its by-product) from reservoir to host.
2. agent: a factor that must be present for a disease to occur in a susceptible host.
3. infection: growth of a pathogenic microbe in a host (with or without evidence of disease) (also called "sepsis").
4. pathogenicity: capable of producing disease.
5. virulence: harmfulness of a disease.
6. reservoir: any place where an infectious agent depends primarily for survival.
7. host: any animal infected by an agent; may be diseased or may be intermediate host.
8. incubation period: time interval between exposure to infectious agent and first sign or symptom of disease.
9. carrier: person or animal that harbors an organism of disease without showing symptoms.
10. asymptomatic carrier: never shows symptoms (also called "inapparent infection").
11. transmission: any mechanism by which a susceptible human host is exposed to an infectious agent.
12. fomites: inanimate objects (other than food, water) which harbor or transmit infectious organisms.
13. vector: insect or other animal that may transfer pathogens to humans.
14. infestation:
 - humans, animals: lodgment, development, and reproduction of arthropods on the surface of the body or in clothing.
 - articles, premises: harboring or sheltering animals (especially arthropods or rodents).

Selected Airborne Diseases

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1. Common cold
agent: rhinoviruses, coronaviruses, others
reservoir: human
transmission: direct contact
<http://www.youtube.com/watch?v=7fmJxALot1E>
2. Influenza:
agent: influenza viruses (3 major serotypes):
 type A: widespread, pandemics
 type B: local epidemics
 type C: only in sporadic cases
reservoir: human
transmission: same as cold
3. Tuberculosis:
agent: Mycobacterium
reservoir: primarily human
transmission: primarily droplet nuclei
4. Coccidioidomycosis:
agent: Coccidioides immitis (fungus)
reservoir: soil
transmission: airborne
5. Pneumonia: inflammation of the lungs with congestion
(not a specific disease, but a pathological term -- i.e., symptoms)

reservoir: essentially human
transmission: generally direct, sometimes airborne
various agents:
 5. pneumococcal pneumonia (Streptococcus pneumoniae)
 6. mycoplasmal pneumonia (Mycoplasma pneumoniae)
 7. pneumocystis pneumonia (Pneumocystis carinii)
 8. chlamydial pneumonia (Chlamydia trachomatis)
 9. others: various viruses, rickettsias (Q fever), Legionella, worms (nematodes), etc.

Selected Water-borne Diseases

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1. typhoid fever

agent: Salmonella typhi
reservoir: human
transmission: indirect, vectorborne (flies)
symptoms: can be asymptomatic
fever, gastroenteritis, nosebleeds
rose spots (red patches on abdomen)

2. paratyphoid fever

agent: 3 main groups of Salmonella paratyphi
reservoir: primarily human
transmission: same as typhoid fever
symptoms: similar to typhoid, but much less virulent

3. Cholera

agent: Vibrio cholera
reservoir: human; perhaps environmental reservoirs
transmission: fecal (or vomitus)
[direct, indirect (food, water, flies)]
symptoms: sudden and severe diarrhea
vomiting, dehydration, death

4. Shigellosis (bacillary dysentery) = acute colitis with diarrhea

agent: 4 groups of genus Shigella (bacteria)
reservoir: humans; primates
transmission: fecal [direct, indirect (food, water, flies)]
symptoms: diarrhea, fever, nausea
stools contain blood, mucus, and pus

5. Amebiasis (amebic dysentery)

agent: Entamoeba histolytica (a protozoon)
reservoir: human; usually a chronically ill
or asymptomatic carrier
transmission: fecal [direct, indirect (food, water, flies)]
acute patients pose limited danger
(absence of cysts)
symptoms: often asymptomatic; fever, chills, diarrhea
stools contain blood, mucus

6. Giardiasis

agent: Giardia lamblia (protozoan)
reservoir: human; possibly other animals
transmission: fecal (water or food) (cysts resist treatment)
symptoms: often asymptomatic; diarrhea, cramps, fatigue

Selected Helminthic Diseases

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1. Trichinosis

agent: Trichanella spiralis
reservoir: pigs, wild boar, bears, foxes, wolves, rats
transmission: eating infected animals
symptoms: nausea, gastroenteritis
(must thoroughly cook pork >150 deg. F)

2. Ascariasis (roundworms)

agent: primarily Ascaris lumbricoides
reservoir: humans, infected soils
transmission: not person to person
ingestion of infective eggs (soil)
symptoms: live worms in stool
varied: coughing, fever, nutrition

3. Schistosomiasis (blood flukes)

agent: Schistosoma (4 species)
reservoir: humans (and various animals)
transmission: vectors (biological)
larvae from snail infested waters
symptoms: varied

4. Other helminthic diseases

- | | |
|-------------------------------------|-------------------------------|
| a. beef tapeworm | <u>Taenia saginata</u> |
| b. pork tapeworm | <u>Taenia solium</u> |
| c. fish tapeworm | <u>Diphyllobothrium latum</u> |
| d. dracunculiasis
(dracontiasis) | <u>Dracunculus medinensis</u> |
| e. ancylostomiasis
(hookworm) | Ancylostoma |
| f. enterobiasis
(pinworm) | Enterobias |

Selected Miscellaneous Diseases

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1. Ringworm

agent: Microsporum, Trichophyton, others (fungi)
reservoir: infected human or animal
transmission: physical contact
symptoms: dermatitis (athlete's foot, jock itch, etc.)
control: cleaning floors, showers, clothing

2. Tetanus

agent: Clostridium tetani
reservoir: soil, street dust, animal feces
transmission: entrance in a wound
symptoms: muscular contractions, spasms
case fatality can be high
control: immunization, cleansing wounds

3. Anthrax

agent: Bacillus anthracis
reservoir: cattle, sheep, goats, horses, swine
transmission: contact with hides or meat, flies
symptoms: itchy skin; complications if untreated
control: vaccine, sanitation, dust control

4. Leprosy

agent: Mycobacterium leprae
reservoir: humans
transmission: not clearly established
prolonged contact is important
symptoms: disease of skin, nerves, nasal musosa
symptoms vary

Selected Food Related Illnesses

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A. Infections

- | | |
|------------------|--|
| 1. Salmonellosis | <u>Salmonella typhimurium</u>
<u>Salmonella enteritidis</u> |
| 2. Campylobacter | <u>Campylobacter jejuni</u> |
| 3. Listeriosis | <u>Listeria monocytogenes</u> |
| 4. Hepatitis | type A = infectious |
| 5. Brucellosis | Undulant Fever |
| 6. Trichuriasis | <u>Trichuris trichiura</u> |
| 7. Anisakiasis | <u>Anasakidae family</u> |

B. Intoxications

- | | |
|-------------------|--------------------------------|
| 8. Staphylococcus | <u>Staphylococcus aureus</u> |
| 9. Botulism | <u>Clostridium botulinum</u> |
| 10. Perfringens | <u>Clostridium perfringens</u> |

C. Poisonous plants/animals

- | | |
|--------------------------------------|-------------------|
| 11. Favism | <u>Vicia faba</u> |
| 12. Snake root | <u>Eupatorium</u> |
| 13. Paralytic
shellfish poisoning | |
| 14. Ciguatera | |
| 15. Scombroid | Scombridae family |

D. Others

- | | |
|---------------|---|
| 16. agent: | <u>Vibrio parahemolyticus</u> |
| reservoir: | oceans (variety of seafood) |
| transmission: | poorly cooked seafood |
| symptoms: | diarrhea, abdominal cramps (rarely fatal) |
| 17. agent: | <u>Bacillus cereus</u> |
| reservoir: | soil |
| transmission: | especially cooked rice at room temperatures |
| symptoms: | sometimes vomiting, sometimes diarrhea |
| 18. agent: | <u>Clostridium perfringens</u> (anaerobic sporeformer) |
| reservoir: | soil; also, GI tract of healthy humans or animals |
| transmission: | spores survive normal cooking,
then germinate, multiply, and produce toxins |
| symptoms: | diarrhea, nausea; usually no vomiting or fever |
| 19. agent: | Copper poisoning |
| transmission: | copper in prolonged contact with acid foods or
carbonated beverages
(e.g., improper vending machines) |
| symptoms: | vomiting and weakness in < 1 hour (often minutes) |

Food Controls

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A. Pasteurization:

1. Ultra Pasteurization: >280 deg. F for >2 seconds
2. Ultra High Temperature: 191-212 deg. F. for 1 to .01 seconds (UHT)
3. High Temp. Short Time: 161 deg. F for 15 seconds (HTST)
4. Holder pasteurizer: 145 deg. F for 30 minutes

B. Food and Temperatures:

5. Thermometers: required in refrigerators.
should be: readily visible
at the warmest part of the unit
accurate to 1 degree Centigrade
6. Stem (or probe) thermometer: designed to check food temperatures typically has metal stem with temperature readings at top of thermometer
Restaurant operators must have on the premises.
7. Maximum registering thermometer: used to check temperatures in dishwashing machines
8. Refreezing: frozen foods may not be thawed and refrozen (exception: when food is cooked or processed after thawing).

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C. Canning operations:

1. soaking and washing: reduces spoilage bacteria
2. sorting and grading: consistent quality of product
3. blanching: direct contact with hot water or steam
destroys enzymes (reducing chemical changes)
softens tissues to fit in can
washes away "raw" flavor
4. exhausting: heat foods in cans prior to closing can
produces partial vacuum
5. sealing: secures lid on can
hermetic double seam
when can cools, lids pull in (concave)
6. retort processing: closed vessel for "sterilization" of food
240 degrees for 30 minutes
7. cooling: quick cooling minimizes thermophilic bacteria
potential for water contamination through seams
(water must be disinfected)

D. Dishwashing:

8. Manual method: 3 compartment sink:
detergent and warm water:
good at removing, not killing bacteria
most important step in dishwashing

rinse: removes detergent before sanitizer

sanitizer:
a "polishing" step
hot water (180 deg F, 30 seconds)
chemicals and warm water (75 deg F):
chlorine: 100 ppm for 30 seconds
quaternary ammonia: 200 ppm for 1 minute
iodine: 25 ppm for 1 minute
9. Machine method: see NSF standards
(National Sanitation Foundation)

wash: 140-160 deg. F

rinse: 180 deg F, 10 seconds, 15-25 psi (water pressure)
or chlorine rinse (50 ppm)

HACCP = Hazard Analysis and Critical Control Point

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developed by Pillsbury Company for NASA astronauts in 1960s
since then, adopted by FDA, USDA, and Dept. of Commerce
predicts hazards and controls them before they happen

1. Identify hazards
(i.e., biological, chemical, and physical hazards)

identify potentially hazardous foods
assess risk (e.g., high, medium, low, negligible)
2. Identify critical control points

def. = any point in an operation where the hazard can be
eliminated, prevented, or minimized

observe the handling of food throughout its lifetime
identify: sources of contamination, and
potential for microbes to survive or grow
3. Establish controls

identify: control criteria (e.g., temperatures)
corrective action
4. Monitor

monitor the critical control points
record the data
5. Establish corrective action

take action when criteria are not met
6. Verify that HACCP is functioning

CURFFL = California Uniform Retail Food Facilities Law
California Health and Safety Code, Division 22, Chapter 4,
Articles 1-17 (containing sections 27500-27863)

Articles

- | | |
|---|---|
| 1. general provisions | 9. open air barbecue facilities |
| 2. definitions | 10. vending machines |
| 3. plan review and permits | 11. vehicles |
| 4. enforcement and inspection | 12. mobile food preparation vehicles |
| 5. permit suspension / revocation | 13. temporary food facilities |
| 6. general sanitation requirements | 14. produce stands |
| 7. sanitation requirements for
food facilities | 15. certified farmer's markets |
| 8. sanitation requirements for
food establishments | 16. satellite food distribution |
| | 17. restricted food service transient
occupancy establishments |

Commercial Food Protection: Who does what in the federal government?

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- A. hopelessly fragmented: 35 laws
12 agencies
51 interagency agreements
(not counting federal-state interagency agreements)
- B. 6 major agencies:
1. Food and Drug Administration (FDA)
 2. Environmental Protection Agency (EPA)
 3. National Marine Fisheries Service (NMFS)
- U.S. Department of Agriculture (USDA):
4. Food Safety and Inspection Service (FSIS)
 5. Agricultural Marketing Service (AMS)
 6. Federal Grain Inspection Service (FGIS)
- C. funds: USDA receives about 3/4 of federal funds
FDA is second, with about 1/8 of federal funds
- D. FDA major laws:
1. Food Drug and Cosmetic Act
 2. Egg Products Inspection Act
 3. Federal Anti-tampering Act
 4. Import Milk Act
 5. Infant Formula Act
 6. Pesticides Monitoring Improvements Act
 7. Public Health Service Act

Selected Food Additives

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1. DES: Diethylstilbestrol
synthetic estrogen
used to fatten cattle and chickens
effects: carcinogen, mutagen
FDA banned in 1977
2. sodium nitrite: illegal to mask food
interferes with browning of meat:
myoglobin + sodium nitrite --> met-myoglobin
deters spoilage and botulism in cured meats
effects: headaches or hives in sensitive persons
nitrites --> nitrosamines (carcinogen)
however: not a direct additive
no evidence of increased cancer
nitrates reduce to nitrites in adult saliva
(nitrates found in spinach, celery,
lettuce, etc.)
3. monosodium glutamate: (MSG, flavor enhancer, natural flavoring,
hydrolyzed vegetable protein)
effects: headaches, nausea, diarrhea,
burning sensation, chest pain, etc.
brain lesions in monkeys and mice
4. aspartame: only in sensitive persons (phenylketonurics)
effects: swelling of eyelids, lips, hands, or feet
5. sulfites: effects: abdominal cramps, diarrhea,
low blood pressure, elevated pulse,
light headedness, chest tightness,
asthma, hives
FDA banned use on raw fruits and vegetables
FDA requires labels when more than 10 ppm

Selected Arthropod Pests

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- A. arthropods:
- insects (roaches, fleas, flies, mosquitoes, lice)
 - arachnids (ticks, mites, spiders)
 - others (myriapods, diplopods, crustaceans)

Insect Pests

B. Roaches:

1. American cockroach: Pareplaneta americana
large (about 1.5 inches)
reddish brown
2. Oriental cockroach: Blatta orientalis
about 1 inch
brown or black
3. German cockroach: Blatella germanica
medium (about 1/2 inch)
light brown
4. Brown-banded cockroach: Supella longipalpa
medium (about 1/2 inch)
light brown with darker
brown bands across abdomen

C. Fleas:

5. Cat Flea: Ctenocephalides felis
not normally a vector
6. Dog Flea: Ctenocephalides canis
not normally a vector
7. Oriental Rat Flea: Xenopsylla cheopis
spreads plague, etc.

Selected Arthropod Pests (continued)

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Insect Pests (continued)

D. Flies:

1. House fly: Musca domestica
2. Lesser House fly: Fannia
3. Stable fly: Stomoxys
4. Bottle fly:
(or Blow fly) Caliphora
5. Flesh fly: Sarcophagidae
6. Horse fly:
(or gadfly) Tabanus
7. Vectors: Tsetse fly: Glossina
Black fly: Simulium
8. Ash whitefly: not a true fly (related to aphids)

waxy coating prevents
absorption of insecticide

no natural enemies in California

E. Mosquitoes:

9. Anopheles: transmits malaria
Anopheles quadrimaculatus
Anopheles albimanus
Anopheles freeborni
10. Culex: Culex pipiens
Culex tarsalis
11. Aedes: Aedes aegypti
Aedes albopictus

F. Lice:

12. head lice: Pediculus humanus capitis
13. crab lice: Pthirus pubis
pubic lice
14. body lice: Pediculus humanus corporis
a major vector

Selected Arthropod Pests (continued)

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Arachnid Pests

A. Ticks:

1. hard ticks: Ixodidae:

Ixodes dammini

Ixodes pacificus

Dermacentor andersoni

Dermacentor variabilis

2. soft ticks: Argasidae:

Ornithodoros hermsi

Ornithodoros coriaceus

B. Mites:

3. chiggers: larval stage

C. Spiders:

4. black
widow

5. brown
recluse

Selected Insect-borne diseases

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1. Onchocerciasis (river blindness)

agent: Onchocerca volvulus (nematode, or roundworm)
reservoir: mostly humans
transmission: bite of infected female blackfly
(genus Simulium) biological vector
symptoms: chronic, nonfatal (incubation 1 year or more)
intense itching, impaired vision

A. mosquito-borne

2. human malarias

agent: Plasmodium
reservoir: human, infected mosquitoes
transmission: anopheles mosquitoes
symptoms: fever, chills, sweats
CNS effects (headache, delirium, coma)

3. filariasis

agent: Wuchereria, Brugia (nematodes, or roundworms)
reservoir: humans
transmission: mosquitoes (Aedes, Anopheles, and Culex)
symptoms: asymptomatic; fever, asthma
elephantiasis in chronic cases (enlarged limbs)

4. yellow fever:

agent: yellow fever virus (a flavivirus)
reservoir: humans (sometimes monkeys) and mosquitoes
transmission: Aedes mosquito
symptoms: sudden onset, fever, jaundice
headache, backache, vomiting

5. dengue (breakbone) fever

agent: Dengue virus
reservoir: human, infected mosquitoes
transmission: Aedes mosquitoes
symptoms: headache, joint and muscle pain, rash

6. Arthropod-borne viral encephalitis

agents: Eastern equine, Western equine,
California encephalitis, etc.
reservoir: unknown for most agents
(possibly birds, rodents, bats, reptiles)
transmission: Culex mosquitoes, possibly Aedes and others
symptoms: often asymptomatic
inflammation of brain, spinal cord, meninges
headache, fever, convulsions, paralysis, coma

Selected Arachnid-borne diseases

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A. Tick-borne

1. Rocky mountain spotted fever

agent: Rickettsia rickettsii
reservoir: dogs, rodents, other animals
transmission: infected ticks (various species)
symptoms: fever, headache, malaise, chills, rash, death

2. Tularemia

agent: Francisella tularensis
reservoir: wild animals (rabbits, muskrats)
transmission: bite of flies or wood ticks,
handling or ingestion of infected animals
symptoms: typically: swollen lymph nodes, gastroenteritis

3. Colorado tick fever

agent: Colorado tick fever virus
reservoir: small animals (squirrels, chipmunks, porcupine)
transmission: infected ticks: Dermacentor andersoni
symptoms: similar to Dengue fever

4. Q fever

agent: Coxiella burneti (rickettsia)
reservoir: ticks, various wild and domestic animals
transmission: raw milk from infected cows, or direct contact
symptoms: typically: chills, headache

5. Relapsing fever

agent: Borrelia recurrentis (spirochete)
reservoir: louse-borne: human; tick-borne: rodents
transmission: lice or tick bites
symptoms: rash, fever

B. Mite-borne

6. Scrub typhus

agent: Rickettsia tsutsugamushi
reservoir: infected larval mites, wild rodents
transmission: mite bites
symptoms: skin ulcer at site of bite, headache

7. Scabies (sarcoptic itch, acariases)

agent: Sarcoptes scabiei (a mite)
reservoir: humans
transmission: skin to skin, mites can burrow in < 3 minutes
symptoms: itching, lesions

Selected Insecticides

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A. inorganic:

1. Boric acid powder
2. Sodium fluoride
3. Paris Green: arsenic trioxide + copper acetate
4. Silica gel (SiO₂): a dessicant

B. botanicals: "natural" pesticides

5. Pyrethrum (and pyrethroids): from chrysanthemums, often used with a synergist (piperonyl butoxide)
6. Rotenone (and rotenoids): roots of Derris plant (legume) dusting powder for ticks on animals
7. Nicotine: usually nicotine sulfate

C. chlorinated hydrocarbons: usually low toxicity, but persistent

8. DDT: dichloro diphenyl trichloroethane
9. others: mirex, endrin, dieldren, chlordane, BHC, heptachlor, toxaphene

D. organophosphates: usually low persistence, high toxicity acetylcholinesterase inhibitor

10. Parathion, Malathion
11. DDVP (Dichlorvos) Diazinon

E. carbamates: also an acetylcholinesterase inhibitor

12. Carbaryl (Sevin) Aldicarb

Selected Rodenticides

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- A. anticoagulants: multiple doses kill by internal bleeding
1. warfarin
 2. others: pival, fumarin, PMP, diphacinone
- B. botanicals:
3. Red squill: (from the plant)
natural emetic (causes vomiting)
 4. others bay leaves, cucumber skins
- C. quick kill: extremely toxic
5. 1080 (Sodium Fluoroacetate)
1081 (Sodium Fluoroacetamide)
only for registered pest controllers
 6. others: Strychnine, Zinc phosphide, cyanide gas
ANTU (alpha naphtyl thiourea)
- D. selective: toxic to Rattus genus
7. Norbromide: vasoconstrictor
-
8. evidence of rodents: droppings, burrows
gnawing marks (wood, cement, wires, etc.)
urine (shiny streaks under blacklight)
greasy runways (especially Rattus norvegicus)
 9. other rodent controls: first, kill fleas (ectoparasite)
cement or steel curtains around house
to prevent burrowing
traps (traditional, or adhesive)

Pest Control

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A. Alternative Pests Controls:

1. quarantine
2. antifeedants/
repellants: irritants to surface feeding insects
no feeding = starvation (e.g., pyrethrum)
3. natural predators: birds, spiders
bacteria, viruses (e.g., Bacillus thuringiensis)
Gambusia affinis (eats mosquito larvae)
4. agricultural practices: irrigation (e.g., minimize standing water)
rotate crops (some crops are naturally resistant)
destroy crop residues (reduces food for pests)
5. natural pesticides: (e.g., botanicals)
6. resistant crop strains: (genetic engineering)
7. pheromones: sex attractants:
confuses males in locating females
only minute amounts needed (low toxicity)
complements the use of pesticide
8. juvenile hormones: internal chemicals that regulate growth
(e.g., eggs hatching to nymphs)
if we can synthesize juvenile hormones:
altered concentration = no development
low toxicity
difficult for pests to develop resistance
9. autocide: insect sterilization (usually U.V. radiation)
sterile males mate with fertile females
most effective when pest population is low
complements chemical methods (which are more
effective when pest population is high)

B. Laws:

10. FIFRA (1947): Federal Insecticide, Fungicide, and Rodenticide Act
registers pesticides, requires testing
11. FEPCA (1972): Federal Environmental Pesticides Control Act
allows EPA to regulate pesticides
12. ToSCA (1977): Toxic Substances Control Act -- allows EPA to:
require information from chemical manufacturers,
test new chemicals for
environmental and health effects,
regulate chemicals not addressed by other laws.

Solid Waste

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A. Solid waste: discarded material (EPA definition)

includes: solids, liquids, contained gases

excludes: agricultural wastes returned to soil
mining and milling wastes returned to mine
domestic sewage, and nuclear materials (!)

1. garbage: relatively decomposable wastes
(kitchen, food wastes)

2. rubbish: relatively non-decomposable wastes
(paper, cloth, glass, metal)

B. phases: input process output outcome

generation -->	transfer -->	disposal -->	effects
source	resource	remediation	
reduction	recovery		compensation

3. collection: greatest cost of solid waste management

4. transfer: temporary holding facilities
(for collection, storage, some treatment)

5. treatment: to reduce volume, mass, or risk

6. incineration: controlled combustion of waste

7. RDF: refuse derived fuel (waste is incinerated)

8. mass burn: nothing is sorted

9. controls: temperature (1400-1800 degrees F.)
turbulence (oxygen) -- grates:
 rectangular, vertical circular,
 rotary kiln, others
time (continuous preferred over batch)

10. ash: solid residue that remains after burning

(bottom ash = at bottom of incinerator)
(fly ash = smaller airborne particles)

11. pyrolysis: burn wastes with no added oxygen ("roasting")

Solid Waste (continued)

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- 12. [composting](#): controlled biodegradation of plant and animal matter
- 13. humus: decomposed plant and animal matter soil conditioner (poor fertilizer)
- 14. windrows: long rows of compost
- 15. procedure: shred (allows faster decomposition)
spread in thin layers (2"-6"):
 - carbon layers: paper, leaves, sawdust
 - nitrogen layers: grass, kitchen scraps, fruit
 - activator layers: manure (dog droppings, etc.)
soil
fertilizersprinkle with water to maintain moistness
ventilate
- 16. problems: AVOID: meat, grease, bones, and weeds
odor: if ammonia smell, add carbon
if rotting smell, add carbon,
ventilate,
stop watering
if too slow: add nitrogen, activator
maintain water and oxygen
- 17. resource recovery: any process where materials are recovered rather than discarded
- 18. reuse: use again in same way
- 19. reclamation: (utilization) use in new ways
- 20. recycling: use raw material in various ways (e.g., cullet = ground glass)
- 21. source reduction: to re-evaluate and eliminate waste generation
- 22. tipping fees: charge to dump garbage at a disposal site (\$/ton)

A. Features:

- 1. protective lining: clay soils or synthetic liners (PVC, PE)
- 2. layers (lifts): 8-10 ft. deep (after compaction)
intermediate settling (prefer 1 year) before next lift
- 3. cover material: daily: 6 inches
intermediate: 12 inches
final cover: 24 inches
2-4 % grade (for proper drainage)
less than 30 degrees on side slopes

B. Methods:

- 4. area: uses natural slope: valley or ravine methods
low area method
ramp method
- 5. trench: man-made

C. Processes:

- 6. LFG: landfill gas
 - aerobic: a. lasts several days to several months
 - anaerobic: b. mostly CO₂ formation (acid formers)
c. increased methane formation (methane producers)
d. stabilized (roughly equal % of methane and CO₂)
(lesser levels of NH₃ and H₂S)
 - rates: depend on temperature, pH (acid inhibits growth),
moisture, type of wastes
 - methane: explosive limit of 5%
- 7. Leachate: from waste itself, or water entering landfill
high in organics, heavy metals

D. Daily concerns:

- 8. records: type and amount of waste received
(measure by weight, because volume changes),
and type of personnel, equipment
monitoring leachate and gas production
- 9. procedures: standby equipment
exposed waste area is minimized
work with prevailing wind
portable fencing (prevent wind blown waste)
compact to 12-18 inch layers (4-5 passes of tractor)

E. Long-term concerns:

- 10. space: land area needed
- 11. access: fences, signs
- 12. time: 20-40 years operation

Page 45: Defining "Hazardous Waste" Click [here](#) to start recorded lecture.

I. Under different federal laws:

<u>production</u>	<u>environment</u>	<u>waste</u>
	--> hazardous air pollutants --> [Clean Air Act (CAA)]	
toxic -----> substances (TSCA)	--> toxic pollutants -----> [Clean Water Act (CWA)]	--> hazardous wastes (RCRA)
	--> hazardous substances -----> (CWA, RCRA, CERCLA)	
	--> hazardous materials -----> (HMTA)	

II. Under RCRA

- A. "D-Wastes": exhibit at least one of four characteristics:
1. ignitibility: flash point < 140 deg. F.
 2. corrosivity: pH < 2, > 12.5, or corrode steel at > 1/4 inch per year
 3. reactivity: explosiveness and toxic by-products from chemical reactions
 4. toxicity: standard extraction procedure (EPA)
- B. any of four lists (created by EPA, and taking precedence over the above characteristics):
5. F-list: from generic processes
e.g., degreasing, solvents, electroplating
 6. K-list: by type of industry:
e.g., iron and steel, petroleum refining
pesticides, explosives
 7. U-list: "toxic wastes" (numerous qualifications)
 8. P-list: "acutely hazardous"
presents substantial hazard
whether improperly managed or not.
- C. Mixtures of solid waste with waste listed above
- D. Waste from the treatment, storage, or disposal (TSD) of wastes listed above

Acronyms

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A. General Considerations

1. DOT: Department of Transportation
2. HMTA: Hazardous Materials Transportation Act (DOT)
3. HCS: Hazard Communication Standard (OSHA)
4. CHEMTREC: CHEMical TRansportation Emergency Center (CMA)
(1-800-424-9300)
5. CMA: Chemical Manufacturers Association

B. RCRA and HSWA

6. SQG: small quantity generators (below legally prescribed quantities, generators are subject to less stringent RCRA requirements)
7. HSWA: Hazardous and Solid Waste Amendments of 1984 (to RCRA)

C. CERCLA

8. RQ: Reportable Quantity (under CERCLA, releases above this level must be reported to the national response center, a toll free hotline at 1-800-424-8802).
9. NCP: National Contingency Plan
10. CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System (an inventory, often a prelude to being placed on NPL)
11. HRS: Hazard Ranking System
12. NPL: National Priorities List (based on HRS)

D. SARA

13. ATSDR: Agency for Toxic Substance and Disease Registry
14. EPCRA: Emergency Planning and Community Right to Know Act (title 3 of SARA)
15. TPQ: Threshold Planning Quantity (under SARA, releases above this level must be reported to the State Emergency Response Commission).
16. TRI: Toxic Release Inventory