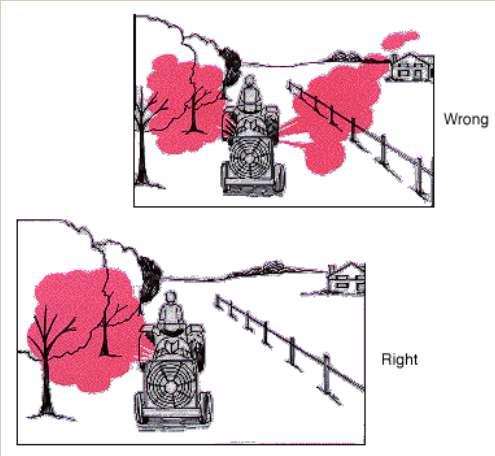
Chapter 10 (pg. 85)
Fate of Pesticides in the Environment

- Environment: Everything around us
- Natural and manufactured, indoor and out
  - Air, soil, water, animals, plants
  - Houses, restaurants, factories, offices

  Where do pesticides go and what effects can they have in the environment?

Pesticides Released into Environment

- **<u>Apply them</u>**: Deliberate release
- **<u>Spill them</u>**: Accidental release
- **<u>Dispose of them</u>**: Proper disposal will prevent pesticide from ending up in unintended places

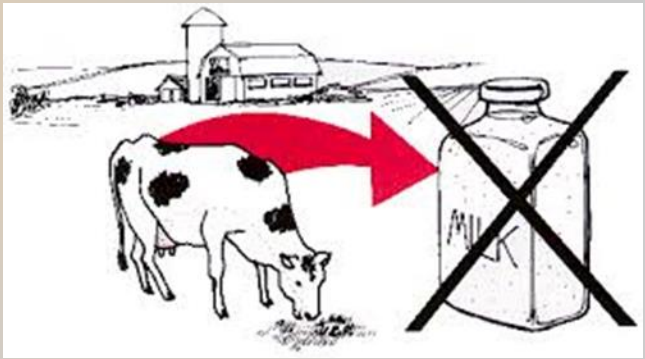


Risks to the Environment
Non-Target Plants

- Plant injury = **Phytotoxicity**
- More common with herbicides
- Too high rate, wrong timing, unfavorable environmental conditions
- Can occur on any part of the plant

Other Non-Target Risks

- Insecticides can kill beneficial insects
- Fish: water pollution from pesticides
- Birds: ingest pesticide granules, baits, or treated seeds, crops
- Livestock: contaminated and drinking water



- Animal predators: **Secondary poisoning**

Preventing Bee Loss

- Read the label & follow directions
- Are bees foraging in target area?
- Use pesticide least hazardous to bees
- Ground vs. aerial application
- Spray in early morning evening
- Weeds are not in bloom
- Spot treat if possible

Pesticide Characteristics (5)

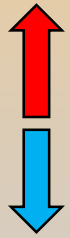
- **Solubility**: ability to dissolve in a solvent
  - Highly soluble = dissolve easily
  - Contaminate water
- **Adsorption**: attracted/binds to soil particle
  - Oil soluble more attracted to clay and OM
  - Less likely to move off site
  - Different from "Absorption" which usually means uptake or moving into something

Pesticide Characteristics

- **Persistence**: Ability to stay in its original form for an extended period.
  - Good: long term pest control
  - Bad: harm non-target species
- **Pesticide Degradation**: Breakdown of pesticide into less toxic compounds.
  - Fast and slow (1 year +)
  - Chemical, Microbial, Photodegradation

Pesticide Characteristics

- **<u>Volatility</u>**: Tendency of a pesticide to turn into a gas or vapor.
  - Volatility increases
    - Temperature
    - Wind
    - Humidity



How Pesticides Move

- Movement in wind or air currents away from the application site is called ***drift***.
- Most pesticide movement in water is by:
  - Surface movement off treated site (***runoff***)
  - Downward movement through soil (***leaching***)
- Pesticides that adsorb onto soil particles can travel long distances on wind-blown or soil runoff (erosion).

How Pesticides Move

- Pesticides can move away on treated plants, animals, and objects.
- Work clothes, PPE equipment
- Applying too much
- Pesticide is spilled
- Heavy rain moves off target
- Water-soluble or persistent pesticide

Areas Sensitive to Pesticides

- **Outdoor**: Playgrounds, recreational areas, grounds of schools and hospitals, habitats of endangered species, surface waters, public gardens, livestock, feed crops
- **Indoor**: Where people live, work, shop, or go to school; food or feed is processed, stored or served; confined livestock

Endangered Species

Brink of extinction

- Each state is responsible for protecting endangered and threatened species from the harmful effects of pesticides.
- Product label may carry a statement to consult a county bulletin
- Developed by the EPA
- Precautionary measures: buffer strips, reduced rates or no application permitted

Chapter 11 (pg. 93) Pesticides and Water

- Sources of Water Contamination
- ***Point-source pollution***
- Comes from a specific, identifiable place or location: pesticide spill, back-siphoning, or improper disposal
- ***Non-point-source pollution***
- Comes from a widespread area: field

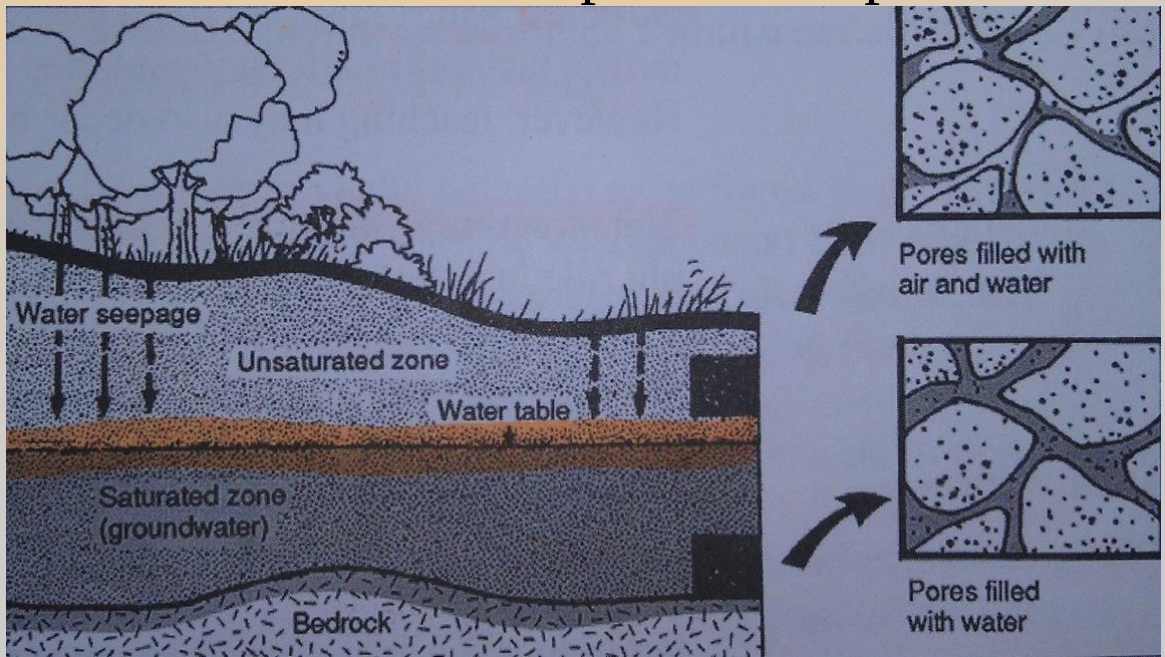
Contamination of Surface Water

Factors that Affect Runoff

- Slope
- Vegetative cover – filter strip
- Soil characteristics – clay vs. sand
- Temperature – frozen ground
- Rainfall or irrigation – heavy or excessive

Groundwater Contamination

- **<u>Groundwater</u>:** underground water in the cracks in the bedrock and in the spaces between sand, gravel and rocks.
- Source for springs and wells
- 70% of all water for public and private use



Geologic formation is called an ***<u>aquifer</u>***

Groundwater Contamination

- Pesticides can move downward with the water that recharges the aquifer. Process is called ***leaching***.
- Characteristics of pesticides that promote leaching
  - High solubility
  - Persistence
  - Low adsorption
- Label will state leaching concerns

Pesticide Leaching

Soil Properties & Environmental Conditions

- Characteristics of soils and the Environment that promote leaching
  - **Soil Texture and Structure**
    - Sandy soils more prone to leaching
    - Size and shape of pores
  - **Organic Matter**
    - ability to hold water, adsorb pesticides
  - **Depth to Groundwater**
    - Shallow water table at risk
  - **Geology:** gravel deposits vs. clay layers

Minimize Groundwater Contamination

Follow the use directions on the label!

- **<u>Best Management Practices (BMP's)</u>** are effective, commonsense practices that emphasize proper mixing, loading, application and disposal of pesticides.
- **IPM Principles**
  - Use non-chemical methods where possible
  - Select products less likely to leach or runoff
  - Calibrate sprayer regularly

Best Management Practices

- Identify Vulnerable Areas
  - Sandy soil, sinkholes, wells, streams, ponds
  - Streets, storm drain, drainage ditches
- Keep Pesticides Away From Wells
- Select Appropriate Mix & Load Site
  - Consider a mixing and loading pad
  - Do not mix near wells, surface water
  - 50 feet

Containment Pad for Mixing & Loading

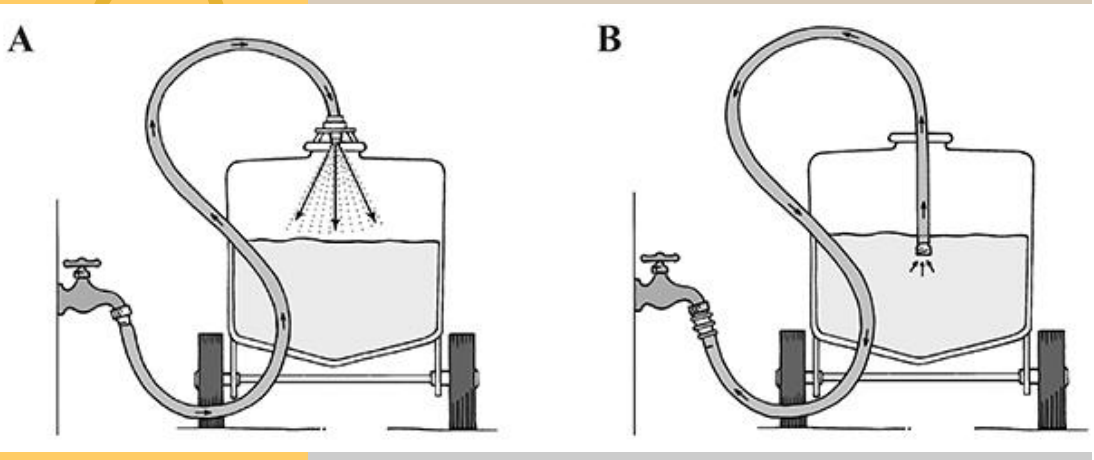
- Pads designed to contain spills, leaks, overflows, and waste water
- Easier to clean up spills
- Prevent environmental contamination
- Made of impermeable material
- Concave or with berms, curbs
- Sump system for removal

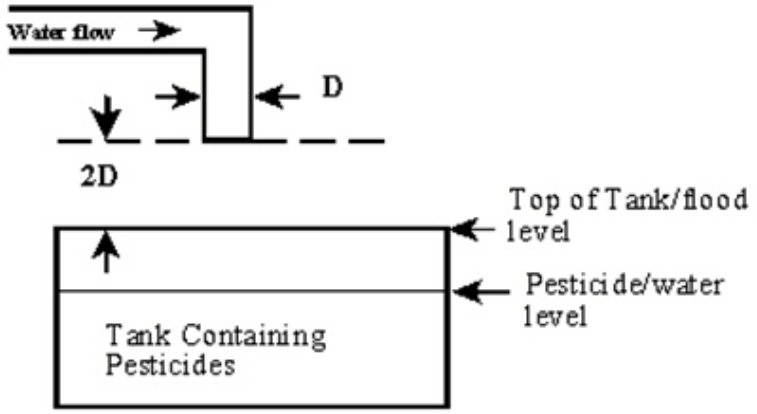
Avoid Back-Siphoning

- Back-siphoning is the reverse flow of liquids into a fill hose.
- Suction occurs when water is turned off
- Suction could cause pesticide contamination of your water source.

Avoid Back-Siphoning

- Use a water tank
- Maintain an air gap: 2x the hose diameter
- Install an anti-siphoning device (must be state approved)





Chapter 22: Pesticide Drift (pg.175)

- Pesticide **Overspray**: occurs when pesticide is directly sprayed outside of the target area. Always avoidable!
- Pesticide **Drift**: occurs when air currents cause pesticide to be deposited outside a target application site.

Types of Drift

- **Spray Drift**: small spray droplets are carried by air movements from the target.

- **Vapor Drift**: when a volatile pesticide changes from a solid or liquid into a gas and fumes move from the target

Factors that Increase Drift

- **Smaller droplet size**: moved easier
- **Increase wind speed**
- **Increase in temperature**: Evaporation
- **Decrease in humidity**: Drier air
- **Increase nozzle to target distance**

Drift: Weather Conditions

- **Air Stability**: warm air currents and higher wind speeds at midday.
- **Temperature Inversion**: rapid cooling of the earth surface which leads to a layer of warm air between layers of cold air.
  - Clear calm nights
  - Fog or smoke

Factors that Affect Vapor Drift

- **Temperature**: increases volatility
- **Soil Conditions**:
  - Wet soil increases the rate of volatilization
    Decreases the effectiveness of incorporation
- **Pesticides**: Volatile herbicides, 2,4-D
- Droplet size: smaller the droplet, quicker to vaporize
- Humidity: drier the air, quicker to vaporize

Drift Management

- First rule of drift management is to know when NOT to spray.
- Be aware of site conditions and assess the risks BEFORE you prepare the pesticide
- Assume there will be little or no tolerance for drift

Choosing to Spray

- Even under good spraying conditions, drift cannot by totally eliminated
- Keep the nozzle as close to the target as possible
- Apply the coarsest droplet size that provides sufficient coverage & pest control
- Droplets < 50 microns highly susceptible

Reduce Droplet Size

- Spray Pressure – low as possible
- Nozzle: select for the coarsest droplet
- Spray Rate: nozzle vs. pressure; consider changing the nozzle before changing the pressure!
- Drift-Reduction Agents
- Sprayers

Chapter 23: Application Safety (pg. 185)

Before application

- Read and understand the label!
- Be prepared for emergencies
- If alone, let one other person know where
- Work in pairs – highly toxic pesticides
- Make voice or visual contact every 2 hr.
- Check through equipment

During Application

- While you are applying pesticides, you are responsible for protecting yourself, other people, domesticated animals, and the environment.
- Minimize drift and runoff
- Wear appropriate PPE
- Monitor your equipment as you apply

Increased Risk to Exposure

- Mist blower or airblast sprayer
- Aerosol and fog generator
- High pressure sprayers & power dusters
- Equipment that directs applications over your head
- Enclosed areas

Reentry Restrictions (WPS)

- Check the pesticide label
- "Agricultural Use Requirements" (REI and PPE information)
- Agricultural employer is responsible for keeping workers out of a treated area.
- No REI, reenter after application
- Soil fumigants more strict