Water Quality Info

What makes water “good quality”?

Depends on the use….

Water Quality Depends on Water Suitability

*__Water quality__= subjective term as not a clearly defined, single set of guidelines is applicable for all circumstances

*Ex. Water for irrigating a field is not necessarily safe for drinking.

*Ex. Swimming pools: chlorine level of 1-3 ppm
Ponds: chlorine level should be 0 ppm

*Water quality can be thought of as **water suitability**

- For this unit, we are going to focus on water for drinking!



Alkalinity

- Alkalinity = buffering capacity, or how well it can neutralize acidic pollution and resist changes in pH
- Measures the amount of alkaline compounds in the water (ex. carbonates, bicarbonates, hydroxides)
- Removes excess hydrogen ions

Alkalinity

- Environmental Protection Agency recommended range: 20-200 mg/L (20-200 ppm) as calcium carbonate

Ammonia

- Ammonia enters surface waters/ ground waters from decomposing nitrogenous organic matter (ex. domestic waste) and some industrial waste discharge
- Groundwater supplies generally have low ammonia concentrations due to binding/adsorption by soil particles
- Amount present in natural or polluted waters is not physiologically damaging (WHO/ ANZECC, 1992) but can indicate sewage pollution

Ammonia

- World Health Organization recommends a maximum level of 1.5 mg/L (1.5 ppm)*

- NOTE: This level may not be toxic but could result in consumer complaints regarding odor/ taste problems

Chloride

- Usually associated with salt content and amounts of dissolved minerals in water
- Amount of chlorides in water determined by types of rocks and soils it has contacted
- Seawater intrusion in groundwater can also be a cause for increased chlorides
- Sources: salt applied to pavements to melt ice, wastewater treatment discharges, water softeners, storm sewers, animal feed, and fertilizers

Chloride

- World Health Organization recommends a maximum level of 250 mg/L (250 ppm)*

- NOTE: This level may not be toxic but could result in consumer complaints

Chlorine

- Used as a disinfectant- destroys or deactivates disease-producing microorganisms

- Not typically found in local ecosystems

Chlorine

- World Health Organization recommendations:

*For effective disinfection there should be enough residual chlorine concentration (> 0.5 mg/L or 0.5 ppm free available chlorine) after at least 30 minutes contact time at pH <8.0.

*Environmental Protection Agency recommends a maximum level of 4 mg/L (4 ppm). Optimal range is 0.2-0.5 mg/L (0.2-0.5 ppm).

Chromium

- Chromium (Cr)- metal found in natural deposits as ores containing other elements
- Used in metal alloys such as stainless steel
- Occurs in protective coatings on metal, magnetic tapes
- Also occurs in pigments for paints, cement, paper, rubber, composition floor covering and other materials
- Soluble forms are used in wood preservatives

Chromium

SHORT TERM EFFECTS:

- skin irritation or ulceration when people are exposed to levels above 0.1 ppm for relatively short periods of time

- also potential to cause damage to liver, kidney circulatory and nerve tissues and skin irritation from a lifetime exposure at levels above 0.1 ppm

Copper

- Copper (Cu)- an essential and beneficial element for plant and animal life
- Rarely occurs in high levels in water supplies
- Not considered to be a health hazard

Copper

- World Health Organization recommends a maximum level of 2.0 mg/L (2.0 ppm)

- NOTE: This level is based on levels which cause taste and laundry staining problems instead of toxicity (not considered harmful)

Dissolved Oxygen (DO_2)

- Direct measurement of dissolved oxygen in water sample
- Depleted DO_2 levels can indicate sewage and other organic decomposition
- algal blooms (and die offs) can reduce DO
- Temperature affects levels (colder water will have higher DO)

Dissolved Oxygen (DO_2)

- World Health Organization recommends levels between 6-9 mg/L (6-9 ppm)

Hardness

- Hardness determined by amount of naturally occurring calcium and magnesium compounds dissolved in water during passage through rock and soil material
- A high hardness level is one of the most common problems with groundwater supplies for drinking water
- Not harmful unless so high water tastes salty

Hardness

- Environmental Protection Agency recommended range: 60-120 mg/L (60-120 ppm) as calcium carbonate

Iron

- Naturally occurring metal
- Enters water supply as water passes through soil and rocks

Iron

- World Health Organization recommends a maximum level of 0.3 mg/L (0.3 ppm)

- High levels of iron creates a bitter, metallic taste

Nitrate

- Nitrate pollution may occur from discharge of human/ animal waste, fertilizer runoff, or seepage into groundwater; could also result from pesticides and detergents

- High levels especially dangerous for infants (methemoglobinemia, or “blue baby syndrome”= blood doesn’t release oxygen properly)

- High levels can cause **eutrophication**- excessive nutrients which can lead to dense growth of plant life, causing high decomposition and death of animals

Missouri Stream Teams: EUTROPHICATION PROCESS

Nutrient-rich runoff enters streams and lakes

Plants and algae grow abundantly

Algae blooms decrease oxygen in stream/lake

Fish and other aquatic life suffer or die



Wears Creek, Jefferson City

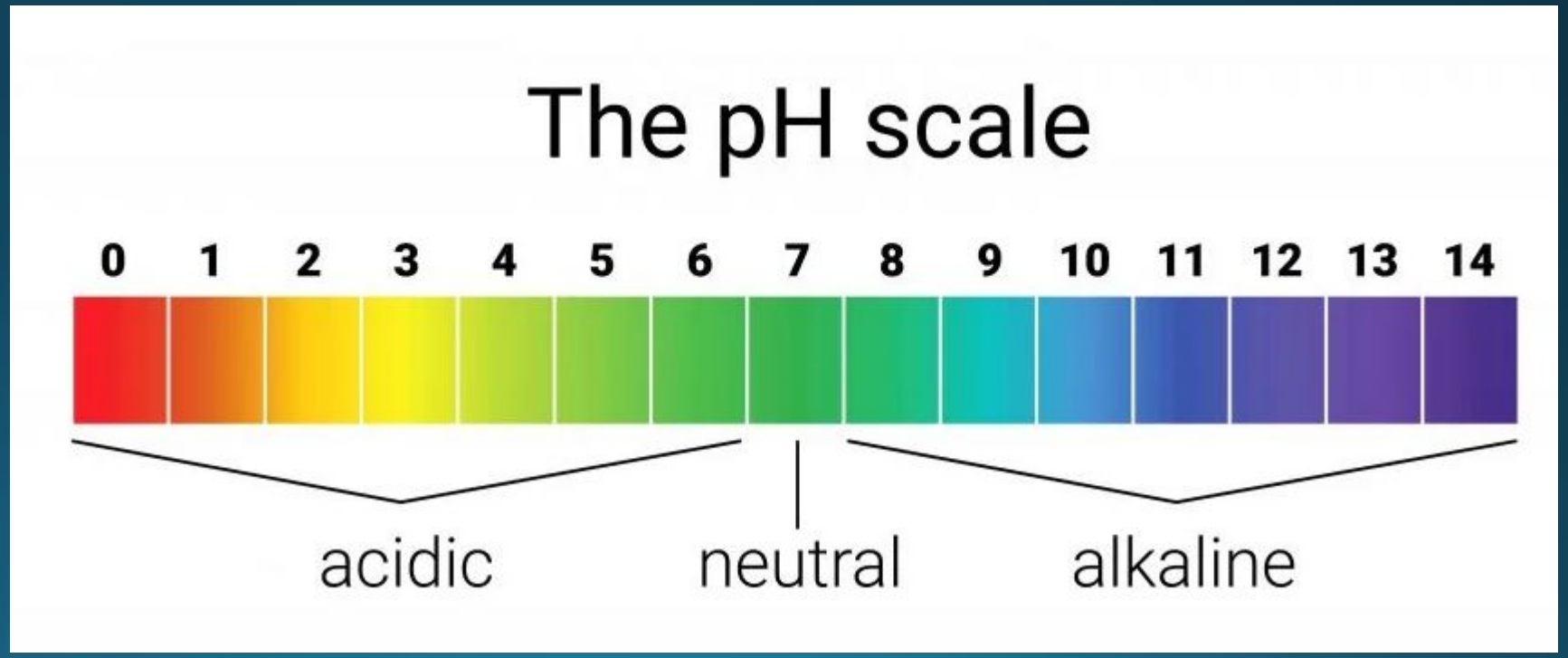
Nitrate

- World Health Organization recommends a maximum level of 10 mg/L (10 ppm)

pH

- pH is a measure of the hydrogen ion (H+) concentration in water
- Scale: 0 (acidic)-14 (basic or alkaline)
- 7= neutral

- not measured in ppm as logarithmic scale



pH

- Most natural water types have pH 5-9
- World Health Organization recommends pH levels 6.5-8.5

- pH of drinking water should be regularly monitored as low levels (<5-6) may cause corrosion of metal pipes and fittings, releasing metals into water

- Water with a pH > 8.5 could indicate that the water is hard

  NOTE: Hard water does not pose a health risk, but can cause aesthetic problems.

pH

- Biological impact:
  - irritation of soft tissues if pH too acidic or basic
    ex. eyes, skin, mucous membranes

Phosphate

- Phosphate pollution may occur from discharge of human/ animal waste, fertilizer runoff, or seepage into groundwater; could also result from detergents

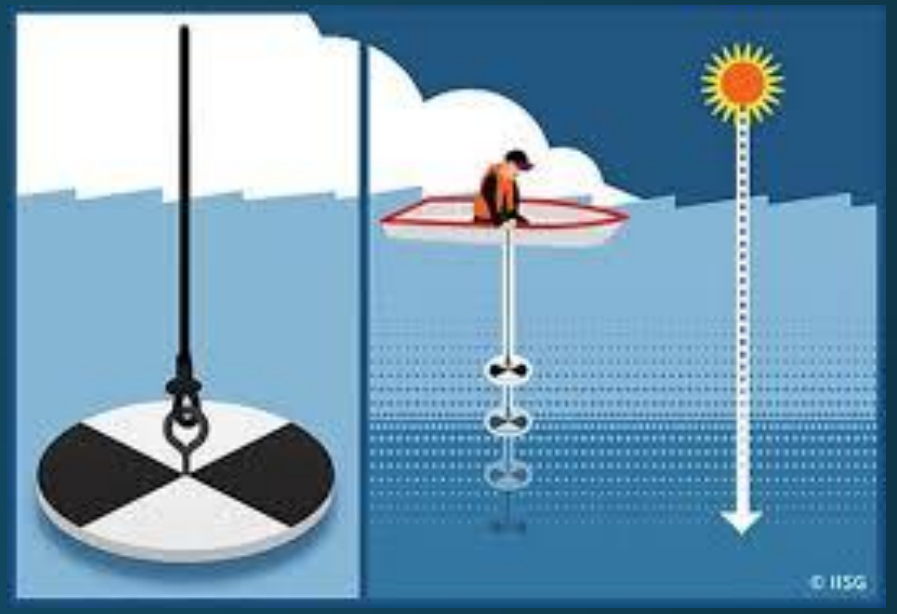
Phosphate

- Environmental Protection Agency recommends a maximum level of 0.1 mg/L (0.1 ppm)

Turbidity

- measure of cloudiness
- not a direct indicator of health risk, but studies show a strong relationship between turbidity and microbes
- particles provide a shelter for protozoa and other microbes such as bacteria

Turbidity



- Secchi disks are commonly used to test turbidity (inexpensive)

NOTE: Scales depend on size of Secchi disk

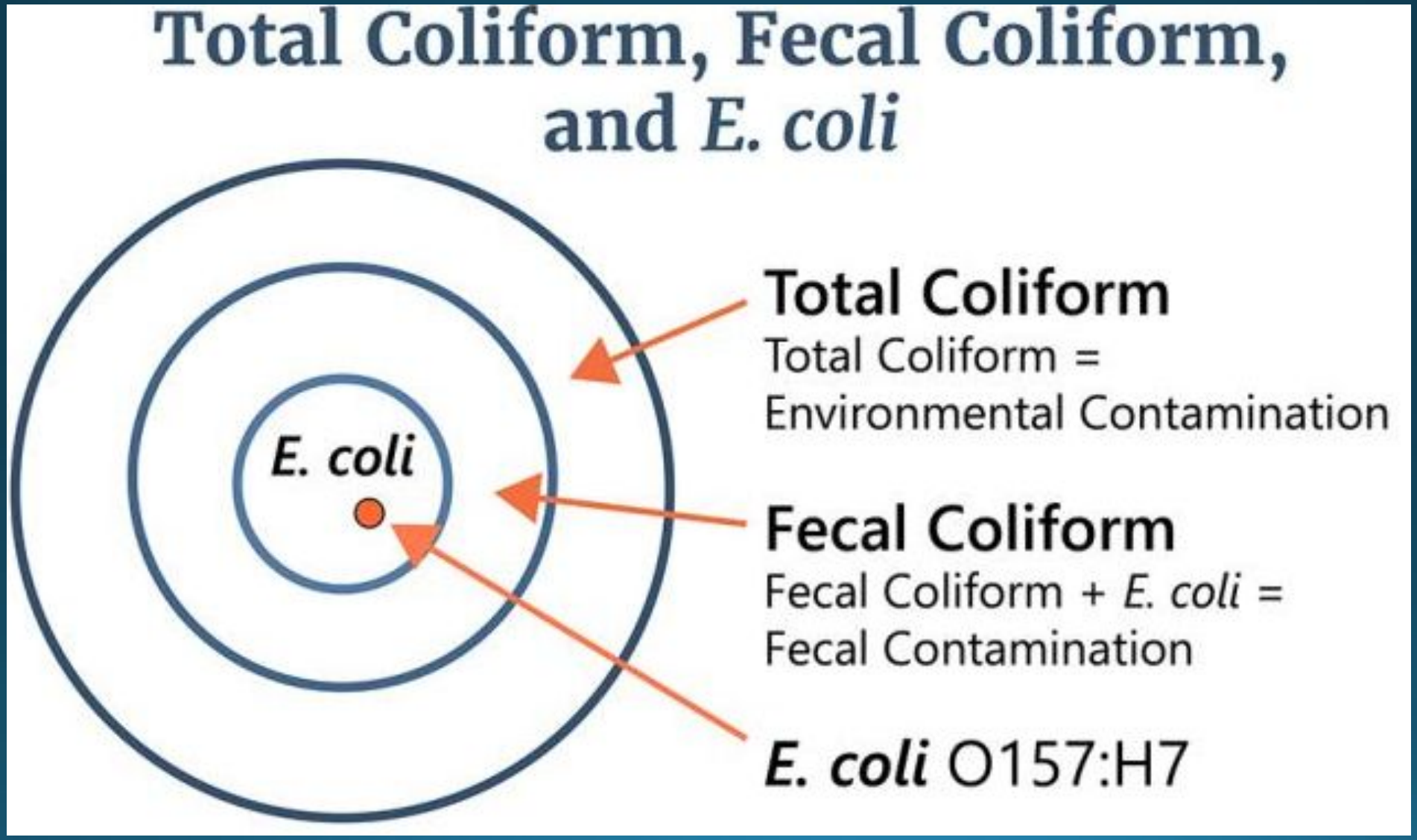
- EPA recommends <1 NTU

- Spectrophotometers can be used as well (expensive)

OPTIONAL: Coliform bacteria

- **Total coliform bacteria**: group of related bacteria that are (with a few exceptions) not harmful to humans
- EPA considers total coliforms a useful indicator of other pathogens for drinking water
- **Pathogens**= a variety of bacteria, parasites, and viruses that can potentially cause health problems if ingested
- *E. coli* is a subset of fecal coliforms

OPTIONAL: Coliform bacteria



OPTIONAL: Coliform bacteria

- World Health Organization recommends no detectable amounts in a 100 mL sample

= 0 CFU/ 100 mL