Laboratory Testing for Safe Drinking Water

Ensuring Water Quality in Small Systems

Importance of Laboratory Testing

- Ensures compliance with water quality standards
- Detects contaminants before they become hazardous
- Monitors treatment efficiency and operational performance
- Helps prevent waterborne diseases
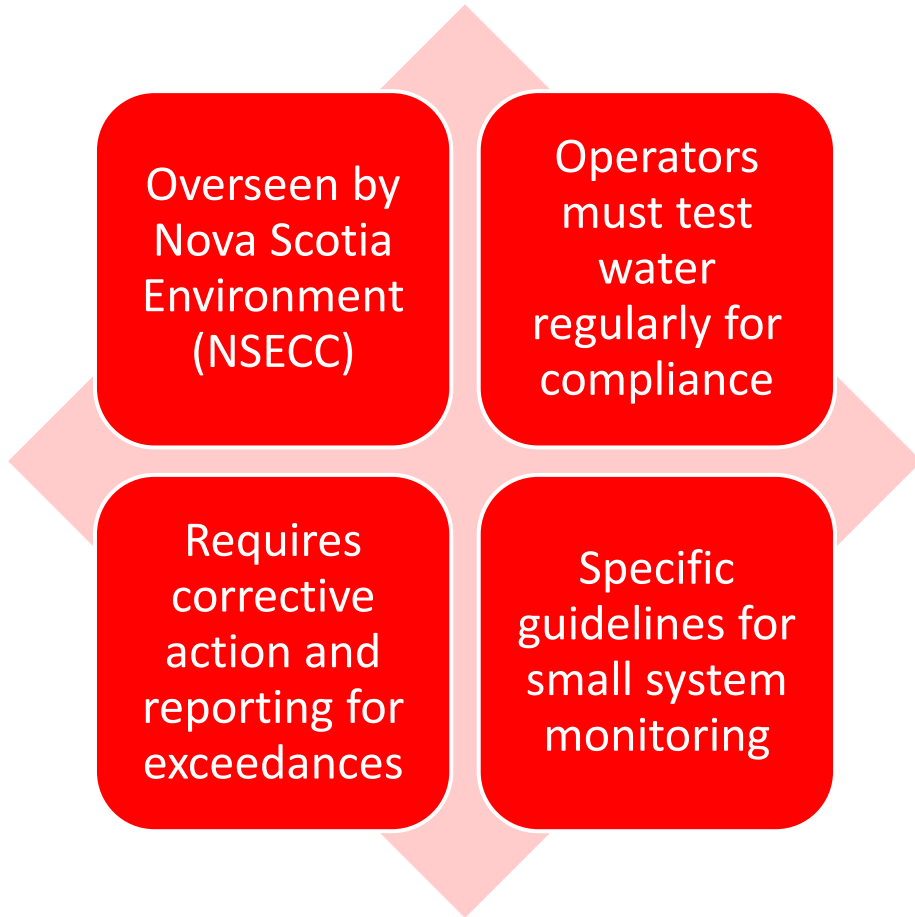- Supports decision-making for system improvements

Overview of Regulatory Requirements

- Health Canada's Guidelines for Canadian Drinking Water Quality (GCDWQ)

- Nova Scotia Environment Climate Control(NSECC) Drinking Water Regulations

- Municipal water testing requirements

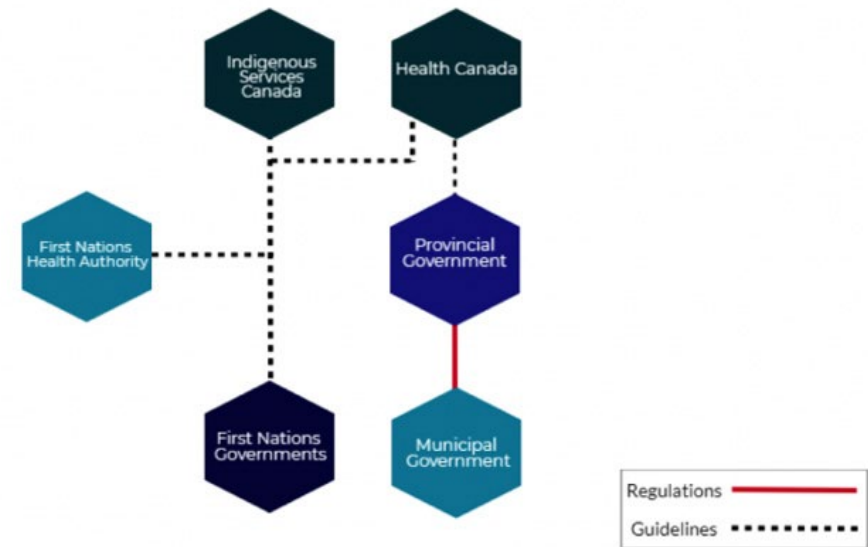- Compliance and reporting obligations

Health Canada Guidelines

- - Sets maximum acceptable concentrations for microbiological, chemical, and physical parameters
- - Provides recommendations for monitoring and corrective actions
- - Helps protect public health by ensuring safe drinking water

Nova Scotia Drinking Water Regulations

Overseen by Nova Scotia Environment (NSECC)

Operators must test water regularly for compliance

Requires corrective action and reporting for exceedances

Specific guidelines for small system monitoring

Water Governance Structure

Indigenous Services Canada

Health Canada

First Nations Health Authority

Provincial Government

First Nations Governments

Municipal Government

Regulations
Guidelines

Reporting & Compliance Responsibilities

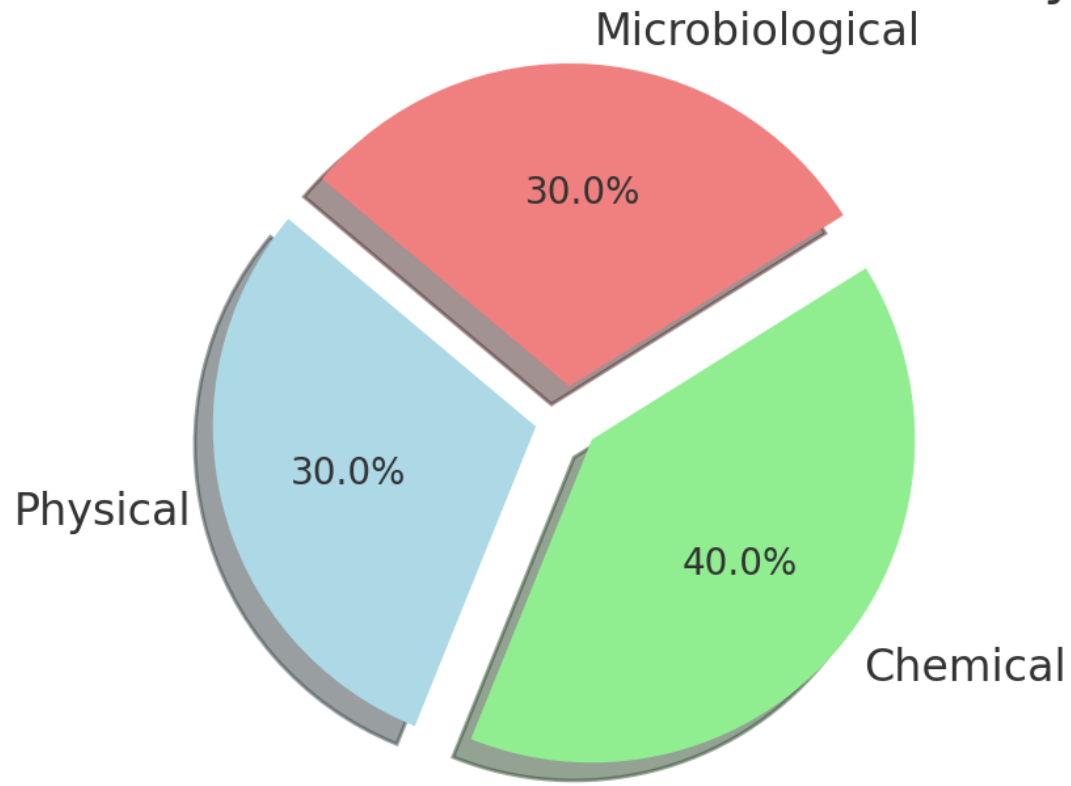Routine water quality monitoring and documentation

Submitting reports to regulatory agencies

Immediate reporting of unsafe water conditions

Implementing corrective actions when exceedances occur

Key Parameters Tested in Small Systems

Key Parameters Tested in Small Water Systems

Physical Parameters

- Turbidity: Measures water clarity & suspended particles

- Color & Odor: Indicates organic material or contaminants

- Temperature: Affects treatment efficiency & biological activity

Chemical Parameters

pH & Alkalinity: Influences corrosion control

Hardness: Measures calcium & magnesium affecting scaling

Chlorine Residual: Ensures disinfection & pathogen control

Conductivity: Assesses dissolved ions & contamination

Microbiological Parameters

- Total Coliforms & E. coli: Indicators of microbial contamination

- Heterotrophic Plate Count (HPC): Measures bacterial growth in distribution

- Sampling & interpretation of microbiological test results

Sampling Techniques for Water Quality Testing

Ensuring Accuracy and Compliance in Water Sample Collection

Proper Sample Collection

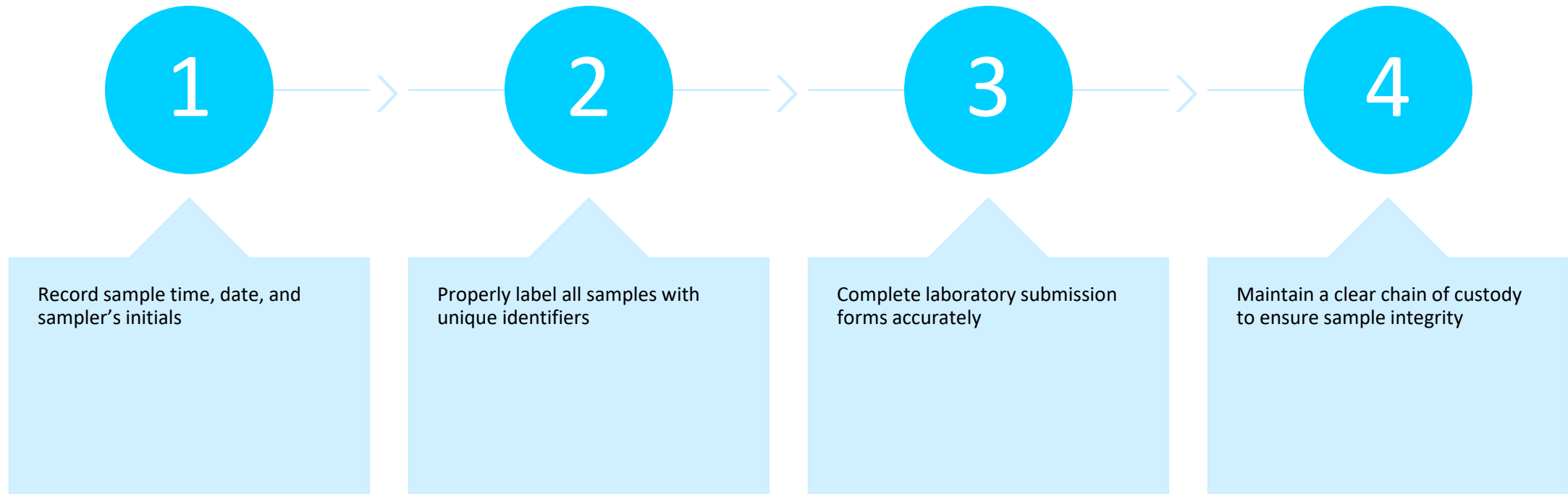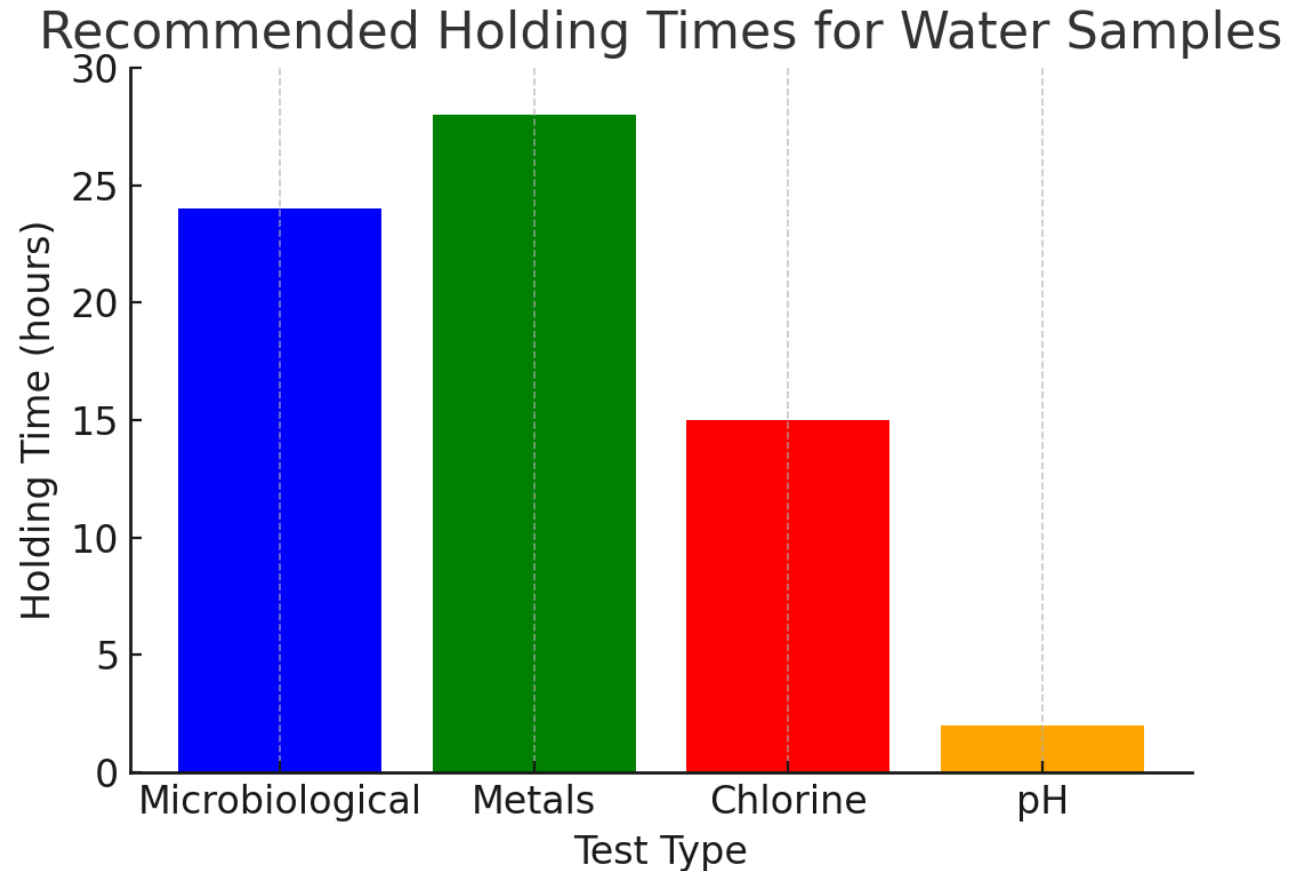| Choose	Use	Avoid	Follow
Choose appropriate sample locations to represent system conditions	Use sterile containers for microbiological tests to prevent contamination	Avoid contamination by wearing gloves and following proper handling procedures	Follow correct sampling order (e.g., before chlorination for bacteriological samples)

Preservation & Storage

- Maintain proper holding times and temperatures for accurate results
- Use appropriate preservatives:
- Acid for metals to prevent precipitation
- Sodium thiosulfate for chlorine-sensitive samples to neutralize chlorine
- Store microbiological samples at 1-4°C and process within 24 hours

Chain of Custody & Documentation

1

2

3

4

Record sample time, date, and sampler's initials

Properly label all samples with unique identifiers

Complete laboratory submission forms accurately

Maintain a clear chain of custody to ensure sample integrity

Recommended Holding Times for Water Samples

Recommended Holding Times for Water Samples

Basic Laboratory Tests for Water Quality

Understanding Physical, Chemical, and Microbiological Analyses

Overview of Basic Laboratory Tests

- Physical Tests: Assess appearance and sensory qualities

- Chemical Tests: Measure dissolved substances affecting water quality

- Microbiological Tests: Detect bacteria and pathogens

- Instrumentation: Ensuring accuracy through proper calibration

Turbidity Measurement

- Measured using a turbidimeter
- Indicates suspended particles in water
- Important for filtration and disinfection effectiveness

Color & Odor Assessment

Visual and sensory evaluation

Indicates presence of organic matter, iron, or contaminants

May signal treatment issues or source water changes

Temperature Measurement

- Affects chemical reaction rates and biological activity
- Influences dissolved oxygen levels
- Critical for monitoring treatment process efficiency

Chemical Tests Overview

Assess water chemistry and potential contamination

Important for corrosion control, disinfection, and scaling prevention
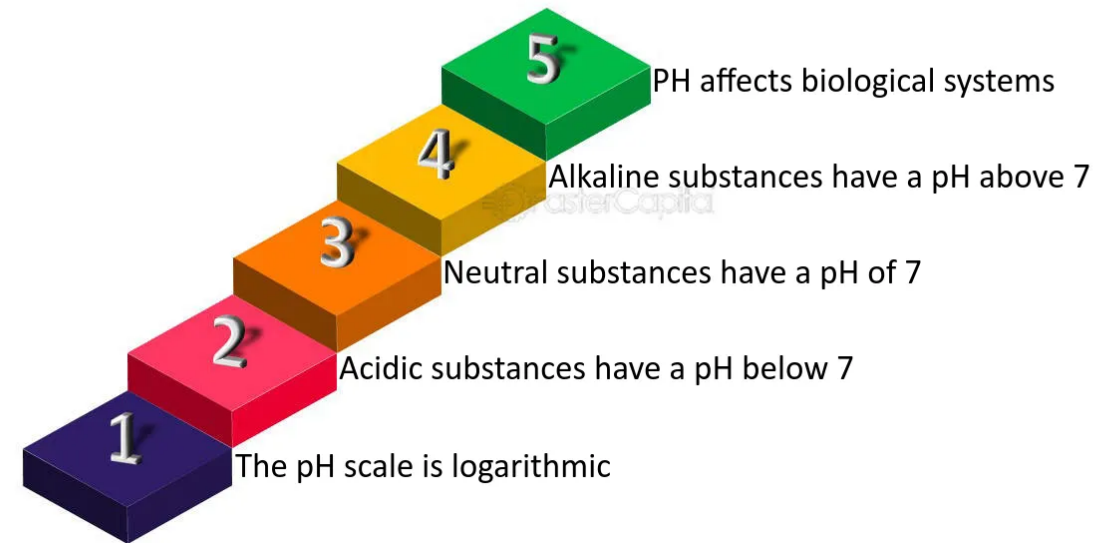
Conducted using laboratory and field testing equipment

pH & Alkalinity Testing

pH measured using pH meters; affects corrosion control

Alkalinity indicates water's ability to neutralize acids

Key factor in treatment chemical dosing

What is pH? Understanding the Concept of Acidity and Alkalinity

PH affects biological systems

Alkaline substances have a pH above 7

Neutral substances have a pH of 7

Acidic substances have a pH below 7

The pH scale is logarithmic

Hardness Testing

- Measured using titration methods
- Determines levels of dissolved calcium & magnesium
- Affects scaling in pipes and water treatment efficiency

Hard water
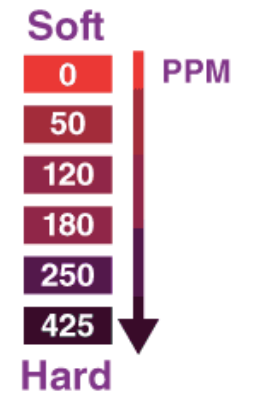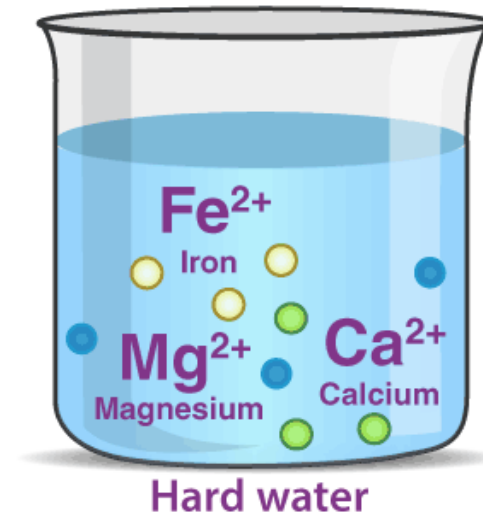
Chlorine Residual Testing

- Ensures disinfection effectiveness

- Measured using DPD colorimetric method

- Key for pathogen control in distribution systems

Conductivity Testing

- Measures dissolved ion concentration

- Indicator of contamination or mineral content changes

- Helps assess water source stability

# Microbiological Tests Overview

- Detects bacterial contamination

- Ensures water is free from harmful pathogens

- Used for regulatory compliance and public health safety

Total Coliforms & E. coli Testing

- Presence/Absence (P/A) or Membrane Filtration (MF) techniques

- Detects bacterial contamination levels

- Essential for drinking water safety compliance

Coliforms Explained

Total Coliforms

Fecal Coliforms

E. coli
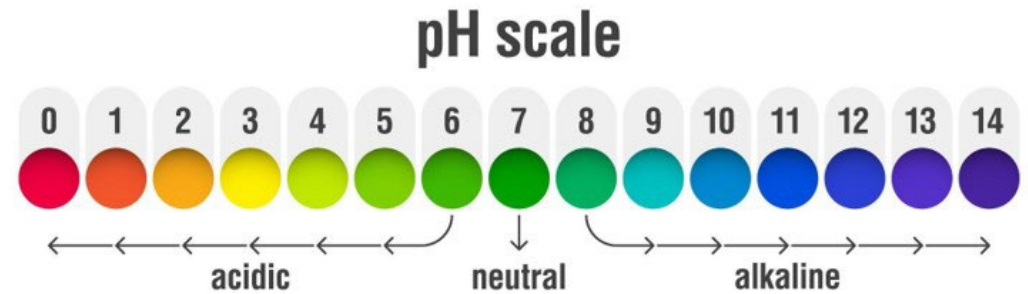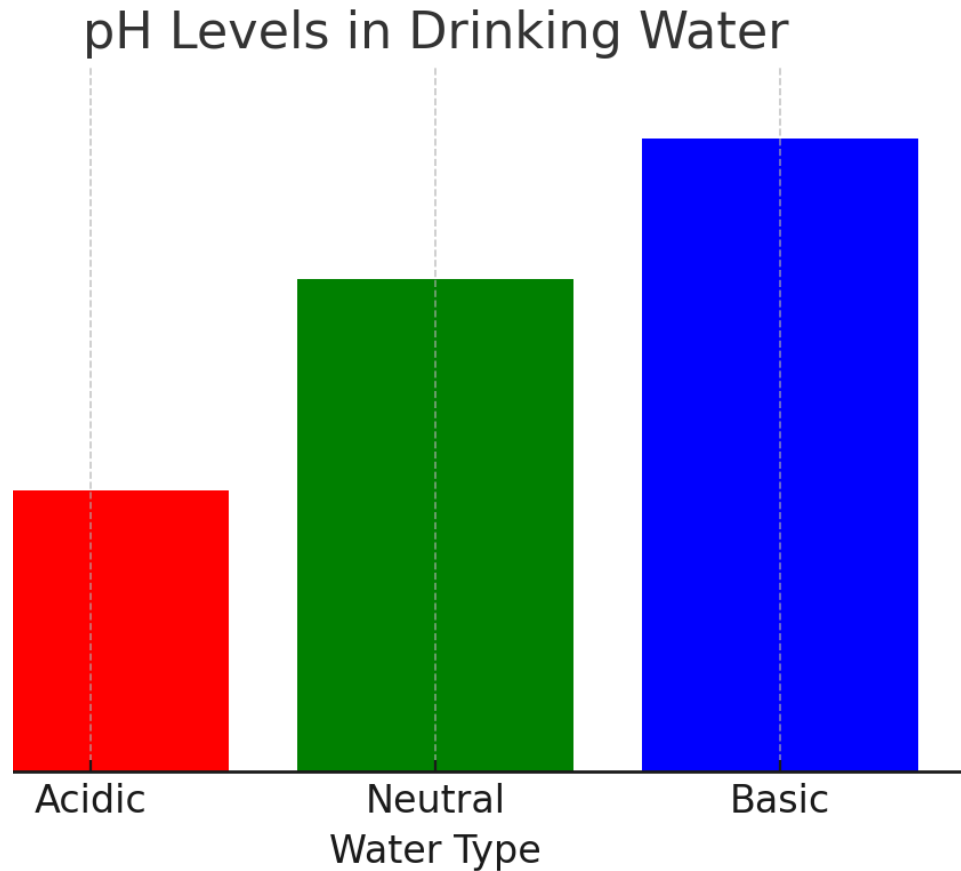
Pathogenic E. coli
(O157:H7)
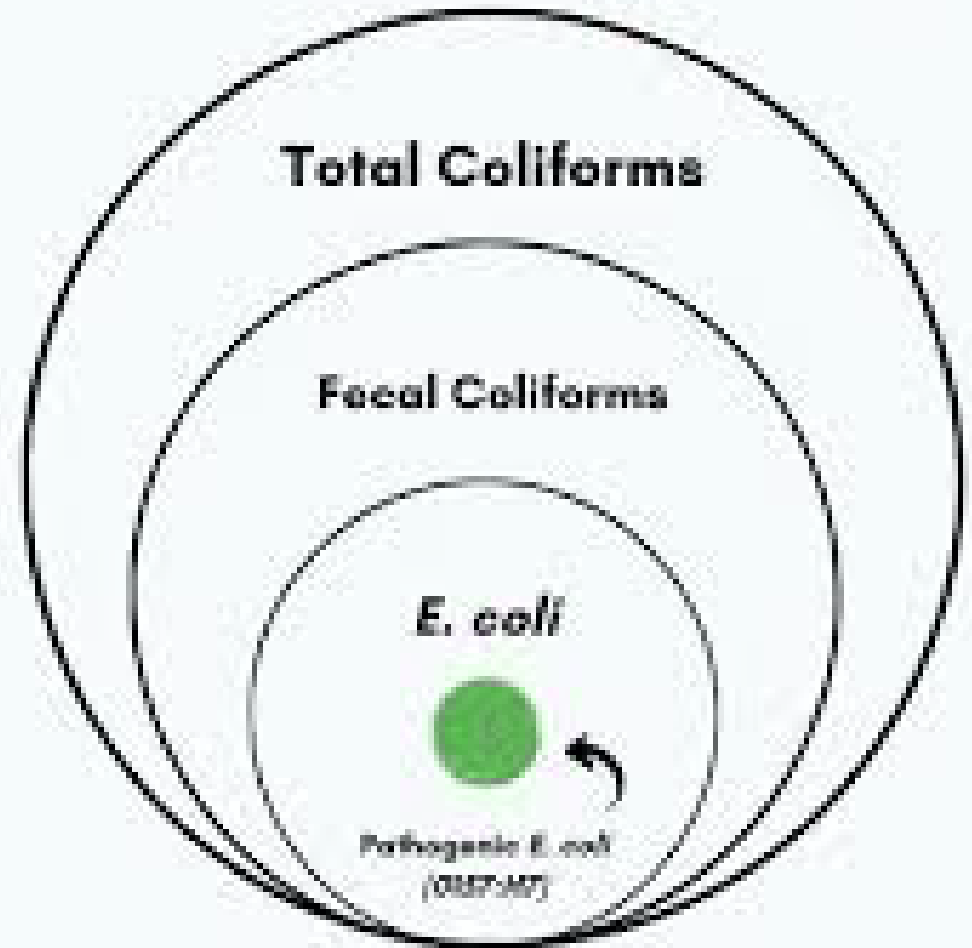
Interpreting Microbiological Results

- A positive test indicates possible contamination

- Requires immediate retesting and corrective action

- Common causes: cross-contamination, system failures

pH Levels in Drinking Water

pH Levels in Drinking Water

Instrumentation Overview

Use of portable vs. bench-top equipment

Regular calibration to ensure accuracy

Maintenance of key lab instruments for reliable results

Interpreting Results & Troubleshooting

Recognizing and Addressing Water Quality Issues

Recognizing Out-of-Range Results

- Identifying abnormal water quality test results

- Understanding potential causes of deviations

- Determining appropriate corrective actions

High Turbidity: Causes & Implications

May indicate sediment breakthrough in filters

Can lead to microbial contamination

Reduces effectiveness of disinfection

Requires investigation into treatment process failures

Low Chlorine Residual: Causes & Implications

- Could indicate high chlorine demand due to organic material
- Possible dosing issues or chemical depletion
- Risk of microbial growth in distribution system
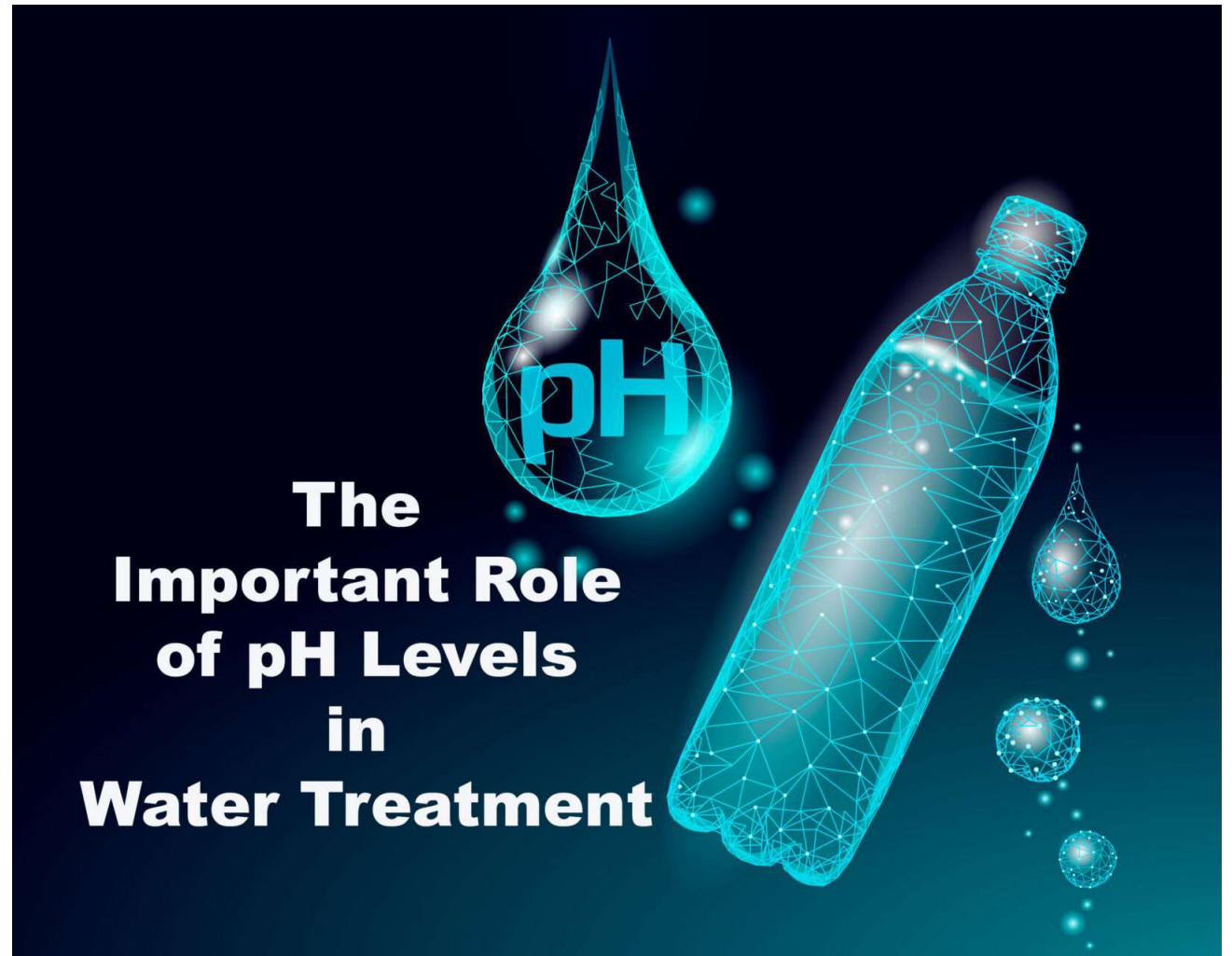- Requires immediate corrective action
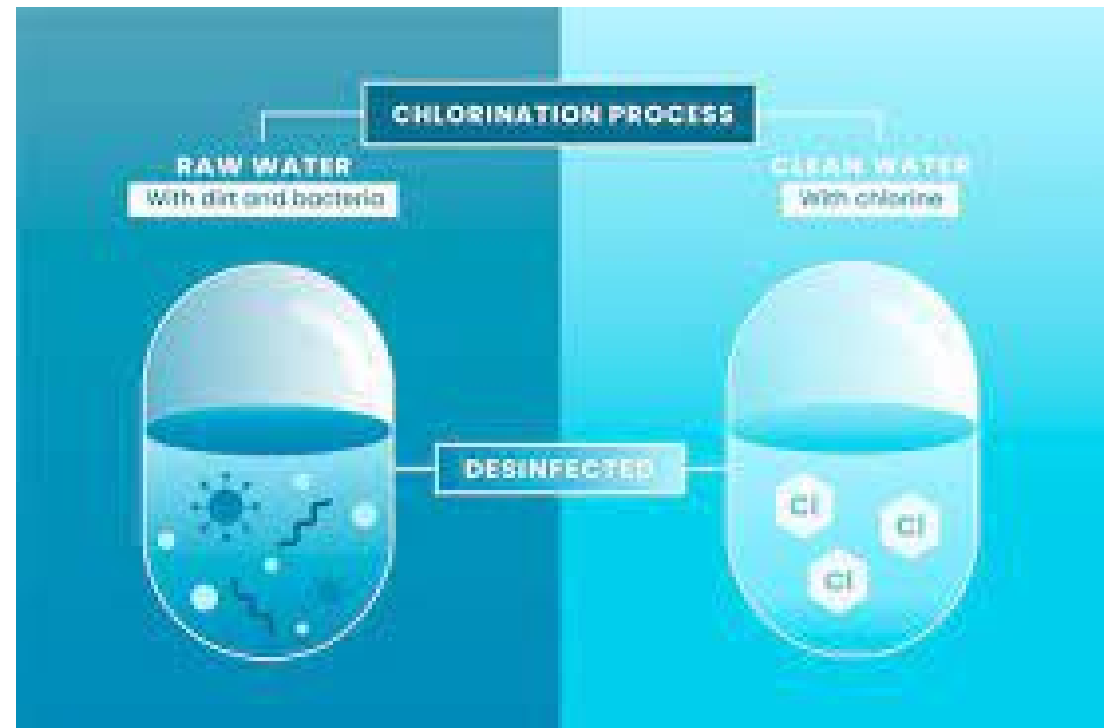
pH Fluctuations: Causes & Effects

Possible causes include CO2 absorption or chemical dosing imbalance

Affects corrosion control and scaling potential

Can interfere with disinfection efficiency

Requires adjustment of buffering capacity

The Important Role of pH Levels in Water Treatment

Microbial Positives: Potential Causes

- Contamination in distribution system or source water

- Inadequate chlorine residual for pathogen control

- Cross-connections or intrusion of contaminants

- Requires re-sampling and investigation

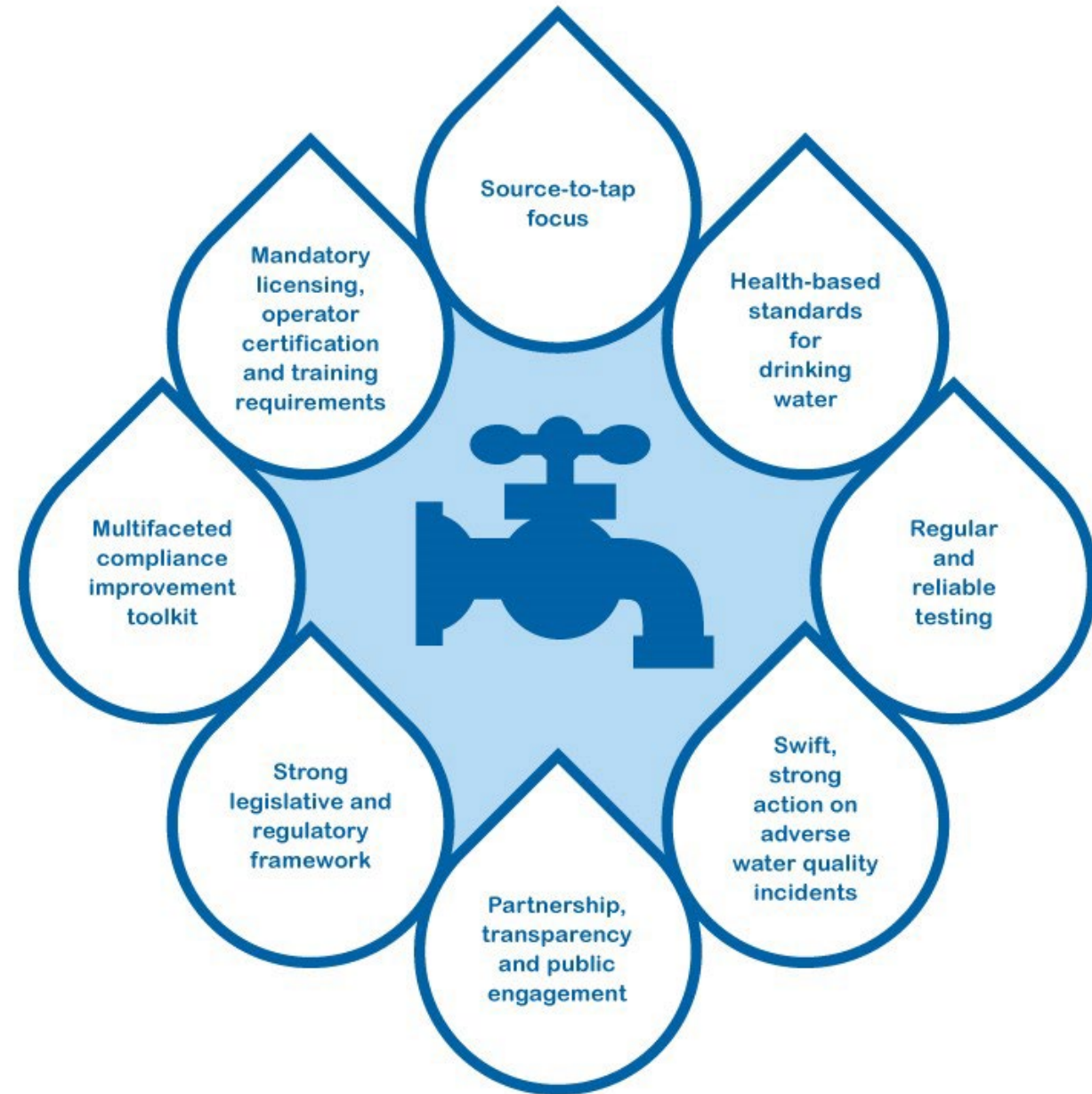# Common Water Quality Issues
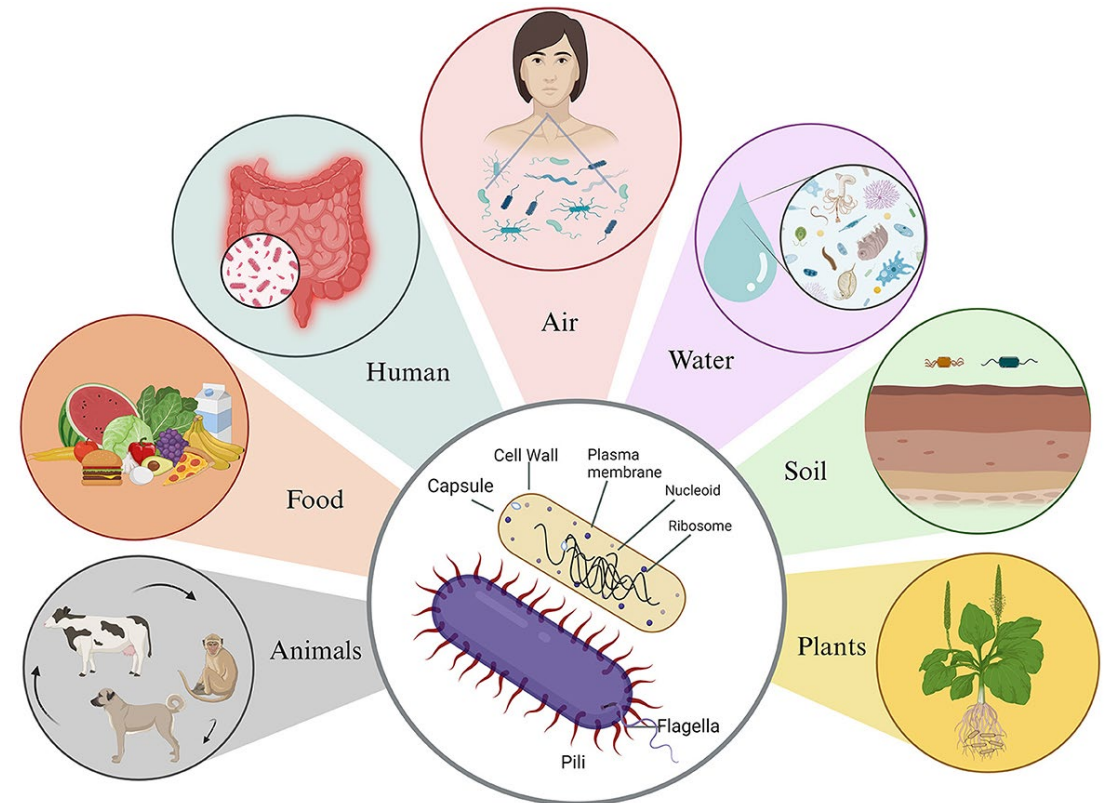
Occurrence Percentage of Common Water Quality Issues
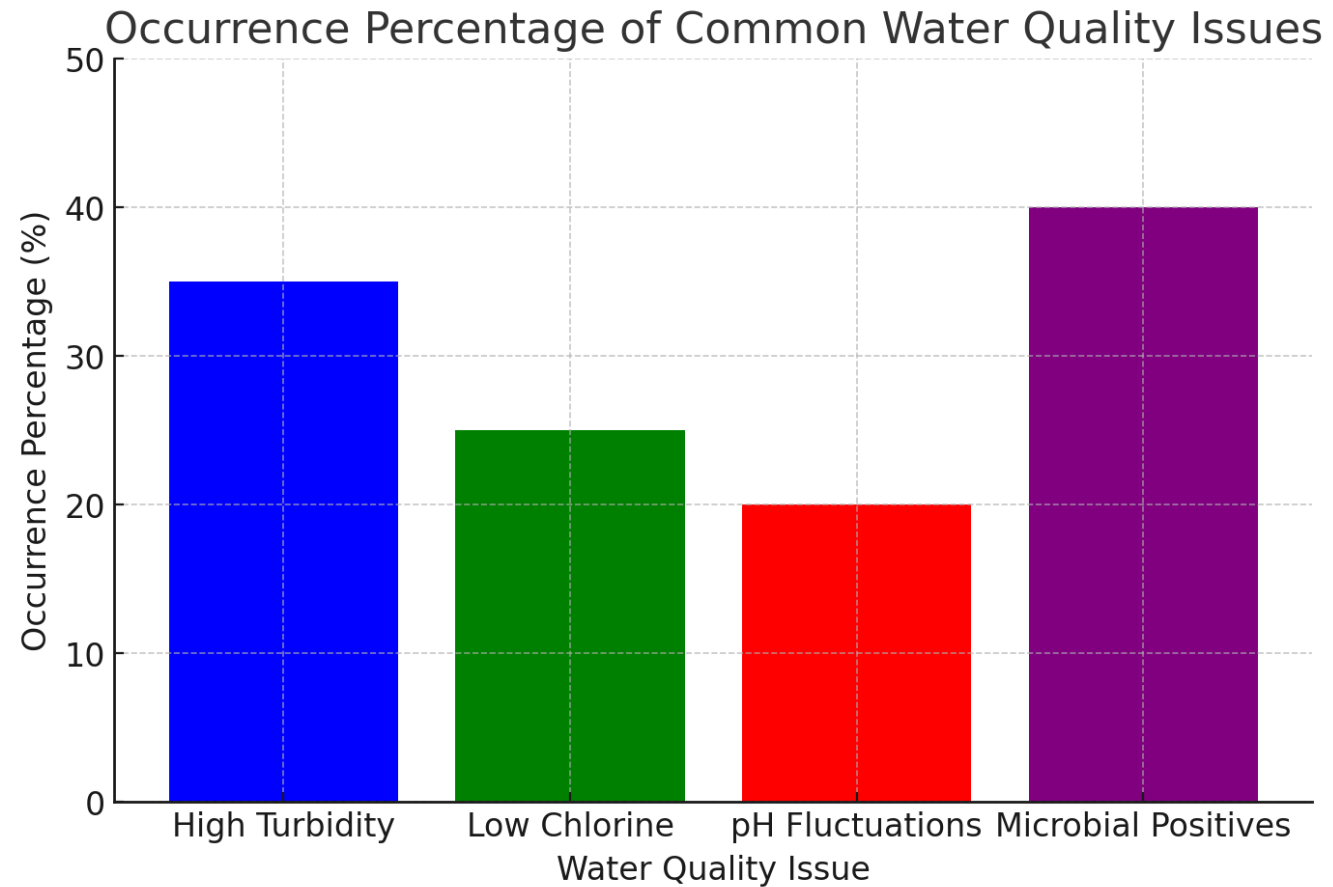
Corrective Actions Overview

- Addressing water quality issues through systematic corrections

- Ensuring compliance with regulatory standards

- Preventing future issues through proactive monitoring

Flushing & Re-sampling Procedures

Flushing helps remove contaminants from the system

Re-sampling ensures the issue has been resolved

Required in case of microbial contamination or residual loss

Adjusting Chemical Dosing

Ensures proper pH balance and disinfection

Prevents corrosion and scaling in pipes

Requires continuous monitoring and calibration

Investigating System Issues

Identifying cross-connections and leaks

Ensuring proper operation of treatment processes

Addressing potential failures in distribution system

HOW BACKFLOW CAN HAPPEN

STAGE 1: Your home or business has a connection to the public water system not protected by a backflow device.

STAGE 2: Water pressure is reduced due to a break in the water main or a fire event using a lot of water suddenly.

STAGE 3: The sudden drop in water pressure creates a reverse pressure situation.
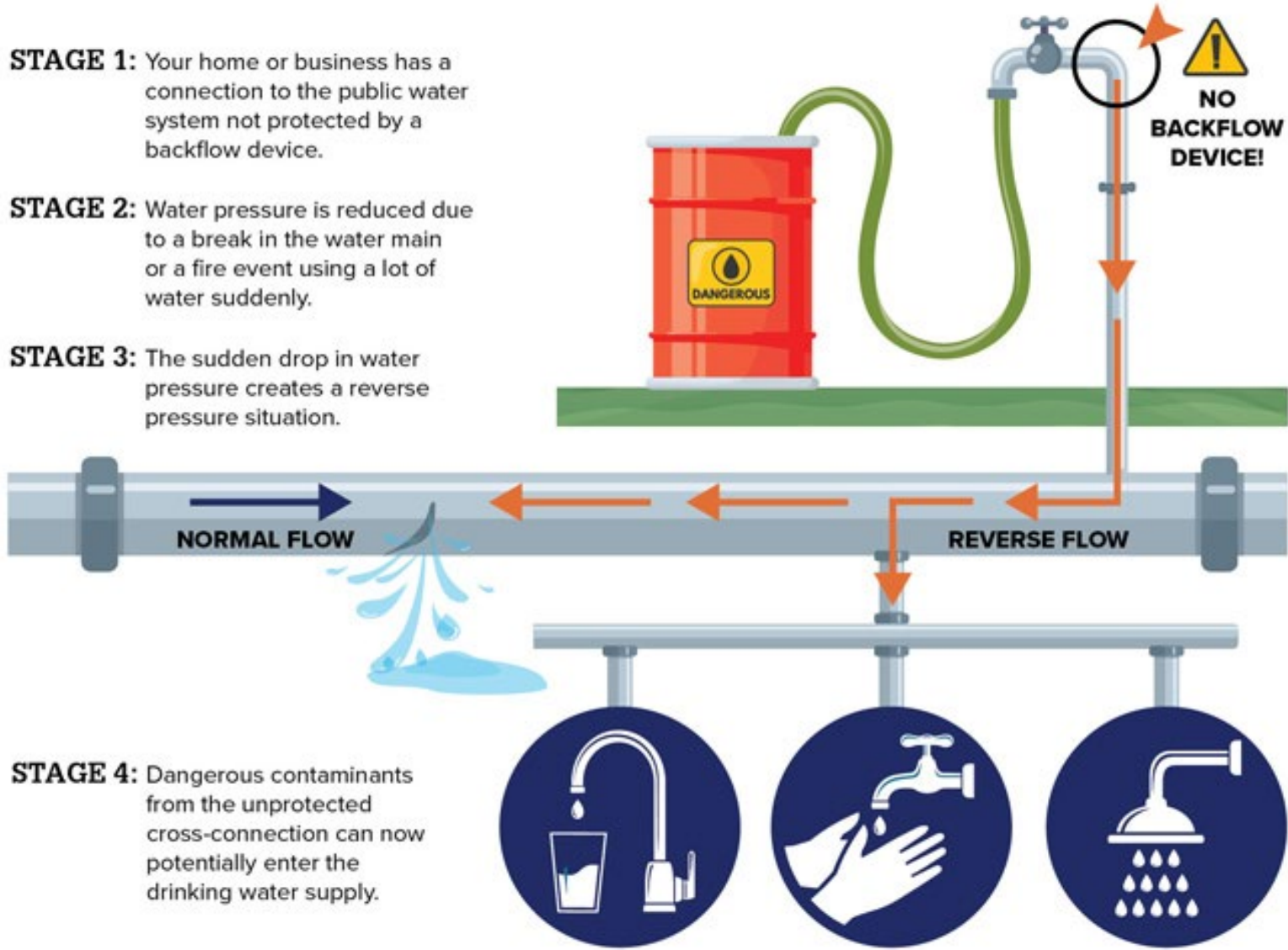
STAGE 4: Dangerous contaminants from the unprotected cross-connection can now potentially enter the drinking water supply.

NO BACKFLOW DEVICE!

DANGEROUS

NORMAL FLOW

REVERSE FLOW

Safety & Quality Control in Water Testing

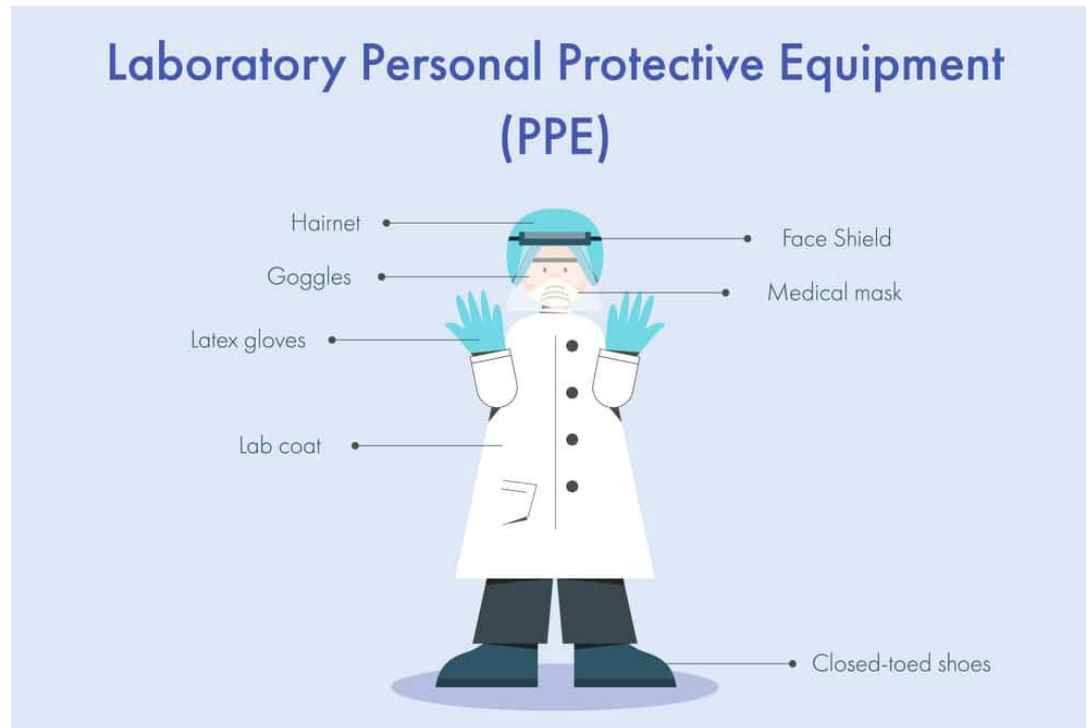Ensuring Laboratory Safety and Reliable Test Results

Laboratory Safety Protocols

- Proper use of Personal Protective Equipment (PPE)

- Safe handling and disposal of chemical reagents

- Microbiological safety practices (e.g., sterilization, disposal of cultures)

Introduction to Clinical Laboratory Safety

Personal Protective Equipment /(PPE/) — 1

Chemical Handling and Storage — 2

Biological Specimen Management — 3

Equipment Maintenance and Calibration — 4

Emergency Preparedness — 5

Proper Use of PPE

Laboratory Personal Protective Equipment (PPE)

Hairnet
Goggles
Latex gloves
Lab coat
Face Shield
Medical mask
Closed-toed shoes

- Wear gloves, safety goggles, and lab coats
- Use masks when handling chemicals or biological samples
- Proper storage and disposal of contaminated PPE

Handling & Disposal of Chemical Reagents

Best Practices for E-Waste Disposal and Compliance

Partner with
Certified Recyclers

Audit
Compliance Procedures

Establish an
E-Waste Management Policy

Offer Employee
Training

[4THBIN]

- Follow MSDS guidelines for safe handling
- Use proper containers for hazardous waste disposal
- Never mix incompatible chemicals

Safe Microbiological Testing Practices

- Proper sterilization of lab equipment
- Disposal of used cultures and media in biohazard bins
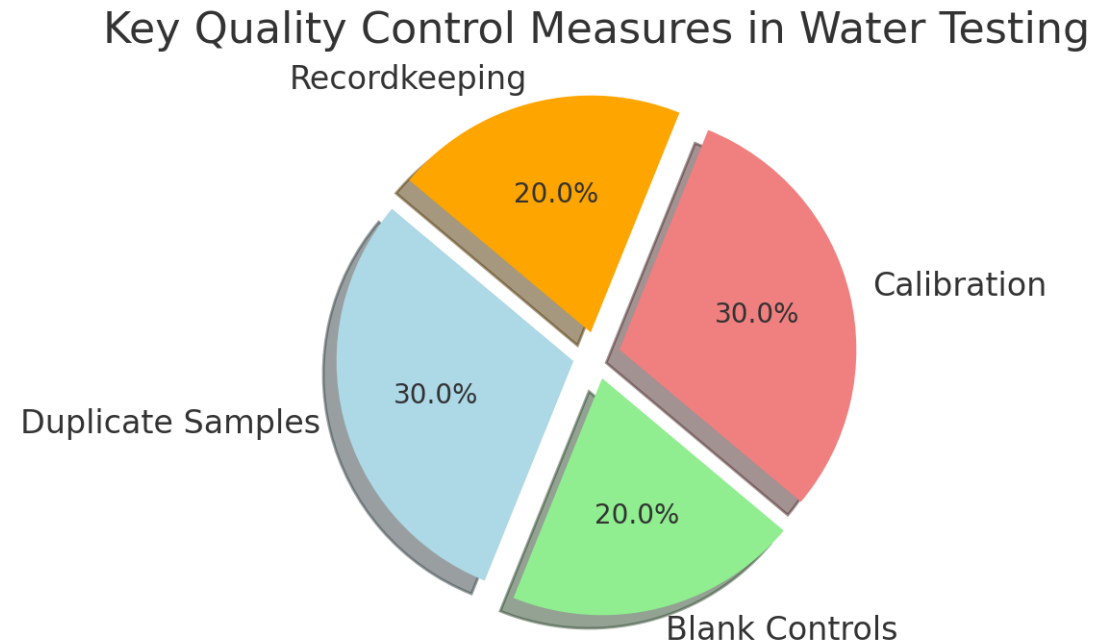- Prevent contamination through aseptic techniques

Quality Assurance & Quality Control (QA/QC)

- Ensuring accurate and reliable test results
- Importance of duplicate samples
- Routine calibration and standardization of equipment

Key Quality Control Measures in Water Testing

Key Quality Control Measures in Water Testing

Routine Calibration & Standardization

- Ensures accuracy of pH meters, turbidimeters, and other instruments

- Use certified standards for calibration

- Regular maintenance prevents instrument drift

Recordkeeping & Documentation

- Maintain detailed logs of all test results

- Ensure compliance with regulatory agencies

- Proper documentation for audits and quality checks

Open discussion on challenges faced by operators in small systems.

Review of best practices and common issues encountered in field testing.