Surface Water - Pollution and Monitoring

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Agenda

- Importance of Surface Waters
- Pollution Sources and Key Pollutants
- Monitoring Approaches
- Czech and EU Water Legislation

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Importance of Surface Waters

What Are Surface Waters?

- Definition: Rivers, lakes, reservoirs, streams, and wetlands.
- **Environmental Role:** Biodiversity support, ecosystems balance.
- **Economic Role:** Agriculture, fishing, tourism, industry.

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Ecosystem Services Provided by Surface Waters

- **Provisioning Services:** Drinking water, irrigation, hydropower.
- **Regulating Services:** Climate regulation, flood control.
- **Cultural Services:** Recreation, tourism, heritage.
- **Supporting Services:** Habitat for aquatic organisms.

Sources and Types of Pollution

Sources of Water Pollution

- **Point Sources:** Factories, sewage plants.
- **Non-Point Sources:** Agricultural runoff, urban drainage.

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Key Pollutants in Surface Waters

1. **Heavy Metals:** Lead, cadmium, arsenic (toxic, persistent).
2. **Nutrients:** Nitrogen, phosphorus (cause eutrophication).
3. **Organic Pollutants:** Pesticides, PCBs, hydrocarbons.
4. **Pharmaceuticals:** Hormones, antibiotics.
5. **Microbial Contaminants:** Bacteria, pathogens.

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Impacts of Pollution on Surface Waters

- **Eutrophication:** Excess nutrients → algal blooms → oxygen depletion.
- **Toxicity:** Harm to aquatic life and food chains.
- **Bioaccumulation:** Persistent chemicals build up in organisms.
- **Microbial Risks:** Pathogens affecting human and animal health.

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Water Monitoring Approaches

Why Monitor Surface Waters?

- Evaluate water quality.
- Detect pollution incidents.
- Ensure compliance with environmental standards.
- Support policy-making and public health protection.

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Monitoring Indicators

1. **Physical Indicators:** Temperature, turbidity, conductivity.
2. **Chemical Indicators:** pH, dissolved oxygen, heavy metals, pesticides.
3. **Biological Indicators:** Fish populations, macroinvertebrates, algae.

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Water Sampling Methods

- **Grab Sampling:** Single-time collection from rivers/lakes.
- **Composite Sampling:** Multiple samples mixed for a better overview.
- **Sediment Sampling:** Tracks pollution accumulation over time.
- **Biological Sampling:** Aquatic organisms as pollution indicators.

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Laboratory Analysis Methods

- **ICP-MS & AAS:** Heavy metals detection.
- **GC-MS & HPLC:** Organic pollutants, pharmaceuticals.
- **Microbiological Tests:** E. coli, coliform bacteria, …

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Water Quality in the Czech Republic

Monitoring in the Czech Republic

- **Act No. 254/2001 on Water Protection:** National water management framework.
- **Czech Hydrometeorological Institute (CHMI):** Main monitoring body.
- **Sampling Frequency:** Monthly to quarterly, depending on the site.

Water Quality Standards (CZ)

- **Chemical Standards:** Heavy metals, pesticides, industrial chemicals.
- **Biological Standards:** Fish populations, algae, invertebrates.
- **Classification System:**
    - High, Good, Moderate, Poor, Bad (based on ecological status).

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River Basin Management Plans

- Developed for each major river basin.
- Address flood risk, pollution control, and water conservation.
- Ensure national and EU compliance.

Water Monitoring in the EU

EU Water Framework Directive (WFD)

- **Directive 2000/60/EC:** Established integrated water management across the EU.
- **Goals:** Achieve “good” water status by 2027.
- **Key Principles:** River basin management, public participation, cross-border cooperation.

EU Environmental Quality Standards

- **Directive 2013/39/EU:** Regulates priority substances (heavy metals, pesticides, PCBs).
- **Environmental Quality Standards (EQS):** Sets maximum permissible concentrations in water bodies.

Urban Wastewater Treatment Directive (91/271/EEC)

- Regulates sewage and industrial wastewater treatment.
- Its revision is currently underway to address new environmental challenges and technologies.
- **Objective:** Minimize water pollution from urban and industrial discharge.

Groundwater and Drinking Water Directives

- **Directive (EU) 2020/2184 on the quality of water intended for human consumption (recast)**. Ensures safe drinking water quality.
- **Groundwater Directive (2006/118/EC):** Prevents and controls groundwater pollution. Still in force, this directive protects groundwater from pollution and has been updated with new technical specifications and standards for better water resource protection.

Marine Strategy Framework Directive

- **Directive 2008/56/EC:** Protects marine waters from pollution.
- **Goal:** Achieve “good environmental status” of EU marine waters.

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Policy Implications and Conclusions

Policy Challenges and Future Directions

- Climate change impact on water resources.
- Increasing urbanization and agricultural pressure.
- Need for better cross-border water management cooperation.
- Strengthening water-related policies and technological solutions.

Summary & Call to Action

- Surface water monitoring is essential for environmental protection, public health, and sustainable development.
- Effective policies and international cooperation are crucial.
- Join efforts to ensure cleaner and healthier water resources!