

Introduction to Environmental Health Sciences

Introduction to Environmental Health Sciences
Key concepts, scope, and foundational principles

1. What Is Environmental Health Science?

Element	Description
Definition	The interdisciplinary study of how physical, chemical, biological, and social environments affect human health and disease.
Goal	Identify, assess, and control environmental risk factors to protect and improve public health.
Core Disciplines	Toxicology, epidemiology, exposure science, risk assessment, occupational health, environmental engineering, policy & regulation.
Typical Settings	Communities, workplaces, schools, homes, natural ecosystems, and built environments.

2. Major Domains of Environmental Health

Domain	Primary Focus	Typical Issues
Air Quality	Inhalation exposures	Particulate matter, ozone, nitrogen oxides, indoor pollutants (e.g., radon, mold).
Water & Sanitation	Ingestion exposures & hygiene	Microbial contamination, heavy metals, chemicals (pesticides, PFAS), waterborne diseases.
Soil & Land	Contact & food chain pathways	Lead, arsenic, pesticide residues, contaminated sites, agricultural runoff.
Chemical Hazards	Toxic substances in all media	Industrial chemicals, endocrine disruptors, flame retardants, nanomaterials.
Radiation	Ionizing & non-ionizing exposures	UV radiation, radon, medical imaging, electromagnetic fields.
Occupational Health	Workplace environments	Ergonomic stressors, chemical exposures, noise, shift work, psychosocial factors.
Built Environment	Urban design & housing	Traffic noise, heat islands, green space, housing quality, transportation.

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Domain	Primary Focus	Typical Issues
Climate Change	Global?scale impacts	Health?stress?vector?borne disease, extreme weather, food security.

3. Exposure Pathways & Routes

1. **Inhalation** – Airborne gases, vapors, particles.
2. **Ingestion** – Food, water, soil/dust ingestion (especially children).
3. **Dermal Contact** – Skin absorption of liquids, solids, gases.
4. **Injection** – Rare in environmental contexts (e.g., vector bites, medical waste).

Key concept: **Dose = Concentration × Duration × Frequency** (often expressed as mg/kg?body?weight/day).

4. The Environmental Health Process

1. **Hazard Identification** – Recognize agents that can cause adverse health effects.
2. **Exposure Assessment** – Measure or estimate how much of a hazard people encounter.
3. **Dose?Response Assessment** – Determine the relationship between dose and health outcome.
4. **Risk Characterization** – Combine the above to estimate risk magnitude and uncertainty.
5. **Risk Management** – Develop and implement control strategies (regulation, engineering controls, behavior change).
6. **Risk Communication** – Convey findings to stakeholders in clear, actionable language.

(Often illustrated as a circular “risk assessment?management” loop.)

5. Key Tools & Methods

Tool/Method	Application	Example
Epidemiologic Studies	Link exposure to health outcomes	Cohort study of air?pollution and asthma incidence.
Biomonitoring	Measure chemicals in biological media (blood, urine)	Detect BPA levels in pregnant women.

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Tool/Method	Application	Example
Environmental Monitoring	Quantify environmental exposure, water, soil	Continuous PM _{2.5} monitoring stations.
Geographic Information Systems (GIS)	Spatial analysis of exposure and disease	