AN INDEPENDENT PUBLIC-HEALTH PUBLICATION · NOVEMBER 2026

The air we measure. The lives we protect.

From environmental observation to trustworthy evidence, accountable decisions, and verifiable protection.

In recognition of the public-health questions that have shaped Dr. María Neira's career: how can knowledge about the environment become meaningful protection for the people who live within it?

> The purpose of environmental science is not only to describe risk. It is to help societies prevent harm, act responsibly, and demonstrate that protection has reached the people who need it.

INDEPENDENCE AND ATTRIBUTION

This independent educational analysis is not authored, reviewed, approved, or endorsed by Dr. Neira or the World Health Organization. The governance model discussed here is a proposed synthesis, not an existing WHO requirement.

EXECUTIVE PERSPECTIVE

From knowing to protecting

Continuous air monitoring is indispensable. It tells us what instruments observe, where conditions change, and when concern may be warranted. But monitoring alone cannot establish who is responsible, which response is lawful, whether it was carried out, or whether people are safer.

> Monitoring reveals conditions. Evidence establishes what can be trusted. Governance connects that knowledge to justified, lawful, bounded action. Verification demonstrates what happened next.

Five commitments for accountable protection

Scientific integrity

Use fit-for-purpose instruments, documented calibration, uncertainty and reproducible methods.

Evidence continuity

Preserve original observations, transformations, custody, gaps and decision-specific relevance.

Lawful responsibility

Identify the applicable legal basis and the actor with standing to decide or intervene.

Bounded intervention

Specify the permitted action, limits, safeguards, escalation and review.

Independent verification

Prove execution separately from environmental improvement and from health outcomes.

01 | THE DISTINCTION

Monitoring is essential—and insufficient

Air monitoring provides observations of particulate matter, nitrogen dioxide, ozone, carbon monoxide and other relevant variables. It can reveal trends, pollution episodes, spatial inequalities and changes following interventions. Indoor systems may also measure carbon dioxide, temperature, humidity and ventilation-related indicators.

A governance system without trustworthy monitoring risks acting blindly; a monitoring system without responsible follow-through may identify danger while leaving it unresolved.

Not every sensor reading is equivalent to a regulatory measurement. Instrument suitability, siting, quality assurance and interpretation depend on intended use and applicable standards.

Continuous monitoring	Accountable governance
Observes and reports conditions	Defines responsibilities, decision rules and safeguards
Shows trends and possible exceedances	Determines whether a specific response is justified
Produces datasets and dashboards	Connects evidence to authority and permitted actors
Supports before-and-after comparisons	Records execution and examines outcomes

02 | MEASUREMENT

What the instrument actually tells us

A sensor reading is an observation produced by a particular instrument at a particular time and place. Its meaning depends on the measurement method, calibration, location, environmental conditions and data handling.

Before interpretation ask: What was measured? Is the instrument fit for this decision? Was the sampling representative? Were clocks synchronized? Were values corrected, imputed or excluded? How large is the uncertainty?

An outdoor PM2.5 monitor does not automatically quantify a child’s personal exposure or establish the cause of an individual illness. Carbon dioxide can inform ventilation assessment, but is not a direct measurement of all indoor pollutants.

A low-cost network may be excellent for screening and awareness while requiring additional confirmation for a specific enforcement decision.

03 | EVIDENCE

From readings to trustworthy evidence

A consequential decision should be reconstructable by a qualified independent reviewer. The record must preserve more than the final displayed number.

Preserve original readings, instrument identity, sampling location, timestamps, calibration and maintenance; document aggregation, correction, exclusion, imputation, software versions, access history, overrides and gaps.

Link each decision to the precise evidence and interpretation used. Distinguish observations, modeled estimates, exposure inferences and causal claims.

In this publication, admissible means authentic, relevant, reliable, traceable and fit for a specified decision. It does not claim a universal legal evidence rule.

04 | SCIENTIFIC HUMILITY

Uncertainty is part of the truth

Good science communicates uncertainty rather than treating it as weakness. Calibration drift, humidity, placement, missing observations, modeling assumptions and exposure pathways all affect interpretation.

Three claims require different evidence: that an instrument measured a concentration; that people experienced a harmful exposure; and that an intervention improved health.

A decline in monitored pollution may support a finding of environmental improvement. It does not, by itself, prove a specific health outcome changed. Health outcomes may take time and can be influenced by other factors.

When evidence is incomplete, record what remains unknown and select a proportionate response in light of urgency, stakes and legal duties.

05 | AUTHORITY

Scientific confidence is not legal permission

Scientific evidence may justify concern or recommend action. It cannot by itself create the legal power to compel a factory, alter a road, change school operations or enter a private building.

Applicable authority may arise from legislation, regulations, delegated powers, permits, contracts, emergency provisions or professional obligations. It must be identified for the specific proposed action.

Established standing is separate: the institution or individual must possess the relevant role, jurisdiction, delegation and responsibility in this setting, for this action, at this time.

Every decision should define its geographic and temporal scope, affected assets and populations, permitted measures, prohibitions, review routes and reassessment conditions.

06 | BOUNDARIES

A decision must remain bounded

Accountable systems need distinct decision postures: proceed when evidence and authority support a specified action; hold when critical evidence is missing; refuse an unauthorized action; or escalate when urgency or jurisdiction demands another decision-maker.

Emergencies may warrant precautionary action under applicable emergency powers while evidence is developing. Necessity, scope, limits and review must still be documented.

Prior permission is not permanent permission. Material changes to the pollutant, facility, actor, location, time or conditions require reassessment.

Decision posture	Meaning
Proceed	Specified action is supported within defined safeguards
Hold	Prerequisites remain insufficient; preserve the record
Do not authorize	Proposed action lacks authority or exceeds bounds
Escalate	Urgency, conflict or jurisdiction requires another actor

07 | EXECUTION

Approval is not proof of protection

Every stage can fail independently. Excellent observations do not guarantee valid interpretation; interpretation does not confer authority; approval does not prove implementation; implementation does not prove health benefit.

Post-action verification deserves a budget, a responsible owner and explicit evidence requirements. Compare follow-up results with a meaningful baseline and consider season, weather, occupancy, behavior and other changes.

Record unsuccessful interventions, unintended effects and exceptions, not only success stories.

Question	Evidence
Was it authorized?	Decision record, legal basis, delegation and conditions
Was it executed as authorized?	Work records, responsible actor, timestamps, safeguards
Did it achieve its objective?	Comparable follow-up measures and suitable evaluation

08 | APPLICATION

A school beside a busy road

Imagine a school with repeated elevated PM2.5 readings around arrival and dismissal. The first task is to establish whether the pattern is reliable and relevant to student exposure.

Investigators examine instrument placement, performance, traffic, weather, indoor infiltration, ventilation and occupancy. Ambient concentration must not be confused with personal exposure.

Possible actions include anti-idling measures, traffic changes, filtration, ventilation improvements or targeted exposure reduction. School, municipal, transport and environmental authorities may hold different responsibilities.

Implementation and before-and-after evidence should be documented, including indoor concentrations where relevant. Families deserve a clear account of uncertainty, maintenance and remaining risks.

Illustrative scenario only; not a report about a specific school.

09 | APPLICATION

Air quality in a hospital

A hospital identifies repeated departures from expected indoor environmental conditions. Monitoring triggers investigation, but intervention must account for vulnerable patients, clinical priorities, infection prevention, system design and continuity of care.

Which spaces are affected? Are the readings direct pollutant measurements or proxies? What source or system failure is plausible? What remains uncertain?

Clinical, facilities, infection-control and safety responsibilities may overlap. Altering ventilation settings, isolating a space or replacing equipment must not bypass the responsible authorities.

After action, verify improvement without creating a new hazard. Preserve operating conditions, equipment changes, commissioning evidence and follow-up results.

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10 | APPLICATION

A city facing persistent pollution

A city can have dense monitoring, public dashboards and ambitious targets while lacking a reliable route from recurring pollution episodes to coordinated action.

Define the health objective, priority populations, measurement quality, source-attribution limits and the agencies responsible for transport, industry, land use and public health.

Communities without monitors must not become invisible. Address coverage gaps, vulnerable populations, environmental justice and accessible communication.

Judge policy through implementation and environmental and health-relevant outcomes, while reporting uncertainty and confounding influences such as meteorology and economic change.

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11 | PUBLIC POLICY

From research to enforceable protection

Regulation is not simply the publication of a threshold. It requires a clear health problem, sound evidence, legal competence, feasible duties, proportionate enforcement, due process, institutional capacity and evaluation.

An evidence-informed process defines the hazard and affected populations; establishes measurement and data-quality standards; consults communities, clinicians, scientists, operators and regulators; identifies legal powers; implements and inspects; and evaluates results.

Different jurisdictions require different legal instruments. This conceptual pathway is not a substitute for statutory analysis.

Transparent reasoning, participation, consistent enforcement, review rights and correction mechanisms are essential to legitimacy.

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12 | PUBLIC BENEFIT

What stronger governance can deliver

Clear triggers and named responsibilities may reduce delays between identifying a concern and making a justified decision.

Preserved evidence and documented authority make decisions more defensible. Communities can examine the basis, uncertainty, safeguards and outcomes of interventions.

Governance can reduce performative compliance by distinguishing possession of a dashboard or policy from actual implementation and verified results.

Comparable records help institutions learn what works, where and for whom. Review can reduce unnecessary intervention while supporting timely protective action.

These are potential benefits, not guaranteed results. Effectiveness depends on resources, institutions, science, law and implementation.

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13 | INSTITUTIONAL CAPACITY

What an institution must build

No single sensor, dashboard or software platform supplies everything required for responsible environmental protection.

Institutions need validated scientific methods, quality assurance, original records and provenance, decision rules, applicable legal powers, authorized actors, bounded execution, audit and appeal mechanisms, and outcome evaluation.

They also need trained people, budgets, interoperable records, public communication and a process for correcting failed interventions.

A credible public-health programme should be able to answer: What was measured? What can be trusted? Which rule permits the response? Who may act now? What is prohibited? How will execution and outcome be independently verified?

A CLOSING REFLECTION

The measure of progress

For a person struggling to breathe, environmental science is not an abstract dataset. It is a path toward fewer preventable exposures, safer homes and schools, more responsive institutions, and the possibility of healthier lives.

The public-health questions associated with Dr. María Neira's career remind us why this matters. Environmental hazards reach the places where people live, learn, work and receive care.

> The ultimate measure of progress is not how much environmental information we collect. It is whether that knowledge helps protect people—and whether we can demonstrate that protection.

Sources and further reading

WHO — Air pollution: https://www.who.int/health-topics/air-pollution

WHO — Ambient air pollution and health: https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health

WHO — Global air quality guidelines (2021): https://www.who.int/publications/i/item/9789240034228

WHO — Environment, climate change and health: https://www.who.int/teams/environment-climate-change-and-health

WHO — Constitution: https://www.who.int/about/governance/constitution

US EPA — Air Sensor Toolbox: https://www.epa.gov/air-sensor-toolbox

Publication note: The scenarios are illustrative. The governance distinctions are independent analysis and are not attributed to Dr. Neira or WHO. No institutional endorsement is implied.