From Air Quality Measurement to Governed Environmental Evidence

Technical Governance Reference v2.0 | Environmental Integrity Governance (EIG) + Atmospheric Integrity Records (AIR)

> INDEPENDENT TECHNICAL PRE-EXAMINATION | Baseline not frozen | No formal disposition | No deployed manufacturer integration, independent assurance, regulatory certification, legal admissibility determination, or authority to control a real facility is claimed.

The proposition

Air quality instruments produce observations. Governance must establish what those observations can support, whether their provenance and continuity are adequate, which requirements and authorities apply, and whether a proposed consequence may proceed. TA14 is a proposed complementary evidence-and-authority layer, not a replacement for sensor hardware, calibration programs, environmental professionals, or local decision-makers.

Governing question: Does this proposed consequence have sufficient Admissible Evidence, Applicable Authority, and Established Standing to become reality NOW?

Why a manufacturer would care

Current capability	Potential additional customer utility
Readings and trend displays	Portable, source-linked environmental evidence with quality and context preserved
Alarms and notifications	Reviewable chronology of observations, gaps, changes and decisions
Control integrations	A separate, locally enforced authorization boundary for consequential action
Post-action data	A method to evaluate observed outcomes without equating command success with environmental success

Commercial value is a hypothesis to test with customers. This document does not establish higher sales, legal admissibility, compliance, reduced liability or a return on investment.

01 What is governed - and what is not

A measured pollutant concentration is not by itself proof of human exposure, regulatory noncompliance, causation, authority to intervene, or successful remediation. Each is a distinct proposition with its own method and evidence burden.

Proposition	What the evidence must additionally establish
Measurement occurred	Instrument identity, units, quality flags, timing, calibration fitness and measurement uncertainty
A requirement was exceeded	Applicable jurisdiction or contractual criterion, method, averaging period, and valid comparison
A person was exposed	Exposure pathway, occupancy and time alignment, and appropriate exposure assessment
A system caused the condition	Causal analysis, competing explanations and limitations
An intervention is permitted	Exact action, current standing, competent authority, safety limits and local enforcement
The intervention succeeded	Observed post-action condition, verification method and deviations

TA14 consequence chain

Anchor	Question
REALITY	What physically occurred? Distinguish observed from inferred.
RECORD	What original device and event produced the record?
CONTINUITY	Can the data be traced across time, location, configuration and transformations?
ADMISSIBILITY	Is it fit for the precise claim under examination?
BINDING	Which criterion and competent local authority govern the consequence?
COMMIT	Who decided ALLOW, HOLD, DENY or ESCALATE, for which scope and duration?
EXECUTION	Was the authorized action actually enforced and carried out?
OUTCOME	What independent or appropriately separated observation establishes the result?

02 Proposed AIR record envelope

The following is a candidate interoperability profile, not an adopted standard. Original observations and later interpretations must remain separately traceable. A hash can detect some changes; by itself it does not authenticate origin, establish trusted time, or provide independent attestation.

Field family	Required context
Source	Manufacturer, model, device and channel ID, site, zone and source reference
Measurement	Analyte, value, units, interval, range, detection limit where relevant, uncertainty
Time	Original event timestamp, receipt timestamp, offset, clock health and known drift
Quality	Calibration reference, validity, diagnostics, maintenance and exceptions
Context	Location, HVAC or process mode, operating configuration and relevant external conditions
Continuity	Sequence, gaps, corrections, transformations, prior versions and custody
Decision	Specific claim, applicable criteria, authority reference, standing, disposition and expiry
Outcome	Execution event, independent observation source, verification window and residual uncertainty

Illustrative machine-readable AIR record (not production schema)


```
{
 "schema": "ta14.air.candidate/0.1", "record_id": "AIR-DEMO-0001",
 "source": {"device_id": "SENSOR-DEMO-07", "zone": "School-West"},
 "observation": {"parameter": "PM2.5", "value": 38,
                 "unit": "ug/m3", "event_time": "2026-10-11T14:00:00Z"},
 "quality": {"calibration_ref": "CAL-DEMO-12", "status": "review",
             "uncertainty": "not established"},
 "continuity": {"sequence": 1402, "missing_samples": 2,
                "raw_source_ref": "RAW-DEMO-1402"},
 "claim_status": "not evaluated", "authority_status": "not established"
}
```


All values and identifiers above are fictional. The example deliberately does not infer compliance, exposure or permission from a concentration reading.

03 Worked example: one reading, four different decisions

Hypothetical setting: A school monitor reports elevated PM2.5. The facilities team considers changing the ventilation sequence. No real school, measured event, threshold, or authority decision is represented.

Stage	What is established	What remains open
1. Observation	Instrument reports 38 ug/m3 at a stated time	Calibration validity, uncertainty, completeness, comparison method
2. Evidence review	Raw record, device ID and two missing samples are preserved	Whether data support a specific exceedance or exposure claim
3. Proposed action	Facilities proposes a bounded HVAC sequence change	Safety effects, approval rights, current operating constraints
4. Disposition	Illustrative HOLD for the proposed control change	An authorized investigation may continue; no blanket shutdown
5. Conditional execution	Only after competent local approval and enforcement	Actual equipment response and alternate control paths
6. Outcome	Separate observations evaluate environmental response	Whether other factors or unintended effects remain

Illustrative disposition: HOLD applies only to the proposed, insufficiently authorized control change. It does not invalidate the measurement, revoke unrelated permissions, or prevent independently authorized investigation.

Four dispositions

ALLOW	HOLD	DENY	ESCALATE
Evidence, authority and standing meet the bounded criteria	Necessary evidence or authority is unresolved	A binding prohibition or invalid condition applies	A designated authority must decide; escalation is not permission

04 Integration architecture and trust boundaries

A manufacturer may expose read-only evidence without embedding TA14 into its firmware. Where physical control is contemplated, evidence examination and permission enforcement are separate engineering obligations.

A Existing instrument
Measures and transmits original data; retains vendor diagnostics and calibration responsibilities.
B AIR evidence adapter
Exports source-linked records, raw/adjusted separation, continuity flags and configuration changes.
C EIG examination
Evaluates precise claims against declared criteria, evidence quality and recognized authority.
D Local execution boundary
Enforces an authorized action at actual effectors; inventories alternate APIs, inherited credentials, overrides and background jobs.
E Outcome verification
Uses an independent or sufficiently separated source and method to assess physical consequences.

A critical distinction

Read-only pilot: Can demonstrate evidence export, integrity, continuity, reviewable decisions and explicit HOLD conditions. It cannot demonstrate complete mediation of physical control.

Control-capable pilot: Requires an independently scoped inventory of all consequential paths, bypass and revocation tests, local authorization enforcement, and observed effect verification. A decision receipt alone is not proof of enforcement.

05 Manufacturer-facing pilot charter

Start with one consenting manufacturer or operator, one device family, one site and one bounded environmental claim. Freeze the source baseline and agree on falsification criteria before assessing results.

Workstream	Required artifact / acceptance evidence
Scope	Named parameter, device IDs, site/zone, time interval, proposed consequence and explicit exclusions
Source baseline	Raw sample references, calibration and diagnostics, time integrity, ownership and documented gaps
AIR export	Versioned candidate schema, mapping table, sample records, reproducible parser and transformation log
EIG examination	Declared criteria, authority matrix, standing evidence, dispositions and traceable rationale
Negative testing	Missing data, clock drift, invalid calibration, substituted source, changed configuration, revoked authority
Execution (optional)	Complete in-scope mutation-path inventory, bypass tests, local enforcement evidence and revocation
Outcome (optional)	Predeclared verification source, method, independence limitations and contrary observations
Independent review	Reviewer scope, conflicts, access, reproducible findings and explicit residual gaps

Pilot exit conditions

• Evidence export PASS: a reviewer can reconstruct raw-to-derived provenance and detect declared gaps and changes.

• Decision trace PASS: every scoped disposition identifies applicable criteria, evidence and locally competent authority; missing requirements do not silently become ALLOW.

• Enforcement PASS (only if claimed): all scoped consequential paths are inventoried and independently challenged; bypass is not merely assumed impossible.

• Outcome PASS (only if claimed): verification is independent or suitably separated from the initiating command, with limitations stated.

• Otherwise: publish HOLD or a bounded partial finding, not a blanket assurance claim.

06 Failure-mode examination

Adversarial condition	Expected evidence / response
Device clock invalid or drifting	Flag time integrity; do not infer sequence certainty
Calibration expired or unverified	Preserve reading; constrain unsupported quantitative claims
Missing samples during alert	Show gap; avoid uninterrupted-exposure inference
Raw value corrected after ingestion	Preserve original and correction method; retain both versions
Device swapped or moved	Rebind source, zone and applicable context before comparison
Criterion changes between readings	Version the applicable rule; do not silently reinterpret historical results
Approval expired or revoked	Block dependent proposed execution within affected scope
Alternate API or inherited credential	Prove local mediation or report enforcement not established
Actuator reports success; condition unchanged	Separate execution record from outcome; preserve failed outcome
Manufacturer and examiner share evidence source	Disclose circularity; require an appropriately independent verification method

Assurance boundary: TA14-generated tests and manufacturer demonstrations are useful engineering evidence, but they are not automatically independent assessment. External examination must have its own defined scope, access, competence and reporting independence.

07 Responsibility and authorization matrix

Participant	Responsible for	Does not automatically establish
Manufacturer	Measurement capabilities, diagnostics, interfaces and device documentation	Compliance, exposure, local execution authority or third-party certification
Site/operator	Configuration, maintenance, operational constraints and source-data access	Authority for every environmental or safety consequence
Environmental specialist	Appropriate measurement interpretation and exposure/compliance methods	Permission to actuate equipment outside delegated role
TA14 examination	Evidence/authority mapping, traceability, gap and disposition documentation	Legal approval, regulatory certification or local control rights
Competent local decision-maker	Defined action authorization under applicable requirements	That the action occurred or achieved its outcome
Independent verifier	Separate review of scoped claims and physical outcomes	Unbounded assurance beyond the verification method

Preserve the authorization history

Prior approvals, procedures and delegated rights must remain visible with their original scope and validity. Changed conditions require examination of what they actually affect; they do not automatically revoke every historical approval. A HOLD disposition is specific to the proposed consequence whose evidence or authority remains incomplete.

Record governance

Before any pilot, agree on data ownership, retention, access, confidentiality, permitted publication, revocation handling and correction/versioning. Privacy-sensitive occupancy and location data require minimization and appropriate permission. No manufacturer name, logo or integration claim should imply endorsement without authorization.

08 Commercial models - hypotheses, not established benefits

Possible engagement	Customer question to validate	Deliverable
Manufacturer evidence export	Will buyers value portable provenance and continuity?	Schema mapping and sample AIR evidence package
Operator governance service	Will operators fund decision traceability for consequential workflows?	EIG examination workflow and decision record
Bounded regulated-sector pilot	Which documented use case justifies an independent review budget?	Pilot charter, evidence register and falsification report
Implementation and training	Who must maintain record quality and authority mappings?	Role-based integration and governance training

What TA14 could supply

- Candidate AIR envelope, field mapping and source-to-claim traceability design.
- EIG examination criteria, disposition structure and authority-boundary documentation.
- A bounded pilot charter, failure-mode suite and findings report with open gaps.
- An independent-review plan; not a claim that external validation already exists.

What a manufacturer or operator would supply

- Authorized access to device records, diagnostics, calibration context and interface specifications.
- Named operating context, actual applicable criteria and accountable local decision-makers.
- A permitted test environment, confidentiality terms and an approved data baseline.
- Separate safety engineering and local enforcement controls if physical actuation is in scope.

> Commercial discipline: No revenue uplift, legal admissibility, certification, liability reduction or market-size forecast is established here. Those claims require customer evidence, jurisdiction-specific analysis and independent technical validation.

09 Questions for prospective equipment partners

• Which unchanged source records, calibration references, diagnostics and quality flags can your platform export?

• Can a customer distinguish raw observations from corrections, normalization and derived estimates?

• How are device replacement, configuration changes, clock drift and missing data represented?

• Which claims do customers currently make from your dashboards that your instruments alone cannot establish?

• Could a read-only AIR export be piloted without modifying certified measurement functions?

• If physical control is contemplated, who owns the actual enforcement points and alternate command paths?

• What independent verifier and contradictory tests would make an assurance claim credible?

• Which single customer workflow has an identifiable decision-maker, consequence and budget?

Proposed next step

Invite one consenting manufacturer or operator to a bounded, manufacturer-neutral evidence pilot. Freeze the initial dataset, specify one environmental claim and one possible consequence, map the authority roles, and predeclare what would cause HOLD, DENY or ESCALATE. Publish limitations as prominently as favorable results.

Institutional reference: https://www.ta14exchange.com/

> Independent educational technical reference. No manufacturer is represented as a partner, participant or endorser. No deployed integration, formal TA14 disposition, independent assurance, legal determination or live environmental control is claimed. All demonstration values and identifiers are hypothetical.