

Worker Exposure Profiles for Construction A Conceptual Framework for Exposure Record Continuity

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Abstract:

Construction occupational-hygiene decisions may depend on information generated under different tasks, contractors and project stages. Retaining a measurement does not ensure that its assessment basis, control conditions and unresolved actions remain available when work changes. This article proposes a Worker Exposure Profile (WEP) and a Construction Occupational Exposure Management Framework (COEMF) to specify that continuity. A targeted narrative synthesis of published exposure research and authoritative technical guidance is combined with conceptual model building, requirement mapping and explicitly hypothetical scenario analysis. No participant survey, operational exposure dataset or longitudinal outcome analysis is reported. The resulting specification defines a worker–task–hazard episode, distinguishes personal measurements from representative assignments, area measurements, calculated estimates and qualitative screening, and retains missing coverage as an explicit state. COEMF connects three layers: exposure evidence, organizational capabilities, and control action with verification. Separate hazard channels prevent incompatible quantities from being combined into a universal health-risk score. An invented eight-hour example demonstrates why an unassessed interval cannot be treated as zero exposure. The proposed handover process links record retrieval to applicability review and accountable action ownership. These are design outputs, not validated intervention effects. Prospective assessment of record retrieval, decision quality, implementation burden and verified control improvement is needed before claims of exposure reduction or disease prevention can be made.

Keywords: Occupational Hygiene; Construction; Worker Exposure Profile; Exposure Records; Conceptual Framework; Information Continuity; Hierarchy of Controls

1. Introduction

Occupational health requires attention beyond the immediate appearance of a work activity. A task can finish without an acute incident while still contributing to harmful occupational exposure. The WHO/ILO global monitoring report documents the burden associated with occupational risk factors across countries and industries [1]. That population-level evidence supports prevention, but it does not establish the effectiveness of any particular construction record-management system.

Construction presents an information-continuity problem when responsibilities and work conditions change. A monitoring report, a work assignment and an occupational-health record may be held by

different organizations. A technically valid measurement can lose operational value if its sampling basis, relevant task conditions or unresolved actions are not available to the next decision-maker. The problem addressed here is therefore the connection between an exposure record and a later justified decision. Its prevalence is not estimated in this article.

Published construction exposure studies illustrate why task context matters. Cothorn and colleagues examined airborne silica exposure during construction tasks [2], and a subsequent study examined temporal variation during task performance [3]. These studies support retaining assessment context when records are reused. They do not evaluate the framework proposed here. Exposure reconstruction also draws on measurement histories and other contextual sources [4], while job-exposure matrices provide structured estimates for occupational groups, including construction occupations [5]. A worker profile should preserve the difference between an individual measurement and an assignment based on group evidence.

Organizational information also requires careful interpretation. Safety-climate research examines perceptions of organizational priorities [6]; such perceptions do not directly demonstrate whether an earlier exposure report was retrieved or whether a control action was verified. A useful management specification should distinguish available information, observed practices and prospective benefits rather than treating them as interchangeable evidence.

This article asks three questions: what information must be retained for an exposure record to remain interpretable; how that information should connect to actions across task and organizational changes; and what evidence would be needed to evaluate the resulting framework. The contribution is a minimum information model, a three-layer operational architecture and a testable research agenda. Longitudinal continuity denotes the intended management capability, not a completed longitudinal investigation.

2. Methodology

2.1 Conceptual Research Design

The article uses conceptual model building supported by a targeted narrative synthesis. Following the methodological emphasis on explicit design choices in conceptual research [7], the focal problem is defined as continuity of interpretable exposure evidence and accountable actions across changes in work. Published sources establish technical boundaries; the WEP fields and COEMF relationships are the author's proposed design response. Figure 1 shows this reasoning sequence. The method is neither a systematic review nor an empirical validation study.

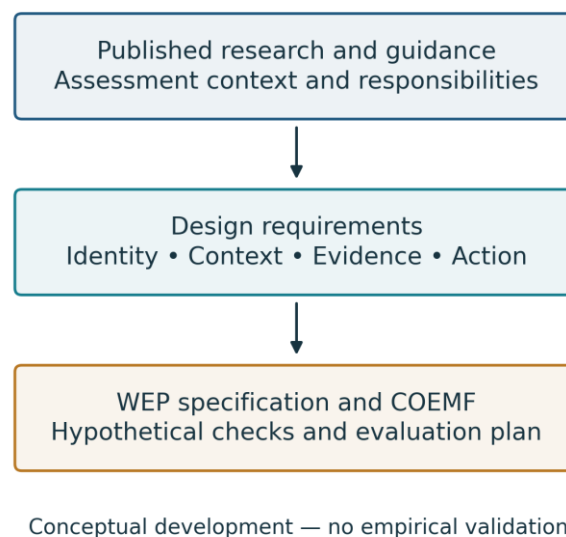
No participant-level survey responses or operational worker-exposure datasets form part of the analysis reported in this article. There is no recruitment, sample-size claim, questionnaire scoring, observed worker sequence or intervention-effect estimate. Numerical examples are invented solely to demonstrate interpretation rules. The hypothetical checks assess internal consistency of the proposal; they do not estimate its usability, adoption or preventive effectiveness.

2.2 Source Selection and Interpretive Synthesis

Sources were selected for direct relevance to construction exposure assessment, exposure reconstruction, conceptual research design, control selection, record governance and implementation evaluation. The source set combines peer-reviewed studies with guidance or standards from WHO/ILO, NIOSH, OSHA, HSE, ISO and the European Union. Relevant questions included how exposure measurements depend on their assessment context, when historical evidence can be reused, what information a handover should retain and how action closure can be distinguished from administrative completion.

Selection was purposive rather than exhaustive. No registered protocol, complete search log, duplicate screening, formal study-quality scoring or pooled estimate is claimed. Examples of relevant search concepts were construction exposure assessment, silica task variability, exposure reconstruction, occupational record keeping and hierarchy of controls. The synthesis records the design implication of each source family rather than treating every source as evidence of an existing continuity failure. This approach supports a bounded conceptual proposal while leaving source-selection bias as a limitation.

Figure 1: Conceptual Development Method Linking Published Evidence, Design Requirements and the Proposed WEP and COEMF



No empirical validation is implied.

2.3 Requirement Mapping and Boundary Checks

The synthesis was organized around five requirements: traceable identity, interpretable assessment context, explicit evidence quality, accountable action and verifiable closure. Each requirement was mapped to a record field or workflow rule. The resulting design was examined against hypothetical cases involving incomplete shift coverage, a changed work condition, a contractor handover and redistribution of hazardous work. The assessment question in each case was whether the proposed rule preserves uncertainty and responsibility without making an unsupported exposure or effectiveness claim.

The outputs are a minimum WEP schema, hazard-specific interpretation boundaries, a three-layer COEMF architecture, a handover process and prospective evaluation measures. They should be read as proposed design requirements. No expert-consensus exercise, field pilot, software implementation or comparative evaluation was performed for this article.

3. Evidence Base and Design Requirements

The framework is anchored in existing occupational-hygiene methods rather than a new exposure metric. Different hazards require different sampling conventions, time bases and interpretation criteria. NIOSH noise guidance and the OSHA construction silica standard illustrate why a common percentage-of-limit label is insufficient to harmonize unlike assessments [8, 9]. A record must retain the relevant criterion and method so that a competent assessor can interpret it in context.

The central design inference is that portability requires more than transferring a number. Table 1 maps selected source families to proposed requirements and identifies the limits of each inference. A technically adequate record may still fail to affect a decision if ownership is unclear; equally, a well-documented action cannot repair a measurement whose applicability is unknown.

Table 1: Literature-To-Requirement Mapping for the Proposed Framework

Source family	Relevant basis	Proposed requirement and limit
Construction exposure studies [2], [3]	Exposure depends on task conditions and timing.	Retain task and temporal context; these studies do not demonstrate WEP effectiveness.
Exposure reconstruction and job-exposure matrices [4], [5]	Evidence can arise from different levels of aggregation.	Record the assignment basis; group evidence is not relabelled as a personal measurement.
Organizational perceptions [6]	Perceived priorities are distinct from documented actions.	Evaluate retrieval and verified closure separately from endorsement or satisfaction.
Hazard-specific guidance [8], [9]	Assessment criteria and time bases differ.	Preserve hazard channels, sampling basis and criterion version; avoid a universal risk score.
Health-record guidance and data protection [10], [11]	Access, purpose and clinical confidentiality require attention.	Separate identity mapping and clinical information from operational records; establish transfer authority.
Management systems and control hierarchy [12], [13]	Responsibilities and control selection require a structured process.	Assign accountable owners and retain closure evidence; documentation alone does not demonstrate prevention.

4. Worker Exposure Profile Specification

The WEP is proposed as a structured operational record that connects an exposure episode with its assessment basis, relevant control conditions and subsequent decisions. It retains distinct hazard channels (Table 2) and a minimum information model (Table 3). These components are intended for prospective evaluation and do not constitute a validated instrument.

A useful management record can display several hazards together while retaining their different assessment systems. Table 2 states the minimum distinctions. The framework does not add noise levels, silica concentrations, vibration values and heat indices. It also avoids interpreting the sum of ordinal hazard categories as an individual probability of disease. Recognized agent-specific mixture or combined-effect methods may still be used by competent assessors where scientifically appropriate; rejecting a universal score does not mean ignoring established interactions.

Table 2: Hazard-Specific Information and Interpretation Boundaries

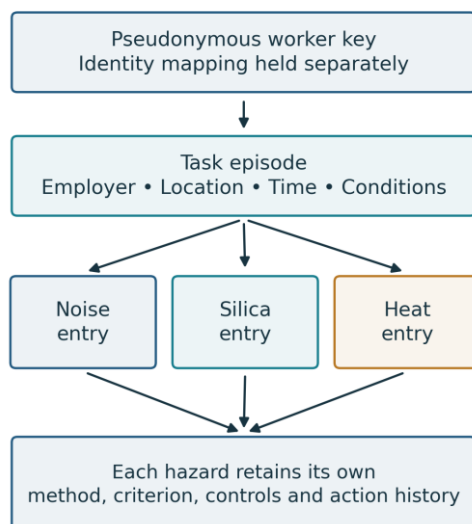
Hazard channel	Evidence to retain	Interpretation boundary
Respirable crystalline silica	Personal or representative sampling, fraction, concentration, duration, method and applicable criterion	A task sample is not automatically a full-shift TWA; record uncovered periods
Noise	Dosimetry or suitable level-duration assessment, weighting, exchange rate and criterion settings	Preserve the assessment convention; do not average decibels arithmetically
Hand-arm vibration	Representative vibration magnitude, tool-use time and A(8) method	Distinguish estimated trigger time from an actual vibration measurement
Chemicals and welding fume	Specific agents, sampling basis, TWA or short-term result, process and controls	Total particulate or generic VOC readings may not resolve agent-specific hazards
Heat	WBGT or other justified method, work intensity, clothing, acclimatization and rest conditions	Heat decisions require current conditions; historical readings do not clear a new shift
Other exposure domains	Hazard-appropriate assessment, assumptions and follow-up	Ergonomic or psychosocial assessments must retain their own interpretation

4.1 Unit of Record and Identity

The basic WEP unit is a worker–task–hazard episode. A worker performing one task with three relevant hazards generates three linked hazard entries, each with its own evidence and interpretation. A shared task identifier connects these entries without merging their values. Multiple episodes form the longitudinal profile.

Figure 2 shows the proposed linkage: a worker key connects task episodes, and each episode retains separate hazard entries. The diagram represents a data relationship, not additional study records.

Figure 2: Proposed Worker–Task–Hazard Relationships in the Exposure-Domain Layer



Noise, silica and heat are separate entries with their own assessment bases; they are not combined into a common risk score.

A pseudonymous worker identifier should remain stable across authorized handovers. The identity mapping should be held separately with controlled access. A crew assessment may be linked to several workers only where a competent assessor documents the basis for representativeness. The profile must distinguish measured-on-worker evidence from assigned group evidence and allow later correction. Crew membership alone is insufficient evidence that all workers experienced identical conditions.

Table 3: Minimum WEP Record Specification

Field group	Minimum content	Purpose
Identity and linkage	Worker code, employer, trade, task ID and source-record ID	Retrieve related episodes without exposing unnecessary identifiers
Work context	Date, shift, location, process, material and nearby relevant activities	Assess whether historical evidence remains applicable
Hazard and method	Agent, sampling fraction, route where relevant, method and evidence class	Prevent incompatible results being treated as equivalent
Exposure evidence	Value or descriptor, units, duration, detection limit and coverage	Preserve the basis and limits of interpretation

Field group	Minimum content	Purpose
Provenance and quality	Assessor, report reference, calibration or method status, uncertainty	Allow audit and professional review
Controls and criterion	Actual control condition; criterion source, version and averaging period	Link the result to the conditions assessed
Action and review	Trigger, decision, owner, due date and interim protection	Convert the assessment into accountable follow-up
Verification and transfer	Verification evidence, closure author, next review and handover status	Maintain continuity and prevent unsupported closure

The schema is a minimum operational specification, not a requirement to measure every worker on every shift. Existing valid reports should be referenced rather than transcribed repeatedly. A project may capture only the fields needed for its defined scope, provided omitted information is visible and no unsupported interpretation is made.

4.2 Evidence Classes and Coverage

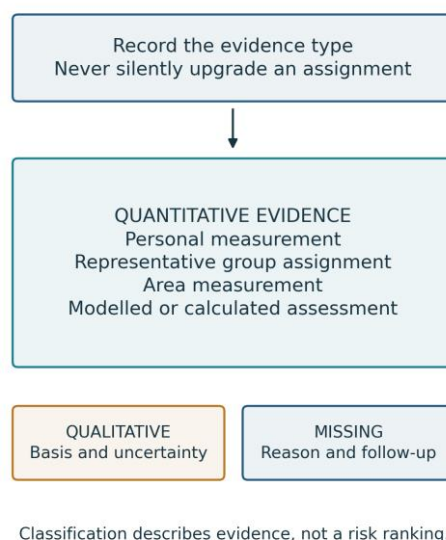
The framework retains two broad information tiers but makes the first tier's internal distinctions explicit. Tier 1 contains quantitative measurements or documented quantitative assessments. Each entry is tagged as a personal measurement, a representative group assignment, an area measurement, or a modelled or calculated estimate. Area measurements support contextual interpretation unless a defensible basis for individual assignment exists. A calculated value carries its inputs and assumptions.

Tier 2 contains qualitative screening information when a suitable quantitative assessment is unavailable or not required for the immediate decision. It records the basis, assessor, uncertainty and next review. A statement such as "potential silica exposure during dry disturbance of concrete; assessment required" is preferable to an unsupported numerical concentration. If local ordinal categories are used, their definitions must be explicit and must not imply equivalence to exposure-limit bands unless that mapping has been justified.

Missing evidence is a separate status. "Not sampled," "below reporting limit," "not applicable" and "not available from previous employer" are different conditions. None is automatically recorded as zero. Historical entries are retained when new evidence arrives so that the reason for a changed decision remains traceable. Tier 1 is not automatically better evidence if it is obsolete, unrepresentative or obtained using an unsuitable method.

Figure 3 summarizes the evidence labels that should remain visible whenever an entry is retrieved or transferred.

Figure 3: Evidence Classification in the WEP



Quantitative records preserve their measurement or assignment basis; qualitative and missing-evidence states remain distinct. The labels identify evidence types, not ranked exposure severity.

4.3 Temporal Interpretation

The WEP supports review at three timescales: within a task or shift, across repeated assignments, and at a handover between organizational units. Each timescale asks a different question. Within-shift review addresses the relevant exposure criterion. Repeated-assignment review examines recurring control failures or persistent evidence gaps. Handover review examines whether the next responsible party can retrieve and understand the information required for the new work.

For an airborne agent assessed using a time-weighted average, compatible interval concentrations can be combined using the relevant averaging time. This requires adequate coverage and explicit treatment of unsampled periods. A calculation cannot convert an unknown interval into a known low exposure. For long-term epidemiological analyses, an agent-specific cumulative metric may be meaningful if the exposure history and modelling assumptions support it. The proposed operational WEP does not calculate a lifetime disease probability or use an apparent unused “dose allowance” to justify additional exposure.

4.4 Privacy and Worker Participation

Worker-linked exposure information remains personal information even if it contains no diagnosis. The proposed governance model uses restricted access, purpose limitation, audit trails, correction procedures and documented transfer arrangements. Workers should be told what is recorded, who can access it and how an error can be corrected. Information should be presented in an accessible language and format.

HSE guidance distinguishes employer-held health records from confidential clinical records [10]. COEMF follows that functional separation: supervisors receive task-relevant control requirements or authorized restrictions, while clinical results remain with the appropriate occupational-health service. The proposal does not prescribe a universal retention period or legal basis for cross-employer sharing. Those decisions require the applicable jurisdiction, contractual context and data-protection requirements to be established before implementation.

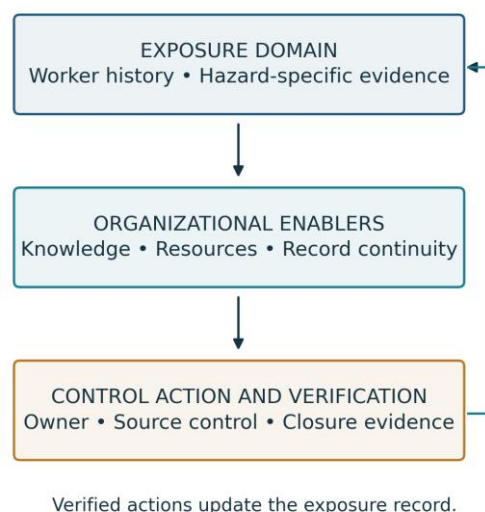
Across contractor tiers and national boundaries, transfers should use pseudonymous worker keys, encrypted transmission, role-limited access and a separately secured re-identification mapping. These safeguards reduce identification risk but do not make linked records anonymous or establish a lawful basis for sharing. Where the GDPR applies, pseudonymised records remain personal data, and relevant processing and international-transfer requirements must still be satisfied; receiving jurisdictions may impose additional requirements [11]. Any future pilot must establish the applicable legal basis and transfer arrangements before worker-linked data are moved.

5. Construction Occupational Exposure Management Framework

5.1 Three-layer Architecture

Figure 4 presents the COEMF architecture. The exposure domain layer stores and interprets hazard-specific evidence. The organizational enabler layer maintains the capabilities needed to produce, retrieve and use it. The control-action layer assigns and verifies preventive measures. Information moves between layers: a recurrent evidence gap can justify additional monitoring resources, and a verified control change can alter which historical measurements remain representative.

Figure 4: COEMF'S Three Interacting Architectural Layers: Exposure Domains, Organizational Enablers, and Control Action with Verification



The feedback route links verified actions to exposure records. Original conceptual diagram; no effectiveness estimates are implied.

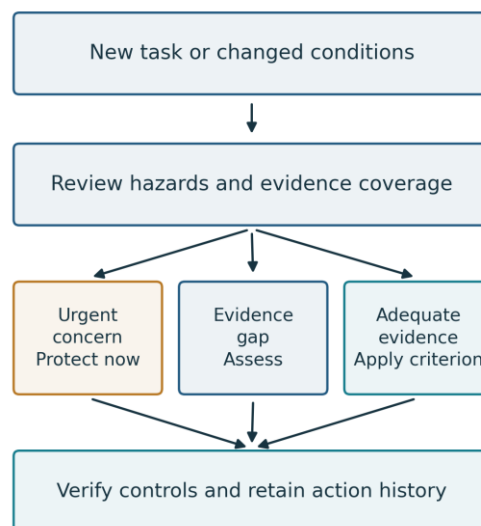
The architecture can be incorporated into an existing occupational health and safety management system. ISO 45001 specifies management-system requirements rather than a dedicated WEP data model [12]. COEMF supplies a narrower exposure-information workflow. Adoption of the workflow does not itself establish certification, legal compliance or conformity with every provision of a management-system standard.

5.2 Decision Triggers and Parallel Action

A trigger is a reason to review or intervene, not a diagnosis. Triggers include an applicable criterion being met or exceeded, deterioration of a control, a new material or process, repeated use of poorly characterized tasks, missing representative evidence and a worker transfer. Projects should define trigger thresholds and response responsibilities before rollout. Terms such as “approaching the limit” require a documented local rule informed by uncertainty; they should not be left as an undefined software setting.

Figure 5 treats the decision routes as parallel. A control failure can require immediate action even when the evidence is incomplete. A request for additional sampling must not defer necessary protection. Likewise, a result below a particular criterion does not close a separate issue involving an unassessed agent, a peak exposure or a changed work condition.

Figure 5: Parallel Routes Connecting the Exposure-Domain Layer with the Control-Action and Verification Layer, Supported By Ownership and Resources in the Organizational-Enabler Layer



Urgent concerns take precedence; records may require several routes. The workflow does not provide automated permission to work.

Table 4: Proposed Trigger and Closure Rules

Trigger	Management response	Evidence needed for closure
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Trigger	Management response	Evidence needed for closure
Criterion exceeded or urgent control failure	Apply the relevant protective response; escalate to competent personnel	Verified corrective action and reassessment appropriate to the hazard
Evidence missing or not representative	Assign an assessment owner and interim precautions	Suitable evidence or a documented, competent assessment decision
Material, tool or environment changes	Review applicability of previous assessment before relying on it	Revised assessment or justified confirmation of applicability
Repeated exposure concern	Review the underlying source and control design	Demonstrated control improvement, not only a completed briefing
Worker or contractor handover	Transfer authorized information and acknowledge unresolved actions	Receiving owner confirms receipt, meaning and responsibility
PPE is the only recorded control	Review higher-order options and the basis for continued reliance	Documented control rationale and protection programme requirements

The hierarchy of controls gives preference to elimination, substitution and engineering measures over administrative controls and PPE [13]. All levels should be considered at every relevant project stage. Construction-stage work can still permit substitution or engineering improvement; the hierarchy is not a sequence assigning effective controls only to early design and PPE only to operations.

5.3 Ownership and Control Verification

The employer responsible for the work retains its applicable duties. For the proposed workflow, the project identifies a custodian for record quality, a competent assessor for technical interpretation and an action owner with authority to change conditions. A client or principal contractor may specify handover expectations, but contractual coordination does not erase another party's responsibilities.

Verification must address the reason the action was opened. For a damaged extraction hose, a photograph can show replacement but may not demonstrate capture performance or representative exposure. For an incomplete handover, acknowledgement alone may be inadequate if the underlying monitoring report cannot be opened. The verification method must match the defect and should identify who judged the action complete. If verification is unsuccessful, the issue stays open and the interim arrangements are reviewed.

Task allocation can be informed by valid exposure information, but moving work to another employee should not substitute for eliminating, substituting or controlling the source, consistent with the hierarchy of controls [13]. Rotation can transfer an unresolved hazard administratively: depending on exposure intensity and duration, it may lower one worker's time-weighted average while increasing the number of workers exposed, including the number exceeding an agent-specific action level. A lower individual average therefore does not establish a reduction in the organization's overall exposure burden. Such redistribution can also extend monitoring, training and surveillance responsibilities under applicable requirements.

Any proposed rotation or reassignment should be assessed for each affected worker and hazard, including short-term limits, representativeness of measurements, coordination and equity. The WEP should retain the decision rationale, affected workers, relevant assessment periods and source-control follow-up. Rotation is not the framework's default response, and organizational liability cannot be inferred from an individual TWA alone.

5.4 Integration into Routine Work

Implementation should start with a bounded use case, such as selected dust-generating tasks and their associated noise exposures. The project can link existing monitoring reports to work assignments and retain a short action log. It need not start with continuous sensors, a new application or a comprehensive lifetime record. The test is whether the next decision-maker can obtain adequate information at the time a decision is needed.

The interface should show unresolved decisions, not only counts of completed forms. Useful views include missing coverage, assessments invalidated by change, overdue actions and handovers awaiting acceptance. A generic green indicator should never imply that every hazard is controlled merely because a record exists. Separate statuses can describe record completeness, assessment validity and action verification without representing them as a combined health-risk score.

6. Illustrative Application of the Proposed Workflow

An explicitly hypothetical example demonstrates the proposed interpretation rules. All concentrations and durations in this example are invented teaching values, not observed worker measurements. Consider an eight-hour shift with two hours at 0.080 mg/m³, two hours at 0.020 mg/m³ and four hours at 0.010 mg/m³ for a compatible airborne-agent assessment. If these intervals validly cover the entire shift, the eight-hour time-weighted average is:

$$\frac{(0.080 \times 2) + (0.020 \times 2) + (0.010 \times 4)}{8} = 0.030 \text{ mg/m}^3$$

If the last four hours are unassessed, the known contribution divided by eight hours is 0.025 mg/m³, but the full-shift average is unknown. The WEP should retain the measured intervals, flag incomplete coverage and assign assessment follow-up. It should not substitute zero for the unknown interval. A control failure observed during this process can require immediate protection while the evidence gap is resolved. Figure 6 visualizes why missing coverage cannot be treated as zero exposure.

Figure 6: Hypothetical Exposure-Coverage Illustration Using Invented Concentrations

A Complete shift: TWA = 0.030 mg/m³



B Missing four hours: TWA unknown

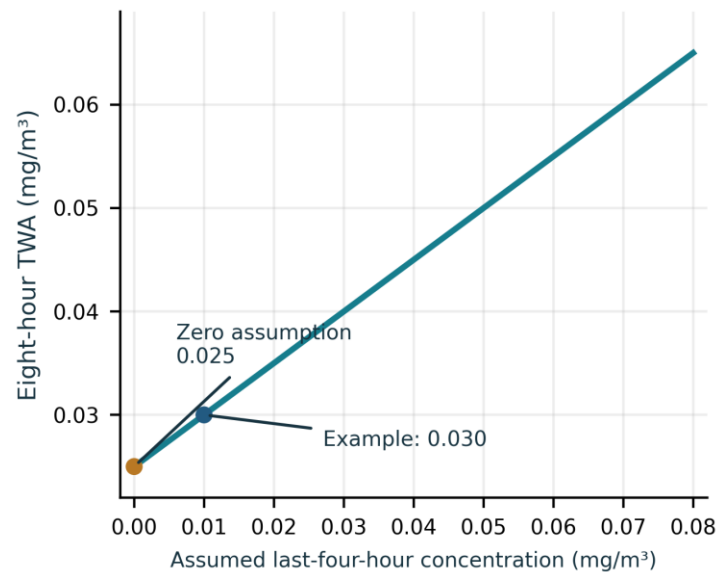


0 2 4 6 8
Elapsed hours (invented scenario)

Panel A assumes valid, compatible measurements over the full shift. In panel B, dividing the known contribution by eight hours gives 0.025 mg/m³, but this is not a valid full-shift TWA because half the shift is unassessed. No study measurements or compliance determinations are shown. Concentrations inside the bars are in mg/m³.

The sensitivity relationship in Figure 7 further illustrates the uncertainty. With the first four hours fixed as above and an assumed average concentration c during the last four hours, the eight-hour TWA equals $0.025 + 0.5c$ mg/m³ when c is expressed in mg/m³. Varying c is a mathematical illustration; it does not estimate the actual missing concentration or establish a compliance classification.

Figure 7: Hypothetical Sensitivity of the Eight-Hour TWA to the Assumed Concentration in the Unassessed Four-Hour Interval



The line is calculated from invented values; no observed exposure data or exposure limit is plotted.

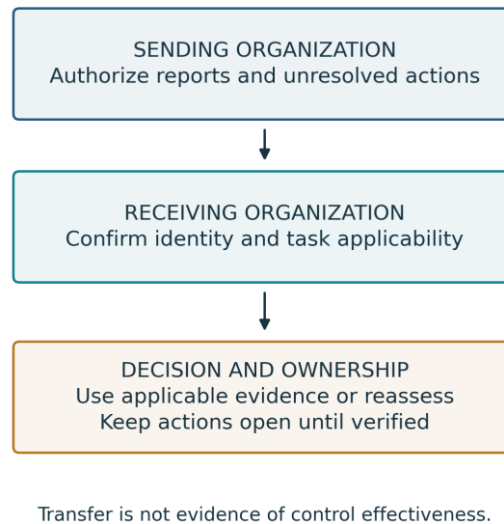
At a contractor handover, the receiving organization would retrieve the authorized report reference, task context and unresolved action, then acknowledge ownership. A previous assessment remains historical evidence whose applicability to the new task must be reviewed. An action closes only when its specified verification is documented. Noise, vibration or heat during the same work remain separate assessment channels. This example demonstrates the workflow, not its effectiveness.

6.1 Hypothetical Contractor Handover

Consider an invented transfer in which a worker moves to a contractor using a different tool and local exhaust arrangement. The sending organization provides an authorized package containing the historical assessment reference, task context, evidence class and outstanding action. The receiving assessor confirms the identity linkage and determines whether the previous assessment represents the new conditions. If applicability is uncertain, the entry remains historical evidence and a new assessment action is assigned; it is not silently treated as proof of adequate control at the new workplace.

Receipt of the package is one event; acceptance of action ownership and verification of an effective control are separate events. If a control defect was already identified, its action remains open until the specified verification is completed. Figure 8 illustrates this proposed handover logic. The example demonstrates responsibilities and record states, not a measured improvement in continuity.

Figure 8: Proposed Handover across Organizational Boundaries



The exposure-domain layer preserves source evidence and applicability; the organizational-enabler layer establishes authorized access and ownership; the control-action layer retains reassessment and closure responsibilities. This is an invented workflow illustration, not an observed transfer.

7. Discussion

7.1 Conceptual Contribution

The proposed contribution is the explicit linkage of an exposure episode, its interpretation, an accountable decision and evidence of action closure. A database can retain a report without prompting its review, while an action tracker can record completion without preserving the basis for that action. WEP and COEMF connect these functions through linked evidence and decision records. This distinction is an operational design proposition, not a claim that existing systems lack the same capabilities.

The framework also treats missingness as information. An unassessed interval, an unavailable historical report and a result below a method's reporting limit have different meanings. Preserving those states prevents a superficially complete profile from implying certainty that the underlying evidence does not support. The hypothetical TWA example tests this rule logically, but it does not show how often such errors occur in practice or whether this specification reduces them.

Continuity is defined at three levels: retention of a record, retrieval and interpretation at the next relevant decision, and transfer of responsibility for unresolved actions. Each level can fail independently. This definition directs future evaluation toward observable processes instead of relying only on perceived usefulness, software adoption or counts of completed fields.

7.2 Operational Value and Implementation Tradeoffs

A bounded implementation could begin with one recurring task and a defined contractor handover. Existing assessment reports should remain authoritative source documents, with the WEP storing

references and the minimum contextual information needed at a decision. Requiring duplicate entry of full reports could increase administrative burden and create conflicting versions. The appropriate balance between structured fields and linked documents should therefore be tested with intended users.

Worker mobility creates a tension between useful continuity and unnecessary circulation of personal information. A profile should carry only information authorized and relevant to the next task. A receiving organization needs the assessment basis and any work-related restrictions it is authorized to receive, not unrestricted access to clinical files. Data minimization, accessible correction routes and clearly assigned responsibility are therefore implementation requirements rather than optional interface features.

A profile must not become a rationale for exposing a different worker instead of controlling a source. The relevant question is whether the work and controls are adequately assessed for every affected worker. The proposed process retains both the basis of any reassignment and the unresolved source-control action. It cannot establish that a lower individual average reduces the total organizational exposure burden.

7.3 Propositions for Prospective Testing

Four propositions follow from the design. First, retaining assessment context and evidence class is expected to improve the defensibility of decisions based on historical records. Second, combining acknowledged handover with named action ownership is expected to improve continuity of unresolved actions. Third, explicit missing-coverage states are expected to reduce unjustified full-shift interpretation. Fourth, closure evidence tied to the original trigger is expected to distinguish verified correction from administrative completion. Each proposition remains untested.

Project scale and subcontractor turnover rate are proposed moderators. Larger projects may have greater resources but also more interfaces; frequent subcontractor changes may increase transfer demands. Neither the direction nor magnitude of these relationships is established here. Future studies should also examine task complexity, workforce language needs, digital access and the maturity of existing occupational-hygiene programmes as possible alternative explanations.

7.4 Limitations

This article offers a conceptual specification, not an empirical research finding. It does not establish the prevalence of record discontinuity, validate the completeness of the proposed schema, measure worker acceptance or demonstrate a reduction in exposure. The narrative source selection is not exhaustive, and guidance from particular jurisdictions does not automatically apply to every construction supply chain. The operational requirements need local technical and governance review before use.

The hypothetical scenarios are deliberately simplified. Real assessments may involve variable tasks, uncertain duration estimates, multiple exposure routes, method limitations and changing control performance. The WEP does not resolve those uncertainties by itself. It also does not calculate lifetime disease probability, produce a common score across hazards or replace a competent occupational hygienist's assessment.

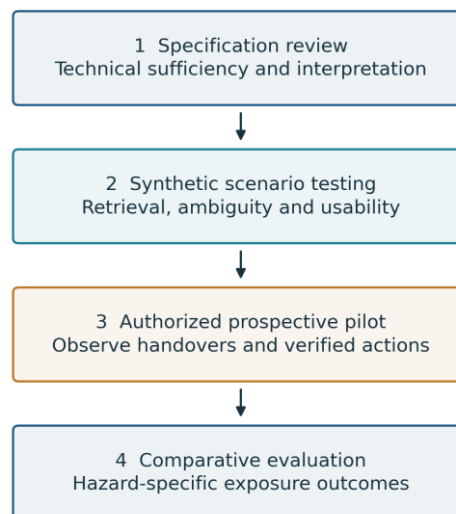
The novelty claimed is limited to the articulated integration and its research agenda. No comprehensive comparison of commercial software, national exposure registries or contractor information systems was undertaken. Similar functions may already exist in practice. Comparative evaluation is needed to establish whether the proposed specification offers additional value and at what implementation cost.

8. Research Agenda and Evaluation Design

Evaluation should proceed from specification review to controlled usability testing and then to a bounded prospective pilot. An expert review should examine whether the fields are technically sufficient and whether the proposed triggers preserve hazard-specific interpretation. Scenario testing can use wholly synthetic records to examine retrieval, ambiguity and decision consistency before any operational worker information is introduced. Neither stage should be described as proof of exposure reduction.

Figure 9 summarizes the proposed sequence and the question addressed at each stage. No stage is presented as already completed.

Figure 9: Proposed Evaluation Roadmap



Specification review and synthetic testing precede any authorized prospective pilot. Comparative exposure-outcome evaluation is a later research stage, not a claimed result.

A prospective pilot should define the eligible handovers, tasks and decision events before data collection. A worker or event must be observed across more than one relevant point if continuity is an intended outcome. Retrieval, review and action closure should be verified against records rather than inferred from favourable questionnaire responses. Any use of participants or operational records would require the applicable ethics determination, participant information and consent arrangements where required, and data-custodian authorization before that study begins.

Table 5 proposes evaluation measures and denominators. A study protocol should distinguish missing evidence from an unsuccessful outcome, document repeated observations and justify its sample size against the principal evaluation question [14]. Comparisons with an existing programme should account for differences in tasks, controls, workforce composition and turnover; observational change alone would not establish causality.

Table 5: Proposed Measures for A Future Evaluation

Evaluation domain	Proposed measure	Interpretation safeguard
Record retrieval	Eligible decision events with the relevant prior report retrieved before the decision / all eligible events.	Define relevance prospectively; record access failure and unavailable history separately.
Handover continuity	Transferred open actions with acknowledged receiving ownership / all actions requiring transfer.	Receipt of a file is not acceptance of responsibility or action closure.
Decision quality	Blinded expert assessment of whether decisions are justified by available evidence.	Use a prespecified rubric and examine reviewer agreement; do not infer quality from confidence alone.
Verified correction	Actions closed with evidence matching the original trigger / all actions due for review.	Report overdue and unverifiable actions; administrative completion is a separate state.
Usability and burden	Retrieval time, task-completion errors and staff time per eligible event.	Collect alongside qualitative feedback; satisfaction does not establish preventive benefit.
Exposure outcomes	Comparable hazard-specific measurements before and after a defined control change.	Retain method and task comparability; address concurrent changes and repeated worker observations.

No results are reported.

The first pilot should prioritize whether the intended information reaches the responsible decision-maker and whether verified actions follow. A subsequent evaluation may examine hazard-specific exposure changes using a design appropriate to the intervention and workplace. Disease-prevention claims would require a different evidential basis, suitable follow-up and careful consideration of exposure history and other determinants of health.

9. Conclusion

Worker Exposure Profiles and COEMF provide a proposed information and workflow specification for maintaining interpretable exposure evidence across construction tasks and organizational changes. The

framework preserves hazard-specific assessment boundaries, separates evidence classes, retains uncertainty and links decisions to accountable actions and verification. Its contribution is conceptual and methodological. The literature provides constraints for the design, while the invented examples demonstrate selected interpretation rules. Prospective evaluation of retrieval, decision quality, implementation burden and verified control improvement is required before effectiveness, exposure-reduction or disease-prevention claims are warranted.

10. Declarations

Funding. This research received no external funding.

Research scope and data availability. This conceptual article reports no recruitment, participant-level survey analysis or analysis of operational worker-exposure records. No empirical dataset is presented or offered for release. The numerical example is hypothetical, and the cited literature and proposed specification constitute the material reported in this article. No institutional ethics approval or exemption is claimed for this conceptual manuscript.

Author contribution. Shajahan Abdul Salam formulated the research problem and directed development of the manuscript. The named author is responsible for reviewing the technical content, references and final submission.

Use of artificial intelligence. ChatGPT assisted with drafting, literature discovery, document preparation and conceptual figure production. AI assistance does not constitute independent validation of the framework or its sources; the author retains responsibility for the manuscript.

REFERENCES:

1. World Health Organization and International Labour Organization, WHO/ILO Joint Estimates of the Work-related Burden of Disease and Injury, 2000–2016: Global Monitoring Report. Geneva, Switzerland: WHO and ILO, 2021. [Online]. Available: <https://www.who.int/publications/i/item/9789240034945>
2. E. J. Cothorn, W. J. Brazile, and D. A. Autenrieth, “The evaluation of worker exposure to airborne silica dust during five OSHA Table I construction tasks,” *Annals of Work Exposures and Health*, vol. 67, no. 5, pp. 572–583, 2023, doi: 10.1093/annweh/wxad012.
3. E. J. Cothorn, D. A. Autenrieth, and W. J. Brazile, “A temporal evaluation of respirable crystalline silica exposure for construction tasks,” *Annals of Work Exposures and Health*, vol. 68, no. 4, pp. 437–441, 2024, doi: 10.1093/annweh/wxae013.
4. P. J. Dopart and M. C. Friesen, “New opportunities in exposure assessment of occupational epidemiology: Use of measurements to aid exposure reconstruction in population-based studies,” *Current Environmental Health Reports*, vol. 4, pp. 355–363, 2017, doi: 10.1007/s40572-017-0153-0.
5. S. Choi et al., “Development of the Korean construction job exposure matrix (KoConJEM) based on experts’ judgment using the 60 consolidated occupations for construction workers,” *Annals of Work Exposures and Health*, vol. 68, no. 4, pp. 397–408, 2024, doi: 10.1093/annweh/wxae017.

6. R. M. Choudhry, D. Fang, and H. Lingard, "Measuring safety climate of a construction company," *Journal of Construction Engineering and Management*, vol. 135, no. 9, pp. 890–899, 2009, doi: 10.1061/(ASCE)CO.1943-7862.0000063.
7. E. Jaakkola, "Designing conceptual articles: Four approaches," *AMS Review*, vol. 10, pp. 18–26, 2020, doi: 10.1007/s13162-020-00161-0.
8. National Institute for Occupational Safety and Health, "Understand noise exposure," 2024. [Online]. Available: <https://www.cdc.gov/niosh/noise/prevent/understand.html>
9. Occupational Safety and Health Administration, "Respirable crystalline silica," 29 CFR 1926.1153. [Online]. Available: <https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.1153>
10. Health and Safety Executive, "Health surveillance: Record keeping." [Online]. Available: <https://www.hse.gov.uk/health-surveillance/record-keeping.htm>
11. European Parliament and Council of the European Union, "Regulation (EU) 2016/679 (General Data Protection Regulation)," *Official Journal of the European Union*, L 119, pp. 1–88, 2016. [Online]. Available: <https://eur-lex.europa.eu/eli/reg/2016/679/oj/eng>
12. International Organization for Standardization, *Occupational Health and Safety Management Systems—Requirements with Guidance for Use, ISO 45001:2018*, 2018. [Online]. Available: <https://www.iso.org/standard/63787.html>
13. National Institute for Occupational Safety and Health, "Hierarchy of controls." [Online]. Available: <https://www.cdc.gov/niosh/hierarchy-of-controls/index.html>
14. D. Lakens, "Sample size justification," *Collabra: Psychology*, vol. 8, no. 1, Art. no. 33267, 2022, doi: 10.1525/collabra.33267.