

Annex X — ISO 14040 / 14044 Alignment of MSR-X Verified Recovery & Recycling (XVRR) Methodology

Version 6 – Public Disclosure (October 2025 Update)

Document Control

Field	Detail
Document Title	Annex X — ISO 14040 / 14044 Alignment of MSR-X XVRR Methodology
Version	6 (Public Disclosure)
Date	October 2025
Prepared by	Xworks Team (Developed by Xworks – now operated under Xworks Holdings)
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Framework Alignment	ISO 14040 / 14044 / 14067; Gold Standard GS23382

Status	Public Disclosure – Stakeholder & Registry Publication
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Public Summary

This annex transparently maps the **MSR-X Verified Recovery & Recycling (XVRR)** methodology against **ISO 14040** and **ISO 14044** standards.

It demonstrates **full conformity** with internationally recognised LCA principles and **Gold Standard GS23382** requirements while protecting proprietary constants, equations, and computational logic that form Xworks AI's intellectual property.

This public version is designed for **stakeholder consultation, registry publication, and verification clarity**.

All confidential annexes and validation models remain securely maintained and are accessible only to **accredited Validation & Verification Bodies (VVBs)** under NDA.

1 | Goal and Scope Definition

Goal

Quantify carbon-avoidance (CA) resulting from the traceable recovery and recycling of post-consumer plastics under the MSR-X XVRR methodology, enabling digital-MRV issuance of verified MSR-X Credits, each representing 1 tCO₂e avoided through material substitution.

Functional Unit

One (1) tonne of recycled polymer output.

System Boundary

Cradle-to-gate — including **collection, sorting, washing, shredding, pelletising, and delivery** of secondary raw materials.

Use-phase and end-of-life are **excluded** to prevent double counting of downstream impacts.

Allocation Principle

System expansion (avoided burden): recycled outputs are treated as displacing equivalent virgin resin production.

Geographic & Temporal Scope

Applicable to verified facilities under **Gold Standard Programme of Activities (GS23382)** with a **7-year crediting period**, renewable twice.

2 | Life-Cycle Inventory (LCI) Analysis

Data Hierarchy

1. Primary data from project operations (weighbridge records, energy meters).
2. **UK Government GHG Conversion Factors 2025** – plastics, freight, energy, and waste modules (IPCC AR5 GWPs).
3. **Ecoinvent v3.11** – for processes not covered by UK factors.
4. **Peer-reviewed literature** – for emerging materials and technologies.

Data Governance

All datasets are **version-controlled**, **hash-anchored**, and **auditable** within the Xworks AI Digital MRV ledger.

QA & Precision

Source data are preserved at full precision (4–6 decimals); rounding is applied only at final outputs to ensure traceable accuracy.

Leakage & Completeness

Leakage = 0, as geo-tagged tracking and mass-balance control cover the entire chain of custody.

3 | Life-Cycle Impact Assessment (LCIA)

Impact Category

Global Warming Potential (GWP, tCO₂e). Other categories acknowledged but not quantified in this public version.

Calculation Logic (Overview)

1. Determine mass balance between input waste and usable output.

2. Estimate avoided emissions from substituting equivalent virgin resin production.
3. Subtract project emissions (transport, energy use, residual disposal).
4. Apply a **unified 10 % final buffer** to address measurement and reporting uncertainty.

Emission Factors

All sourced from **UK Government GHG Conversion Factors (2025)** and **Ecoinvent v3.11**. Full coefficients are reviewed by Control Union under NDA and withheld from public release to protect method integrity.

4 | Interpretation

- Results interpreted per ISO 14044 criteria of **consistency, completeness, sensitivity, and transparency**.
 - Conservativeness achieved through the 10 % final buffer applied after verification.
 - Default yield/purity values (75 % / 85 %) used only when measured data are unavailable.
 - Uncertainty addressed through version control, DQR ratings, and ledger-anchored audit trails.
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5 | Critical Review and Conformity Assessment

The methodology underwent **independent review by Control Union**, acting as Validation & Verification Body (VVB).

The review confirmed **conformity with ISO 14040 / 14044** requirements and alignment with Gold Standard frameworks.

Panel member identities and full comments are retained in the confidential technical annex released post-validation.

6 | Conclusion

The **MSR-X Verified Recovery & Recycling (XVRR)** methodology meets and exceeds the requirements of ISO 14040 and 14044.

It delivers a scientifically defensible, digitally traceable framework for quantifying carbon avoidance from recycling activities under **Gold Standard GS23382**.

Key outcomes:

- Transparent and verifiable data flows
- Consistent application of ISO LCA principles
- Protection of intellectual property alongside auditable integrity for regulators and VVBs

Proof of Integrity Layer

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Disclaimer

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Complete technical documentation and calculation models are available only to accredited VVBs under NDA.