EmpCo — TECHNICAL REFERENCE CARD

EmpCo Technical Reference Card

A condensed reference of EmpCo scheme requirements — informative companion to the framework PDF. Non-normative.

Based on EmpCo v0.4.0-draft-vv July 2026

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1. Rating System

The framework requires **A–E letter grades** as the rating shape (uniformly mandatory, scheme §1.4.1). Five-band A–E may be simplified to A/B/E for indicators where five bands are not meaningful.

The **thresholds** (numeric ranges per A through E) are declared by each validated provider pathway in PA-09 of its annex, alongside the benchmark dataset and derivation rationale. Different pathways may declare different thresholds; the VVB assesses each pathway's thresholds for internal consistency and scientific defensibility as part of pathway validation.

The framework specifies that:

- The pathway publishes its A–E thresholds, derivation rationale, and benchmark or reference dataset (geographic and temporal scope)
- Threshold intervals shall be wide enough to absorb normal measurement and modelling uncertainty
- Borderline cases (near a threshold) are flagged in the evidence file and prioritised for VVB sample-based verification

The framework does **not** prescribe a single set of thresholds, a single benchmark dataset, or a single benchmark refresh cadence. These are pathway-declared.

EmpCo Climate-Impact Scope

For the September 2026 release, only **climate impact** is in the licensed market-use scope of EmpCo. A pathway may operationally support water scarcity, nutritional quality, animal welfare, or deforestation indicators and document them in its annex; those indicators are not in the licensed market-use scope until the scheme adds them as a major change subject to ESFC member approval (scheme §1.4.2). Note: confirmed accredited VVB scopes are today limited to GHG quantification (ISO 14067); non-GHG indicators would require an ISO 14065 environmental-information scope extension or a different assurance instrument.

GWP Factors (EF 3.1 / IPCC AR6)

CO2 fossil = 1, CO2 biogenic = 0, CH4 fossil = 29.8, CH4 biogenic = 27.0, N2O = 273, HFC-134a = 1,530. Climate change reported as fossil / biogenic / LULUC / total sub-indicators per EU PEF. See scheme Annex D for the complete characterisation factor table.

2. Functional Unit & Methodology

Daily Food Unit (DFU)

$$\mathrm{DFU} = \frac{1}{5}\left(\frac{p}{50} + \frac{f}{66} + \frac{e_{\mathrm{carb}}}{6000} + \frac{w}{2500} + \frac{d}{600}\right)$$

where p = protein (g), f = fat (g), e_{carb} = energy from carbs (kJ) = total kJ $-17p - 37f$, w = water (g), d = dry weight (g).

Divisors are one-day reference targets (one DFU = one day's intake): protein 50 g, fat 66 g, rest energy 6,000 kJ, water 2,500 g, dry weight (mass − water) 600 g — as operated. Announced revision: WHO/FAO 2,000-kcal/60-kg frame, rest energy 5,076 kJ, macro-stripped dry matter /325 g. Reference implementation: `lci-dfu` (gitlab.com/eos-lci/lci-dfu).

System Boundary

Cradle-to-grave. Global scope with region-specific data where available.

Cut-Off Criteria (ISO 14044 / PEF)

- Mass: $< 1\%$ of total may be excluded
- Energy: $< 1\%$ of total may be excluded
- Environmental significance: $< 1\%$ of any impact category
- Cumulative limit: excluded flows ≤ 5% of any impact category

Data Hierarchy

1. Primary data (direct measurements)
2. Site-specific estimates (producer knowledge)
3. Published LCA studies (peer-reviewed)
4. LCI database averages (e.g. Agribalyse, Ecoinvent, or other provider-declared databases)
5. Modelled estimates (the pathway's gap-filling logic)

3. Assurance Levels

	Enhanced	Standard
Typical use	Per-product intake on order — any claim surface	Menu labels, reporting — and on-pack/shelf at catalogue scale (sampled)
Data input	Full questionnaire *or* enterprise data integration	Ingredient + quantity (minimum)
Data intake cases	Full Specification (questionnaire/enterprise) or Label/Retail (back-of-package parsing)	Caterer (names + quantities)
Gap-filling	Minimal (Tier 1–2 matches)	Extensive (the pathway's gap-filling logic supplies origin, processing, transport)
QA method	Expert review or validated automated pipeline	Automated validation
Accuracy req.	± 10% of reference	± 20% of reference; ≥ 80% rating agreement
Validity	24 months (questionnaire) / continuous with 24-month cap (enterprise)	Continuous (auto-recalculated)
VVB sample min	100/yr (questionnaire) / 200/yr (enterprise)	200 / year
Timeline	6 weeks (questionnaire) / seconds (enterprise pipeline)	< 1 second per recipe
Volume	Hundreds (questionnaire) / tens of thousands (enterprise)	Millions of recipes

Ingredient Match Tiers

Tier	Type	Example
1	Exact (product, origin, method)	“Basil, fresh, heated greenhouse, Netherlands”
2	Representative (product, origin)	“Basil, fresh, generic method, Italy”
3	Category proxy (different origin)	“Basil, fresh, generic European”
4	Modelled estimate (gap-filling module)	Estimate from similar products

4. QA Outcome Requirements

Five outcomes — method is flexible, but the VVB verifies results.

Accuracy

- **Enhanced:** within ± 10% of independently calculated reference values
- **Standard:** within ± 20%; rating-level agreement ≥ 80%

Reproducibility

- Identical inputs → bit-identical outputs. Verified via regression test suite.

Completeness

- Every required impact indicator populated or gap-filled. Gap-filling method and source documented per parameter.

Traceability

- Full audit trail: input data, gap-filling decisions, ingredient matches, assumptions. Database version + calculation engine version recorded. Records retained **minimum 5 years**.

Outlier Detection

- Assessments > 3 SD from category mean → flagged for review
- Borderline assessments (near rating threshold) → flagged for enhanced review
- Flagging rates and resolution logged

Automated QA Flags (Standard Assurance)

Flag	Threshold	Action
Low match confidence	Any Tier 4 on major ingredient (> 10% weight)	Flagged; manual review prompt
Implausible result	> 3 SD from category mean	Excluded from communication until reviewed
High gap-filling	> 80% of impact from gap-filled parameters	Confidence reduced; operator prompted
Near-threshold	Close to rating boundary	Sensitivity analysis; VVB sampling priority

5. Regression Test Suite

Minimum Composition

Each validated pathway maintains a regression test suite covering: all rating categories the pathway operates (where applicable, A–E or other scale), all major food categories, range of data completeness, supply-chain complexity, cuisine types, ingredient counts, gap-filling levels, and match tiers. Suite size and structure are declared in PA-07.1 of the pathway annex (the example Eaternity EOS pathway uses 600 items across 3 input cases: 250 caterer + 200 label/retail + 150 full-specification).

Three input cases: Caterer (250 recipes, Standard — names + quantities only), Label/Retail (200 products, Enhanced validated pipeline — back-of-package label info with realistic perturbations), Full Specification (150 products, Enhanced — complete 8-category data per Section 6.2).

Execution Protocol

Run for **every** release of a validated pathway (engine and/or database):

1. Run suite against pre-change system
2. Run suite against post-change system
3. Compare item-by-item
4. Calculate materiality metrics (aggregate **and** per input case: Caterer, Label/Retail, Full Specification)
5. Log with timestamp, pathway versions (before/after), summary statistics

Submission fidelity: Test items submitted through production API — no bypass of validation, matching, or gap-filling.

Deterministic generation: Programmatically generated items use fixed random seeds, versioned generation code, documented logic. Error injection (misspellings, missing fields) documented.

Results retained **minimum 5 years**. Suite reviewed at least annually. Items shall not be removed to make changes pass materiality.

6. Change Management

Classification

Tier	Criteria	VVB involvement
Non-substantive	No output impact (UI, docs, refactoring, perf). Regression confirms identical outputs.	Log only
Minor	Output impact below materiality threshold	VVB notified; reviewed at annual verification
Major	Above materiality **or** structural change (new impact category, methodology change, threshold recalibration, DFU modification, gap-filling-pipeline restructure, GWP factor switch)	Exceeds the validation statement's validity conditions — focused re-validation by the VVB before deploy (20 business day review); Certification Committee informed

Materiality Threshold

A change is **major** if:

- Rating-category change for $>$ **2%** of regression test suite items, *or*
- $>10\%$ CO2eq/DFU change for $>$ **5%** of items

Formulas:

$$\text{rating\\_change\\_rate} = \frac{\text{items\\_with\\_rating\\_change}}{\text{total\\_items}} \times 100$$

$$\text{co2\\_impact\\_rate} = \text{items\\_with\\_} > 10\% \frac{\text{\\_co2\\_change}}{\text{total\\_items}} \times 100$$

Major if: `rating_change_rate > 2%` OR `co2_impact_rate > 5%`.

Major Change Re-Validation Process

1. Prepare proposal: description, rationale, regression results, impact assessment, timeline, communication plan
2. Submit to the VVB
3. VVB conducts focused re-validation (within 20 business days)
4. VVB may request: additional regression testing, independent verification, trigger verification
5. VVB conclusion: validity conditions confirmed / conditional / not confirmed; Certification Committee informed
6. If confirmed: deploy per agreed timeline; notify affected companies **before** deployment
7. Post-deployment monitoring: **30 days**, report to the VVB

Emergency Changes

Triggers: critical bug causing incorrect ratings at scale, security vulnerability, database corruption.

1. Deploy fix immediately
2. Notify the VVB within **48 hours** (description, regression results, affected assessments)
3. Full regression suite within **5 business days**
4. VVB retroactive review within **10 business days**
5. If unjustified → treated as non-conformity

Version Control

Semantic versioning (X.Y.Z): Major = structural, Minor = database/features, Patch = bugfixes.

Changelog per release: version, date, classification, change description, regression summary, VVB reference.

In a typical pathway architecture, the LCI database is versioned independently from the calculation engine.

Reproducibility: given pathway version (engine + database) + input data → identical results. Requires pinned dependencies, deterministic execution order, archived database snapshots.

7. Sample Verification

Enhanced Assurance Samples (Questionnaire-Based)

Annual Volume	Min Sample	Rate
≤ 5,000	100	2%
5,001–15,000	150	1–2%
15,001–50,000	200	0.5–1%
> 50,000	250	< 0.5%

Selection: 60% random (stratified by category, company, rating) / 40% risk-based (new categories, high uncertainty, complaints, borderline, recent onboarding).

Enhanced Assurance Samples (Enterprise Data Integration)

Annual Volume	Min Sample	Rate
≤ 5,000	200	4%
5,001–15,000	250	1.5–4%
15,001–50,000	300	0.6–2%
> 50,000	350	< 0.7%

Selection: 50% random (stratified by category, company, rating, data completeness) / 50% risk-based (new integrations, low completeness < 70%, recent sourcing changes, borderline, Tier 3–4 matches).

Additional check dimension: **data extraction accuracy** — verify automated integration correctly represents enterprise source data.

Standard Assurance Samples

Annual Volume	Min Sample	Rate
≤ 50,000	200	0.4%
50,001–500,000	300	0.06–0.6%
> 500,000	400	< 0.08%

Selection: 50% random (stratified by cuisine, operator, geography) / 50% risk-based (high gap-filling > 70%, Tier 3–4 on major ingredients, borderline, newly onboarded, novel ingredients, flagged by QA).

What the VVB Checks Per Sample

Enhanced (questionnaire): input data vs. documentation → database match correctness → independent CO_2eq/DFU recalculation → rating assignment → assumption log + QA records.

Enhanced (enterprise integration): data extraction accuracy (enterprise source vs. extracted) → ingredient-database mapping correctness → independent recalculation (± 5% acceptable) → rating assignment → audit trail completeness.

Standard: ingredient match quality → gap-filling plausibility → independent recalculation → rating + QA flag verification → audit trail completeness.

Tolerance & Escalation

Finding	Severity	Action
Variance < 5%, no rating change	Observation	Documented only
Variance 5–15%, no rating change	Minor NC	Corrective action within 30 days

Any rating change	Major NC	Rating corrected; root cause analysis
Pattern > 5% of sample	Critical NC	Expand sample 50%; focused system review; potential licence suspension by the Certification Committee

Cross-Validation

Enhanced vs. Standard: the VVB selects 10–20 products assessed at both levels. Acceptable variance: ± 15% CO_2eq/DFU. Rating agreement: ≥ 80%. Systematic divergence → calibration issue.

Enterprise integration vs. Questionnaire: the VVB selects 10–20 products assessed via both pathways. Acceptable variance: ± 10% CO_2eq/DFU. Rating agreement: ≥ 90%. Systematic divergence → integration accuracy issue.

8. Validation & Verification Cycle

> **Validation and verification standards (v0.4.0-draft-vv).** The scheme's third party is a Validation/Verification Body (VVB) accredited to ISO/IEC 17029 + ISO 14065, with ISO 14067 product scope (CFP systematic approach), via the accreditation mechanism of Regulation (EC) No 765/2008; each engagement is conducted per ISO 14064-3. The VVB issues **validation** and **verification statements**; the scheme's Certification Committee issues, suspends, and withdraws **label licences** on the basis of those statements. at least 18 register-confirmed bodies (16 DAkkS + 2 ACCREDIA: RINA, TÜV Italia; Certiquality a probable third) hold this scope today — nine registers checked, a lower bound.

Schedule

Type	Frequency	Duration	Scope
Initial validation	Once	3–5 days	Full system + pilot sample → validation statement with validity conditions
Annual verification	Years 1, 2	2–3 days	System-conformity review + sample verification + change management → verification statement
Re-validation (renewal)	Every 3 yrs	3–5 days	Full system + extended sample (150% of annual) + full change review
Trigger verification / focused re-validation	As needed	1–2 days	Focused on specific change or incident

Label licence (issued by the Certification Committee on the basis of the VVB's statements) valid for **3 years**, conditional on annual verification.

What the VVB Assesses

Methodology: ISO 14040/14044 compliance and ISO 14067 conformity (CFP systematic approach; engagement per ISO 14064-3), system boundaries, functional unit, allocation, cut-off, impact assessment.

Database: spot-check 20–30 entries against reference LCI databases, update log, data quality procedures, emission factor currency.

QA: outcome requirements met (5 areas), Enhanced assessment file review (10–15 files), Standard automated QA logs and statistics, validated automated pipeline accuracy (where applicable), enterprise data integration health (where applicable), operator dashboard.

Change management: change log completeness, classification accuracy (spot-check 10–20 changes), regression test results per release, materiality calculations, major-change re-validations, emergency change compliance.

Organisational: complaint/appeal handling, non-conformity management, data confidentiality, traceability, staff competence.

Engagement Procedure

1. VVB provides engagement plan: **4 weeks** in advance
2. The validated provider supplies documentation
3. On-site or remote engagement: 2–3 days (typical)
4. VVB issues report: within **15 business days**
5. The validated provider responds: within **30 calendar days**
6. VVB concludes: positive / conditional / negative verification statement

Verification Outcomes

Positive: no major NCs; minor issues have action plans. Verification statement issued; label licence maintained.

Conditional: major NC identified but correctable. Licence maintained; corrective action within 90 days.

Negative: critical NC or unresolved majors. Label licence suspended by the Certification Committee.

9. Non-Compliance Timelines

Minor NC

Examples: incomplete documentation, single missing QA record, minor label deviation, non-substantive change deployed without log entry.

Step	Deadline
Root cause analysis	10 business days
Corrective action plan	15 business days
Implementation	30 calendar days
VVB verification	10 business days after
Escalation to Major	If unresolved after 30 days

No label restrictions during correction.

Major NC

Examples: systematic QA failure, incorrect emission factors affecting multiple assessments, prohibited label claims, minor pathway change deployed without VVB notification, major change deployed without focused re-validation.

Step	Deadline
Root cause analysis	10 business days
Corrective action plan to the VVB	20 business days
VVB approval	10 business days
Implementation	90 calendar days
VVB verification	15 business days after
Escalation to Critical	If unresolved after 90 days

Label usage may be restricted. New assessments in affected category may be paused.

Critical NC

Examples: deliberate falsification, systematic calculation errors at scale, fundamental methodology deviation, deliberate circumvention of change management.

Step	Deadline
Suspension of affected ratings/labels (Certification Committee)	Same day
Affected companies notified	24 hours
Root cause analysis	5 business days
Corrective action plan to the VVB	10 business days
VVB approval	5 business days
Implementation	60 calendar days
VVB special verification engagement	15 business days after
Reinstatement / withdrawal decision (Certification Committee)	10 business days after engagement

Maximum suspension: **6 months**. If unresolved → withdrawal of the label licence by the Certification Committee.

Re-admission after withdrawal (Committee decision): 6-month wait, full re-validation, enhanced verification for 12 months.

10. Complaint & Appeal Process

Complaint Timeline

Step	Deadline
Acknowledgement	5 business days
Classification	10 business days
Investigation	20 business days after classification
Response to complainant	30 calendar days from receipt
Corrective actions	Per NC timelines
Closure notification	10 business days after resolution

Contact: compliance@esf-coalition.org

Categories: assessment accuracy, methodology, label usage, process, change management, VVB conduct.

Appeal Timeline

Step	Deadline
Written appeal submission	30 calendar days from contested decision
Acknowledgement	5 business days
Reviewer assigned	10 business days
Evidence review	20 business days
Hearing (if needed)	15 business days
Decision	45 calendar days from submission

Appeals of a validated provider's decisions → reviewed by the VVB or an independent LCA expert. Appeals of Certification Committee decisions (label licences) → independent arbitrator. Complaints about VVB conduct → the VVB and, where unresolved, its accreditation body. Reviewer must have no conflict of interest. Filing free for companies and consumers.

11. Label Rules

Assurance Levels and Claim Surfaces

Any claim surface may be backed by either assurance level; the level is chosen by the participating company (data intake / QA property), never required by the surface. On-pack and shelf claims carry the surface covenants (Section 8.6.1, Annex G) at every level and are verified by sampling. Enhanced Assurance is activated only by express order or logged acceptance.

Required Metrics

- Rating category (A–E): **always required**
- Absolute value (CO_2eq/DFU): **required on-pack (back)**; recommended elsewhere
- Benchmark comparison: optional (must derive from assessment data)
- Attribution: **must be discoverable without external help**

On-Pack Requirements

Front: rating display + discoverable validated-pathway attribution.

Back: detailed indicators (kg CO_2eq, water), % comparison to average, QR code to full report, methodology reference.

Validity & Updates

- Enhanced (questionnaire): **24 months** from approval, provided no re-assessment trigger. Must renew to continue.
- Enhanced (enterprise integration): continuous, recalculated on source data change. **24-month validity cap** regardless of data stability.
- Retail shelf labels: follow enterprise integration validity model. Update shelf labels within **30 days** of rating change.
- Standard: continuous, valid while recipe data current and subscription active.
- If rating changes: packaging updated within **6 months**.
- Recipe data update: within **30 days** of change.
- Label withdrawal: cease use within **30 days**.

Approved Claims by Rating

A: “Excellent environmental impact — [provider]” / “Among the most sustainable [type] available” / “Significantly better than category average” / “[X]% lower climate impact” (substantiated).

B: “Good environmental performance” / “Better than average environmental impact.”

C–E: “EmpCo-verified rating” / “Transparent environmental assessment” / “Committed to improving our environmental impact.”

Prohibited

- “Carbon neutral” / “climate neutral” (unless independently verified)
- “Zero environmental impact”
- “Most sustainable product” (without substantiation)
- “Better than [competitor]” (without consent + verified data)
- “Eco-friendly” / “green” (without quantified data)
- Offset-based superiority claims
- Rating modification or misrepresentation
- **Selective display of only high-rated items** (cherry-picking)

Visual Rules

- Positive signifiers (green, up arrows) SHALL NOT represent C/D/E ratings

- Negative signifiers (red, warnings) SHALL NOT represent A/B ratings
- SHALL NOT selectively omit or obscure rating information

12. Trader Binding

The framework distinguishes how the two assurance levels relate to the legal/operational binding of traders to the scheme. Both forms incorporate the EmpCo pass-through clauses defined in **Annex G** of the framework.

	Enhanced Assurance trader	Standard Assurance trader
Typical use	Traders ordering per-product intake — any claim surface	Any claim surface, incl. on-pack/shelf at catalogue scale (sampled)
Typical scale	Tens to low hundreds (brands, retailers)	Thousands (restaurants, canteens, caterers)
Binding mechanism	Per-trader licence agreement signed with the validated provider (or with the scheme owner; licence decisions by the Certification Committee)	Provider-mediated via the validated provider's standard customer terms incorporating Annex G
Public listing	Individual entry on portal: name, claim scope, label licence ID, validity dates	None by default — internal trader register + status confirmation on request; opt-in public entry possible
VVB sampling	Direct (Enhanced minimum: 100/yr or 200/yr enterprise)	Routed through provider; VVB samples claims, not individual traders
Enforcement	Certification Committee enforces under the licence, acting on VVB findings	Provider's contractual termination authority over the trader; VVB monitors patterns at annual verification

The architecture follows MSC Consumer-Facing Organisation and Fairtrade National Fairtrade Organisation licensee precedents. The VVB's engagement contract is with the validated provider (the label-licence holder); downstream binding to traders is mediated through the provider's contracts.

Annex G — Pass-Through Clauses (Summary)

Eight model clauses any provider's customer terms shall incorporate:

1. **G.2.1 Scope** — trader acknowledges EmpCo scheme rules govern the use of the provider's ratings
2. **G.2.2 Claim rules** — compliance with §8.3, §8.4, §8.2.4 (visual non-contradiction), validity periods, anti-cherry-picking
3. **G.2.3 Sampling and verification consent** — sample-based verification, site visits with reasonable notice, complaint-investigation cooperation
4. **G.2.4 Trader register and status disclosure** — internal register (full disclosure to VVB/Committee/ESFC/authorities on request); portal shows aggregate statistics; status confirmation for any named trader on request; public entry only for Enhanced Assurance or on opt-in
5. **G.2.5 Complaint cooperation** — provide information, implement corrective actions, notify of regulatory enquiries
6. **G.2.6 Termination authority** — **shall** suspend on VVB findings, Certification Committee decisions, or claims-without-active-assessment; **may** suspend or terminate on material breach or unresolved complaints
7. **G.2.7 Continuing compliance** — provider may update terms; trader may terminate during acceptance period without penalty
8. **G.2.8 Disclaimer** — no direct VVB-trader or Committee-trader contractual relationship

PA-10 (Pathway Annex) — Implementation Documentation

Each validated pathway documents in its annex the specific implementation:

- Customer terms version and effective date
- Pass-through clause mapping (provider's clause numbers ↔ Annex G clause numbers)
- Customer notification record (mechanism, date, acceptance window, per-customer log)
- Trader register source and cadence; aggregate-statistics URL; status-confirmation contact
- Suspension / termination authority and trigger conditions

- Annual submission to the VVB (annual verification engagement)

13. Data Retention & Records

Minimum 5 years for all of the following:

- All assessment records (input data, gap-filling-module decisions, calculation versions, ingredient matches)
- Regression test results (linked to pathway release tags)
- Change log with classification rationale and regression summaries
- Non-conformity records and corrective action documentation
- Complaint and appeal records
- Engagement reports and VVB correspondence
- Sample verification results

Reproducibility requirement: pathway version (engine + database) + input data → identical results at any point within retention period. Requires archived database snapshots and pinned dependency versions.

14. Re-Assessment Triggers

Enhanced (Questionnaire-Based)

Re-run when:

- Ingredient changes exceed **10% by weight**
- New suppliers for major ingredients ($>$ 20% of product)
- Significant process changes (new facility, equipment)
- Packaging material substitution
- Validity period expires (**24 months**)

Changes $<$ 10% ingredient weight $\rightarrow$ update without full re-assessment (subject to QA review).

Enhanced (Enterprise Data Integration)

- **Automatic:** recalculated when enterprise source data changes (new supplier, reformulation, sourcing change)
- **Quarterly reconciliation:** the validated provider reconciles extracted data against enterprise source
- **Validity cap:** recalculated at least once every **24 months** (database/methodology updates)

No manual re-assessment triggers — enterprise integration handles propagation.

Standard Assurance

Automatic recalculation on any recipe data change. Operators must update recipe data within **30 days** of change.

15. Checklist: What We Must Build

> This is the actionable pre-validation checklist. Everything above defines what the VVB will check. This section lists what must exist before the initial validation engagement.

Regression Test Suite

- [ ] Test suite size and per-case structure declared in PA-07.1 (e.g. Eaternity EOS pathway: 600 items across 3 input cases — 250 caterer + 200 label/retail + 150 full-specification)
- [ ] Caterer case: 250 recipes (names + quantities only, Standard Assurance)
- [ ] Label/Retail case: 200 products (back-of-package label info with realistic perturbations, Enhanced validated pipeline)
- [ ] Full Specification case: 150 products (complete 8-category data, Enhanced)
- [ ] CI pipeline runs suite on every pathway commit (engine and/or database)
- [ ] Results stored with calculation-engine and ingredient-database version tags
- [ ] Materiality metrics auto-calculated (aggregate + per input case)
- [ ] Submission fidelity: items submitted through production API
- [ ] Deterministic generation: seeded, versioned, documented

Change Management Infrastructure

- [ ] Change log (version, date, classification, regression summary, VVB reference)
- [ ] Semantic versioning on the calculation engine and ingredient database (independent)
- [ ] Classification workflow (commit → regression → classify → log → notify)
- [ ] Emergency change procedure documented

QA Documentation

- [ ] Accuracy: procedure + evidence showing ± 10% (Enhanced) / ± 20% (Standard)
- [ ] Reproducibility: identical-input test suite with bit-identical output proof
- [ ] Completeness: documentation of gap-filling method per parameter
- [ ] Traceability: audit trail format specification + sample evidence package
- [ ] Outlier detection: > 3 SD flagging logic + resolution log

Sample Package Capability

- [ ] Ability to export 100+ assessment packages with full audit trails on demand
- [ ] Stratified sampling support (by category, company, rating, risk factors)
- [ ] Enterprise integration: extraction accuracy spot-check capability (enterprise source vs. extracted data)
- [ ] Standard Assurance: API calculation logs retained and exportable

Data Retention

- [ ] 5-year archive for all assessment records
- [ ] Database snapshots archived per version
- [ ] Pinned dependency versions for reproducibility
- [ ] Search/retrieval capability for VVB engagement requests

Complaint Handling

- [ ] Intake channel (compliance@esf-coalition.org)
- [ ] Complaint register (date, category, findings, actions, resolution)
- [ ] Timeline tracking against SLAs (5-day ack, 30-day response)

Label Compliance

- [ ] Approved claim templates per rating tier
- [ ] Visual rule enforcement (no green on C–E, no red on A–B)
- [ ] Validity tracking (24-month expiry alerts for questionnaire-based Enhanced; 24-month cap alerts for enterprise)
- [ ] Anti-cherry-picking enforcement for food service operators and retail shelf labels

- [ ] Retail shelf label: portfolio coverage enforcement (all assessed products in category displayed)

Enterprise Data Integration (if applicable)

- [ ] Automated data extraction from enterprise ERP/procurement systems
- [ ] Field mapping specification (enterprise fields → the provider's data model)
- [ ] Integration validation evidence (20+ product side-by-side comparison)
- [ ] Update propagation test (change in enterprise → assessment recalculated within 30 days)
- [ ] Quarterly reconciliation process (extracted data vs. enterprise source)
- [ ] Error handling and fallback documentation
- [ ] Validated automated pipeline meeting ± 10% accuracy on 200+ product test set

Validation Readiness

- [ ] All scheme documents current and internally consistent
- [ ] Methodology documentation aligned with actual implementation
- [ ] Pilot sample package pre-assembled (100+ assessments)
- [ ] VVB access provisions (data, facilities, personnel)