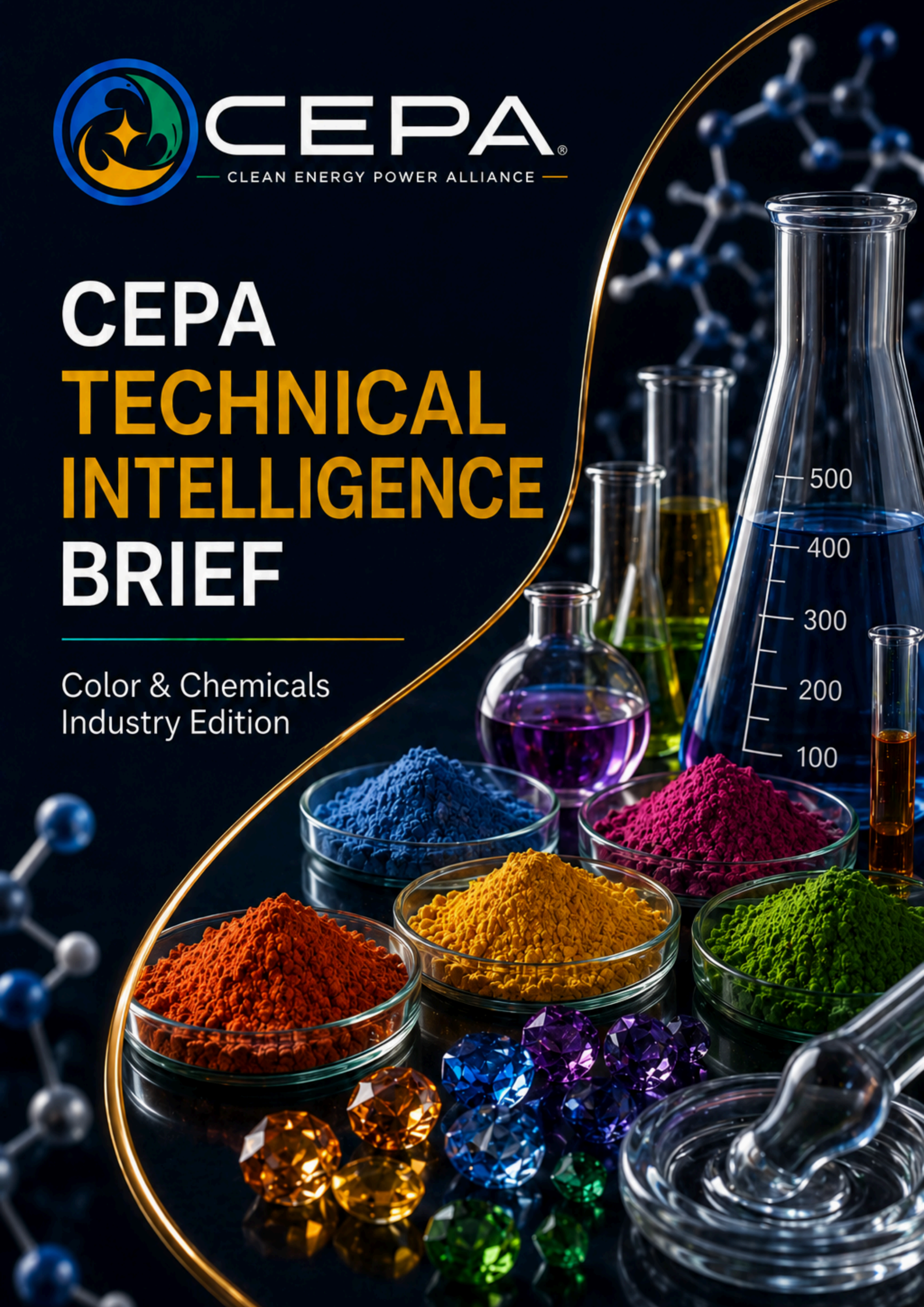




CEPA TECHNICAL INTELLIGENCE BRIEF

Color & Chemicals
Industry Edition





CEPA
— CLEAN ENERGY POWER ALLIANCE —



CEPA TECHNICAL INTELLIGENCE BRIEF

COLOR & CHEMICALS INDUSTRY EDITION

Process Loss, Wash Water and Recovery Evidence

A decision-grade framework for formulation residues, cleaning streams, sludge, packaging and verified material recovery.



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Issue 002
2 August 2026



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DATA • INSIGHT • IMPACT

Process Loss, Wash Water and Recovery Evidence



CEPA-TIB-COLCHEM-002-20260802

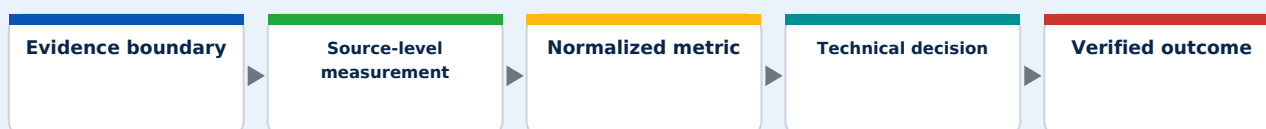
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FIELD	VALUE
ISSUE	Issue 002
DATE	2 August 2026
DOCUMENT CODE	CEPA-TIB-COLCHEM-002-20260802
PUBLISHED BY	CEPA
PREPARED BY	EterSolis Waste & Carbon Management
MAIN X HANDLE	@CEPAIntel
EDITION X HANDLE	@CEPAColorIntel
PUBLIC ACCESS	https://etersolis.com/insights/technical-intelligence-brief?issue=CEPA-TIB-COLCHEM-002-20260802

CONTROLLING EXECUTIVE FINDINGS

- 1 Cleaning is a production-yield problem before it becomes a wastewater problem.
- 2 The first recoverable heel or flush normally has greater value than later dilute rinses.
- 3 Wet sludge tonnage is not comparable without percent-solids normalization.
- 4 Off-specification generation, rework and disposal are separate performance outcomes.
- 5 Solvent and aqueous cleaning require different engineering, safety and accounting systems.
- 6 Recovery is credible only when route, receiving process and mass acceptance are documented.
- 7 Final-effluent compliance cannot identify where saleable material left the process.

DECISION-GRADE PUBLICATION SYSTEM



COL-001 | Sources: C01, C02, C04, C08

The manuscript is a technical intelligence product, not a facility permit, certification or substitute for jurisdiction-specific legal advice.

Scope, boundaries and evidence discipline

COL-002

KEY

The issue is decision-grade only when every quantitative statement states the process boundary, denominator, period, evidence class and uncertainty.

Documented + analytical

DOCUMENTED

Law, permit, standard, official method or audited record.

MEASURED

Calibrated meter, scale, laboratory result or production record.

CALCULATED

Transparent calculation from measured or documented inputs.

REPORTED

Company, association, stewardship or public disclosure.

ESTIMATED

Engineering estimate, market estimate or extrapolation.

UNCERTAIN

Incomplete, non-comparable or boundary-limited information.

SCOPE AND BOUNDARY

The manuscript covers formulation, cleaning, wastewater, air emissions, residues, packaging and recovery evidence. It does not create universal sector benchmarks or replace permits, waste classification, occupational-safety duties or product specifications. Market and stewardship data establish materiality and route examples; they do not estimate a specific facility's waste.

DECISION RULE

The practical consequence is that facility claims must reconcile measured inputs, conforming output, reuse, residuals, emissions and inventory change. A low reported disposal rate is not persuasive when unaccounted loss or stored material is large.

CONTROL ACTION

Declare physical and logical boundaries before collecting data.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when water or chemical reductions are proposed without validated hygiene, product-release or.

COL-002 | Sources: C16, C17, C22
Regulatory applicability is jurisdiction- and permit-specific.

Executive decision system

COL-003

KEY

The most effective control sequence is prevention, concentration preservation, internal reuse, verified recovery, treatment and only then disposal.

Documented + analytical

01

Measure value before dilution - Track concentrated product, heel, first rinse and by-product before mixing.

02

Separate prevention from recovery - A lower disposal rate is not proof of prevention or verified recovery.

03

Normalize every metric - Declare numerator, denominator, period, product family, owner and confidence.

04

Protect safety and quality - Efficiency cannot override chemical safety, food safety or product conformance.

05

Require route evidence - Collection, storage or transfer is not a completed recovery outcome.

EXECUTIVE QUESTION	EVIDENCE	DECISION
Where is value lost?	Batch and stream balance	Prioritize source control
What creates load?	Flow x concentration	Prevent or segregate
Is recovery credible?	Receiving specification and accepted mass	Approve or reject claim
Can data be compared?	Aligned boundary and denominator	Benchmark or caveat

COL-003 | Sources: C01, C08, C10
 Recommendations require site validation.

CEPA TECHNICAL INTELLIGENCE BRIEF | PROCESS SYSTEM

Formulation process architecture

COL-004

KEY

Paint and ink formulation are batch systems in which mixing, grinding or milling, tinting, thinning and packaging create identifiable material-retention and cleaning interfaces.

Documented + analytical

TECHNICAL BASIS

EPA describes paint production as batch formulation with typical batch sizes around 400-1,900 litres and large facilities up to about 23,000 litres. Ink formulation similarly combines mixing, grinding or milling, tinting, thinning and packaging. These descriptions support a process-based loss map, but they do not determine an individual plant's configuration.

DECISION INTERPRETATION

The operating model should map every transfer, vessel, mill, filter, hold tank, filling line and cleaning circuit, including retained volume and the destination of each flush.

Identify exposure

Locate source

Measure record

Normalize metric

Decide control

Verify evidence

SOURCE: Paint and ink formulation are batch.

RECORD: Source record linked to the process event

DECISION: The operating model should map every.

CONTROL ACTION

Create equipment-level flow diagrams and retained-volume estimates.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when the process record, denominator, boundary, owner or evidence class is missing or inconsistent.

COL-004 | Sources: C01, C03
 EPA batch descriptions are sector context, not a universal plant design.

Raw-material receipt and transfer

COL-005

KEY

Loss prevention begins with reconciling delivered, accepted, transferred and rejected material before formulation starts.

Documented + analytical

TECHNICAL BASIS

Powders can remain in bags, enter dust collectors or spill during charging. Liquids can remain in drums, IBCs, hoses and couplings. A purchase quantity is not the same as process input unless packaging residues, rejected deliveries and inventory movement are resolved.

DECISION INTERPRETATION

Receipt data should include supplier lot, gross and net weight, container tare, accepted quantity, transfer residue, spill quantity and final packaging destination. High-value additives require tighter measurement resolution than bulk fillers.

Receipt yield = accepted mass / delivered net mass × 100 Inventory change and container residues must be included.

Loss point	Record	Control metric
Bag emptying	Bag count and residual audit	kg residue/t input
IBC transfer	Meter and heel estimate	kg heel/delivery
Dust capture	Collector weight	kg dust/t powder

CONTROL ACTION

Verify scale calibration and transfer-meter accuracy.

REQUIRED RECORDS

Meter and heel estimate

AUDIT TRIGGER

Escalate when the process record, denominator, boundary, owner or evidence class is missing or inconsistent.

COL-005 | Sources: C01, C05
Facility-specific measurement is required.

CEPA TECHNICAL INTELLIGENCE BRIEF | MATERIAL AND EXPOSURE

Dry pigments, fillers and dust

COL-006

KEY

Powder handling can create simultaneous material loss, occupational exposure, housekeeping burden and particulate emissions.

Documented + analytical

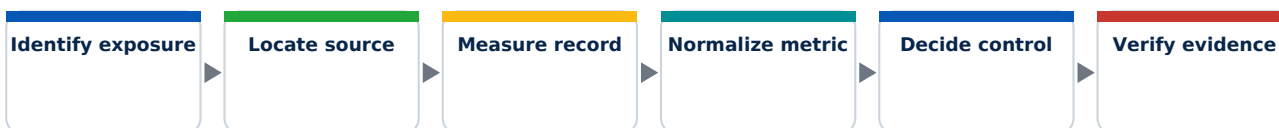
TECHNICAL BASIS

The analytical priority is to distinguish product-grade recovered powder from mixed dust and contaminated sweepings. Dust-collection mass can reveal charging losses, but it cannot be automatically returned to product without identity, contamination and quality controls.

DECISION INTERPRETATION

A powder-loss map should relate delivery, charging, dust extraction, housekeeping and residual packaging. Emission factors may support screening, while facility measurements and mass balances should control decisions.

Parameter	Purpose	Caution
Dust mass	Material reconciliation	May contain mixed products
Particle size	Exposure/control design	Sampling method dependent
Composition	Reuse/classification	Cross-contamination risk



CONTROL ACTION

Enclose charging and use local extraction.

REQUIRED RECORDS

Dust mass

AUDIT TRIGGER

Escalate when the process record, denominator, boundary, owner or evidence class is missing or inconsistent.

COL-006 | Sources: C05, C06, C18
 AP-42 factors are representative estimates, not measurements.

CEPA TECHNICAL INTELLIGENCE BRIEF | MATERIAL CONTROL

Liquid storage, transfer and inventory

COL-007

KEY

A solvent or resin balance is credible only when storage losses, transfer residues and inventory uncertainty are explicitly resolved.

Documented + analytical

TECHNICAL BASIS

Tank level, purchase and batch-issue records frequently use different units and temperature bases. Density, temperature, meter calibration and line holdup can create apparent losses. Volatile materials also require separation of physical transfer loss from potential air emissions.

DECISION INTERPRETATION

The preferred balance converts all quantities to a consistent mass basis and records opening stock, receipts, issues, returns, waste, recovered material and closing stock.

Material reconciliation error = $\frac{|\text{inputs} - \text{outputs} - \text{inventory change}|}{\text{inputs}} \times 100$ Outputs include product, reuse, waste, emissions estimates and verified transfers.

Identify exposure

Locate source

Measure record

Normalize metric

Decide control

Verify evidence

SOURCE: A solvent or resin balance is credible.

RECORD: Source record linked to the process event

DECISION: The preferred balance converts all.

CONTROL ACTION

Use temperature-compensated density where material variation matters.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when the process record, denominator, boundary, owner or evidence class is missing or inconsistent.

COL-007 | Sources: C05, C06, C18
Mass-balance uncertainty must be reported.

CEPA TECHNICAL INTELLIGENCE BRIEF | PROCESS LOSS

Premixing, dispersion and milling

COL-008

KEY

Mill heels and retained dispersion are high-value losses because pigments, resins, additives and processing energy are already embedded.

Documented + analytical

TECHNICAL BASIS

Loss mechanisms include wall coating, dead legs, mill media retention, transfer residues, filter capture and incompatible flushes. The process may also create dust or volatile emissions depending on raw materials and enclosure.

DECISION INTERPRETATION

Equipment selection and campaign planning should be evaluated using recoverable heel, cleaning requirement, transfer efficiency, quality risk and cycle time—not nominal throughput alone.

Metric	Definition	Decision use
Heel intensity	kg retained/t product	Equipment/campaign design
Flush ratio	kg flush/kg heel	Cleaning optimization
Recovery yield	kg reused/kg collected	Route validation

Identify exposure

Locate source

Measure record

Normalize metric

Decide control

Verify evidence

CONTROL ACTION

Measure retained mass after drain and after recovery.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when the process record, denominator, boundary, owner or evidence class is missing or inconsistent.

COL-008 | Sources: C01, C06
 Product-quality validation governs internal reuse.

Let-down, tinting and adjustment

COL-009

KEY

Corrective additions should be treated as process signals, not hidden as normal formulation consumption.

Documented + analytical

TECHNICAL BASIS

Viscosity, colour, solids and performance corrections can increase batch volume, extend cycle time and create later incompatibility or overproduction. A batch that is ultimately saleable can still have experienced avoidable process instability.

DECISION INTERPRETATION

Facilities should record every correction by reason, quantity, time, approver and final disposition. Statistical review can distinguish raw-material variability, dosing error, method error and equipment effects.

Correction intensity = total corrective additions / conforming product Report separately by product family and correction type.

Identify exposure

Locate source

Measure record

Normalize metric

Decide control

Verify evidence

SOURCE: Corrective additions should be treated.

RECORD: Source record linked to the process event

DECISION: Facilities should record every.

CONTROL ACTION

Create standardized correction reason codes.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when the process record, denominator, boundary, owner or evidence class is missing or inconsistent.

COL-009 | Sources: C01, C03
Correction is not automatically waste, but it is a process-stability indicator.

CEPA TECHNICAL INTELLIGENCE BRIEF | PRODUCT AND PACKAGING

Filtration, filling and packaging

COL-010

KEY

Filling losses combine retained product, filter solids, overfill, damaged containers and quality rejects; each requires a different corrective action.

Documented + analytical

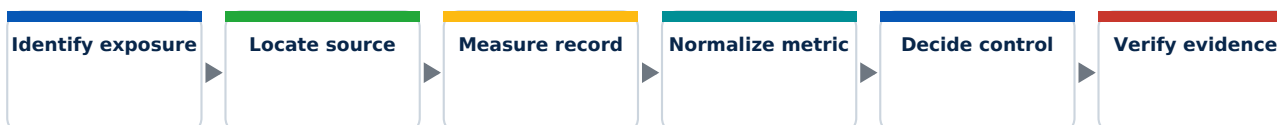
TECHNICAL BASIS

Filter residue may contain concentrated pigments and binders, while line heel may remain saleable if identity is preserved. Overfill creates invisible giveaway rather than waste, and packaging defects can convert conforming product into a disposal problem.

DECISION INTERPRETATION

A combined filling balance should reconcile bulk feed, filled units, nominal and actual fill mass, rejects, line heel and filter residue.

Loss	Preferred denominator	Primary owner
Giveaway	kg above nominal/t	Operations/quality
Line heel	kg/changeover	Engineering
Package rejects	units/10,000 filled	Packaging



CONTROL ACTION

Use checkweigher data to quantify giveaway and underfill risk.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when the process record, denominator, boundary, owner or evidence class is missing or inconsistent.

COL-010 | Sources: C01, C03
 Legal metrology and product requirements remain controlling.

CEPA TECHNICAL INTELLIGENCE BRIEF | QUALITY SYSTEMS

Laboratory, retains and quality-control waste

COL-011

KEY

Laboratory waste is small in mass but can be chemically diverse, poorly segregated and disproportionately hazardous.

Documented + analytical

TECHNICAL BASIS

Samples, retains, solvents, drawdowns, test panels and mixed residues often leave the production mass balance through administrative rather than process records. Their composition may be more variable than production waste.

DECISION INTERPRETATION

The laboratory should maintain material-family segregation, sample minimization, retain expiry rules and traceable transfer to approved internal or external routes.

Identify exposure

Locate source

Measure record

Normalize metric

Decide control

Verify evidence

SOURCE: Laboratory waste is small in mass but.

RECORD: Source record linked to the process event

DECISION: The laboratory should maintain.

CONTROL ACTION

Standardize minimum sample and retain quantities.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when the process record, denominator, boundary, owner or evidence class is missing or inconsistent.

COL-011 | Sources: C03, C07, C16
 Waste classification depends on composition and jurisdiction.

Off-specification product and rework

COL-012

KEY

Off-specification generation, successful rework and final disposal are three separate indicators and must never be collapsed into one rate.

Documented + analytical

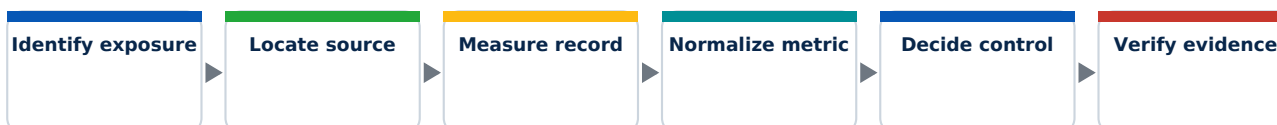
TECHNICAL BASIS

A high rework success rate can prevent disposal while still revealing poor first-pass capability. Conversely, a low disposal rate can mask repeated corrections, long cycle time and excess inventory.

DECISION INTERPRETATION

The governing dataset should record failure mode, quantity, correction route, additional inputs, additional energy, release result and residual disposal.

Indicator	Formula	Interpretation
First-pass yield	conforming without rework / total	Process capability
Rework success	returned to conforming / off-spec	Disposition effectiveness
Final loss	disposed / total output	Residual impact



CONTROL ACTION

Measure first-pass yield by product family.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when the process record, denominator, boundary, owner or evidence class is missing or inconsistent.

COL-012 | Sources: C01, C08
Internal quality criteria determine conforming status.

Cleaning system selection

COL-013

KEY

Solvent wash, caustic wash and water wash are distinct process systems with different hazards, wastewater consequences and recovery options.

Documented + analytical

TECHNICAL BASIS

EPA identifies the three methods in paint formulation. Solvent wash is associated with solvent-based operations; water washing is common in water-based operations; caustic washing can be used in both. The correct selection depends on chemistry, product compatibility, fouling and required cleanliness.

DECISION INTERPRETATION

The cleaning design should preserve concentrated material first, then apply the least resource-intensive validated cleaning sequence.

Recover product

Pre-rinse

Validated wash

Intermediate rinse

Sanitize / release

SOURCE: Solvent wash, caustic wash and water.

RECORD: Source record linked to the process event

DECISION: The cleaning design should preserve.

CONTROL ACTION

Document cleaning validation criteria for each equipment/product family.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when water or chemical reductions are proposed without validated hygiene, product-release or.

COL-013 | Sources: C01, C02, C03
 Historical EPA descriptions do not replace current site safety or permit requirements.

Solvent-wash systems

COL-014

KEY

Spent solvent should be managed as a recoverable material stream where technically and legally feasible, not diluted into wastewater.

Documented + analytical

TECHNICAL BASIS

EPA's covered oil-based solvent-wash rule requires zero discharge for specified facilities and notes reclamation by distillation, reuse or incineration. Solvent systems also create flammability, worker-exposure and air-emission considerations.

DECISION INTERPRETATION

A solvent-loop balance should distinguish virgin solvent, internal reuse, recovered solvent, distillation bottoms, product incorporation, inventory change and estimated loss.

Potential solvent loss = input - product - recovered - waste - inventory change This is a screening balance; direct emission measurement may still be required.

Purchase

Product

Cleaning

Recovery

Waste / emissions

Variance

SOURCE: Spent solvent should be managed as a.

RECORD: Source record linked to the process event

DECISION: A solvent-loop balance should.

CONTROL ACTION

Use closed containers and compatible transfer systems.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when the solvent balance does not reconcile, recovery quality fails specification, or flammability controls.

COL-014 | Sources: C01, C03, C07
 The zero-discharge requirement applies only within its regulatory coverage.

Aqueous-wash systems

COL-015

KEY

The first aqueous rinse can contain far more recoverable product and pollutant load than later rinses, even when the final combined concentration appears moderate.

Documented + analytical

TECHNICAL BASIS

Water washing converts retained paint into a larger-volume stream containing suspended solids, dissolved organics, surfactants, colour and potentially metals or other constituents. Composite final-effluent data can hide episodic concentrated losses.

DECISION INTERPRETATION

Source sampling should capture individual rinse stages and calculate mass load as volume multiplied by concentration.

Batch pollutant load = $\sum(\text{volume}_j \times \text{concentration}_j)$ Use consistent units and representative sampling.

Identify exposure

Locate source

Measure record

Normalize metric

Decide control

Verify evidence

SOURCE: The first aqueous rinse can contain far.

RECORD: Source record linked to the process event

DECISION: Source sampling should capture.

CONTROL ACTION

Segregate first rinse where safe and technically feasible.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when the process record, denominator, boundary, owner or evidence class is missing or inconsistent.

COL-015 | Sources: C01, C02, C16
Relative concentration patterns require facility sampling.

Caustic-wash systems

COL-016

KEY

Caustic cleaning can solubilize or detach resin and pigment residues but transfers alkalinity, dissolved organics and solids into a treatment problem.

Documented + analytical

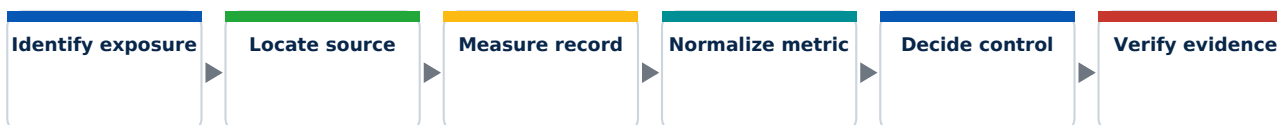
TECHNICAL BASIS

The cleaning solution may be reusable for multiple cycles until loading or cleaning performance reaches a limit. Dump frequency, active concentration, contamination and neutralization demand should therefore be measured as a managed bath rather than a one-use chemical.

DECISION INTERPRETATION

Optimization requires validated cleaning performance plus a bath-life model and controlled final disposition.

Control	Measurement	Failure indicator
Bath strength	Active alkalinity	Under-cleaning or excess use
Contamination	COD/solids/colour	Loss of cleaning capacity
Dump decision	Cycles and specification	Premature disposal



CONTROL ACTION

Track active alkalinity and contamination loading.

REQUIRED RECORDS

Cycles and specification

AUDIT TRIGGER

Escalate when the process record, denominator, boundary, owner or evidence class is missing or inconsistent.

COL-016 | Sources: C02, C16
 Chemical compatibility and worker safety must be separately assessed.

First-rinse concentration cascade

COL-017

KEY

Concentration preservation creates the best opportunity for product recovery and the lowest-cost pollutant prevention.

Documented + analytical

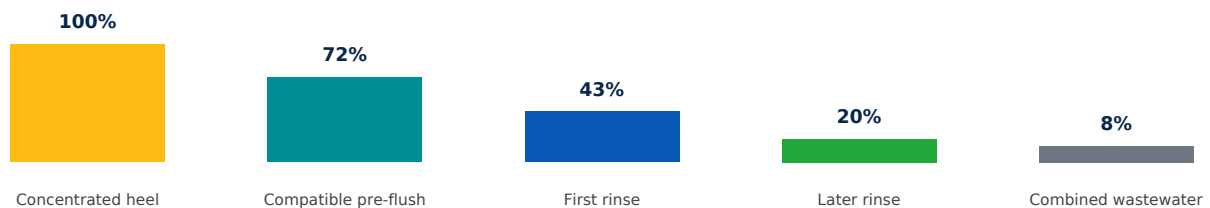
TECHNICAL BASIS

A typical cleaning sequence produces a steep concentration decline from drainable heel through first flush and later rinses. The exact curve is facility-specific, but the engineering implication is stable: do not mix the most concentrated stream with large volumes before evaluating reuse or recovery.

DECISION INTERPRETATION

Interface detection can use mass, conductivity, density, turbidity, colour, total solids or product-specific spectroscopy.

Illustrative concentration preservation profile — site measurement required



SOURCE: Concentration preservation creates the.

RECORD: Source record linked to the process event

DECISION: Interface detection can use mass,.

CONTROL ACTION

Establish cut points from validated product and wastewater data.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when the process record, denominator, boundary, owner or evidence class is missing or inconsistent.

COL-017 | Sources: C01, C02
 The plotted curve is conceptual, not a facility benchmark.

Wastewater source map

COL-018

KEY

Final discharge sampling demonstrates treatment outcome but cannot substitute for source-level information needed to prevent product loss.

Documented + analytical

TECHNICAL BASIS

The source inventory should distinguish equipment cleaning, floor wash, laboratory discharge, cooling water, stormwater, sanitary sewage and treatment residuals. Each source has different contamination, variability and control potential.

DECISION INTERPRETATION

A source-to-treatment map links batch events to equalization, physicochemical treatment, biological treatment and sludge production.

Source stream

Identity preserved

 Measure flow +
load

Select route

Verify outcome

SOURCE: Final discharge sampling demonstrates.

RECORD: Source record linked to the process event

DECISION: A source-to-treatment map links batch.

CONTROL ACTION

Meter or estimate each major source separately.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when load peaks are unexplained, source streams are mixed, or final discharge data cannot be traced to a.

COL-018 | Sources: C16, C17
Sampling frequency must reflect batch variability.

CEPA TECHNICAL INTELLIGENCE BRIEF | WASTEWATER ANALYSIS

Wastewater load and sampling design

COL-019

KEY

Concentration without flow cannot quantify pollutant load, and a compliant average can conceal damaging batch peaks.

Documented + analytical

TECHNICAL BASIS

Minimum analysis commonly includes flow, pH, temperature, conductivity, COD, TSS, colour, oil and grease, total solids and relevant metals or organics. Parameter selection must follow materials used, permits and treatment design.

DECISION INTERPRETATION

Use event samples for concentrated cleaning discharges, composites for representative average conditions and duplicate or quality-control samples where decisions depend on the result.

Pollutant load (kg) = flow (m3) × concentration (mg/L) / 1000 For concentration in mg/L and flow in m3.

Identify exposure

Locate source

Measure record

Normalize metric

Decide control

Verify evidence

SOURCE: Concentration without flow cannot.

RECORD: Source record linked to the process event

DECISION: Use event samples for concentrated.

CONTROL ACTION

Calculate daily and batch loads.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when load peaks are unexplained, source streams are mixed, or final discharge data cannot be traced to a.

COL-019 | Sources: C16, C17
The analytical suite must be facility- and permit-specific.

CEPA TECHNICAL INTELLIGENCE BRIEF | TREATMENT

Physicochemical treatment and solids capture

COL-020

KEY

Treatment efficiency is not a substitute for preventing product entry to wastewater; it changes the residual from liquid load to sludge.

Documented + analytical

TECHNICAL BASIS

Coagulation, flocculation, pH adjustment, sedimentation and flotation can remove suspended or colloidal material. The selected chemicals affect sludge mass, dewaterability, composition and disposal route.

DECISION INTERPRETATION

Performance should be reported as influent load, effluent load, removal efficiency, treatment-chemical use and dry solids generated.

Output	Required basis	Decision
Removal	kg influent - kg effluent	Treatment performance
Sludge	kg dry solids	Residual burden
Chemical use	kg active/kg removed	Optimization

Identify exposure

Locate source

Measure record

Normalize metric

Decide control

Verify evidence

CONTROL ACTION

Run jar tests against representative batch variability.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when wet mass changes without dry-solids evidence, chemistry changes, or a receiving route rejects the.

COL-020 | Sources: C16, C17, C19
 Treatability depends on formulation chemistry.

Sludge: wet mass versus dry solids

COL-021

KEY

Wet sludge tonnage is not a comparable performance measure unless total solids and conditioning additions are reported.

Documented + analytical

TECHNICAL BASIS

Dewatering changes water content without necessarily changing the mass of captured pigment, polymer, filler or treatment solids. A facility can appear to reduce sludge simply by increasing cake solids. Conversely, added coagulant can increase dry solids despite better effluent quality.

DECISION INTERPRETATION

Report wet mass, percent total solids, dry solids, volatile solids where useful, conditioning chemicals, composition and destination.

Dry sludge mass = wet sludge mass × total-solids fraction Use decimal fraction; document sampling and method.

Identify exposure

Locate source

Measure record

Normalize metric

Decide control

Verify evidence

SOURCE: Wet sludge tonnage is not a comparable.

RECORD: Source record linked to the process event

DECISION: Report wet mass, percent total solids, ..

CONTROL ACTION

Verify percent solids with representative laboratory testing.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when wet mass changes without dry-solids evidence, chemistry changes, or a receiving route rejects the.

COL-021 | Sources: C10, C11, C19
 Pathway limits and classifications are jurisdiction-specific.

Air emissions and solvent balance

COL-022

KEY

Emission factors support screening and inventory development, but measured or facility-specific material-balance data should control high-consequence decisions.

Documented + analytical

TECHNICAL BASIS

EPA defines emission factors as representative relationships based on source tests, material balances and engineering estimates. Paint, varnish, waste-solvent reclamation and tank cleaning are recognized AP-42 source categories.

DECISION INTERPRETATION

Potential emission points include storage, transfer, mixing, thinning, filling, cleaning, waste handling and solvent recovery.

VOC potential = solvent input - solvent in product - recovered solvent - solvent in waste - inventory change A potential-release balance is not equivalent to a stack test.

Purchase

Product

Cleaning

Recovery

Waste / emissions

Variance

SOURCE: Emission factors support screening and.

RECORD: Source record linked to the process event

DECISION: Potential emission points include.

CONTROL ACTION

Develop a source inventory before selecting factors.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when the solvent balance does not reconcile, recovery quality fails specification, or flammability controls.

COL-022 | Sources: C05, C06, C07, C18
 Emission factors may be dated or low quality; document factor rating and applicability.

Process safety and incompatibility

COL-023

KEY

Resource-recovery decisions are unacceptable when they create uncontrolled flammability, reactivity, toxic exposure or incompatible mixing.

Documented + analytical

TECHNICAL BASIS

Concentrated solvent and reactive cleaning streams can present greater immediate risk than dilute wastewater. Segregation systems require compatibility review, grounding/bonding, ventilation, ignition control, container integrity and emergency response.

DECISION INTERPRETATION

The route decision must combine material value with hazard properties, legal classification and receiving-facility capability.

Identify exposure

Locate source

Measure record

Normalize metric

Decide control

Verify evidence

SOURCE: Resource-recovery decisions are.

RECORD: Source record linked to the process event

DECISION: The route decision must combine.

CONTROL ACTION

Maintain compatibility matrices for combined streams.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when the process record, denominator, boundary, owner or evidence class is missing or inconsistent.

COL-023 | Sources: C04, C07, C16
 This manuscript does not replace process-hazard analysis or occupational-safety standards.

CEPA TECHNICAL INTELLIGENCE BRIEF | PACKAGING

Packaging residues and container recovery

COL-024

KEY

Container recyclability depends on residual content, material type, contamination and the receiving recycler's specification.

Documented + analytical

TECHNICAL BASIS

Metal drums, pails, plastic containers and IBCs may be reusable, reconditionable or recyclable. Residual paint can change transport, handling and waste classification. Container count alone does not quantify residual product loss.

DECISION INTERPRETATION

The preferred system drains or recovers product, measures residual content, segregates packaging type and verifies reconditioning or recycling.

Route	Evidence	Key constraint
Reuse	Inspection and traceability	Product compatibility
Reconditioning	Authorized processor receipt	Residue/hazard
Recycling	Accepted material specification	Contamination



CONTROL ACTION

Record container tare and estimated residual mass.

REQUIRED RECORDS

Accepted material specification

AUDIT TRIGGER

Escalate when a route lacks receiving specification, mass acceptance, legal authorization or proof of actual.

COL-024 | Sources: C12, C13, C14
 Stewardship examples concern architectural paint and are not universal industrial routes.

CEPA TECHNICAL INTELLIGENCE BRIEF | PREVENTION

Batch sequencing and campaign design

COL-025

KEY

Production sequencing can reduce cleaning frequency and incompatible transition loss without new treatment equipment.

Documented + analytical

TECHNICAL BASIS

Sequence decisions should consider colour, resin system, solvent or water base, performance additives, customer urgency, shelf life and contamination risk. A simple light-to-dark rule is insufficient when chemistry changes.

DECISION INTERPRETATION

The optimization objective should minimize transition cost while maintaining service, product quality and safety.

Transition cost = heel loss + flush + water/solvent + labour + downtime + treatment + risk
Use true cost, not disposal fee only.

Identify exposure

Locate source

Measure record

Normalize metric

Decide control

Verify evidence

SOURCE: Production sequencing can reduce.

RECORD: Source record linked to the process event

DECISION: The optimization objective should.

CONTROL ACTION

Build a transition matrix from historical cleaning and rework data.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when the process record, denominator, boundary, owner or evidence class is missing or inconsistent.

COL-025 | Sources: C01, C03, C08
 Production commitments and product stability constrain sequencing.

Solvent recovery and distillation

COL-026

KEY

Solvent recovery is a quality-separation process; recovery percentage alone is insufficient without purity, yield, bottoms and reuse specification.

Documented + analytical

TECHNICAL BASIS

Distillation performance depends on solvent mixture, water, dissolved resin, pigments, boiling range, heat sensitivity and contamination. Recovered solvent may be suitable for cleaning but not formulation.

DECISION INTERPRETATION

A recovery trial should quantify feed, distillate, bottoms, losses, energy, purity and successful reuse.

Metric	Formula	Minimum evidence
Mass yield	distillate/feed	Scale records
Usable yield	spec product/feed	Laboratory approval
Residue rate	bottoms/feed	Disposition record



CONTROL ACTION

Define separate specifications for formulation and cleaning reuse.

REQUIRED RECORDS

Mass yield; Scale records

AUDIT TRIGGER

Escalate when the solvent balance does not reconcile, recovery quality fails specification, or flammability controls.

COL-026 | Sources: C01, C07
 Economic viability is site- and mixture-specific.

CEPA TECHNICAL INTELLIGENCE BRIEF | RECOVERY TECHNOLOGY

Pigment, resin and solids recovery

COL-027

KEY

A concentrated solid is not automatically a usable feedstock; composition consistency and receiving-process function determine recovery.

Documented + analytical

TECHNICAL BASIS

Filter cake, sweepings, dust and wastewater solids can contain valuable pigment, filler or polymer but may also contain mixed chemistries, metals, coagulants and high moisture. Recovery routes can include controlled internal reuse, secondary products or mineral applications when specifications and law permit.

DECISION INTERPRETATION

Characterization must precede route selection and should include solids, moisture, organic fraction, metals, particle size and variability.

Identify exposure

Locate source

Measure record

Normalize metric

Decide control

Verify evidence

SOURCE: A concentrated solid is not.

RECORD: Source record linked to the process event

DECISION: Characterization must precede route.

CONTROL ACTION

Preserve source identity before treatment.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when wet mass changes without dry-solids evidence, chemistry changes, or a receiving route rejects the.

COL-027 | Sources: C10, C13, C14, C19
 Product and environmental safety must be validated for each destination.

External route qualification

COL-028

KEY

A transfer note proves movement; it does not prove beneficial use, displacement or final recovery.

Documented + analytical

TECHNICAL BASIS

Route qualification should identify the receiving facility, authorization, process, input specification, accepted quantity, rejection quantity, conversion yield and final residual. Brokered or stored material remains unresolved until destination is confirmed.

DECISION INTERPRETATION

The evidence chain should reconcile dispatched mass with accepted and processed mass.

Identify exposure

Locate source

Measure record

Normalize metric

Decide control

Verify evidence

SOURCE: A transfer note proves movement; it does.

RECORD: Source record linked to the process event

DECISION: The evidence chain should reconcile.

CONTROL ACTION

Audit high-volume or high-risk outlets.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when a route lacks receiving specification, mass acceptance, legal authorization or proof of actual.

COL-028 | Sources: C10, C11, C12
 Confidentiality may limit detail, but core mass and process evidence remains necessary.

Stewardship systems: PaintCare and Paintback

COL-029

KEY

Product-stewardship collection data demonstrate system scale and route development, but they do not measure factory process efficiency.

Documented + analytical

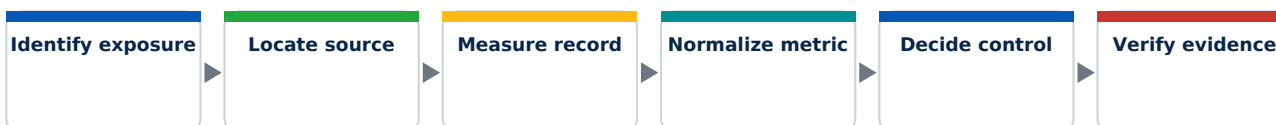
TECHNICAL BASIS

PaintCare reported 648,554 gallons collected in Oregon in 2023. Paintback reports more than 75 million kilograms collected and treated since 2016 and has developed centralized separation and repurposing capacity. These are program-reported figures.

DECISION INTERPRETATION

The defensible lesson is institutional: collection accessibility, financing, aggregation, material separation and downstream market development are all required for end-of-life performance.

Program signal	What it demonstrates	What it does not prove
Collection volume	Participation and aggregation	Manufacturing yield
Route development	Market-building activity	Universal recovery rate
Network access	Convenience	Environmental superiority



CONTROL ACTION

Separate manufacturing loss metrics from post-consumer collection.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when the process record, denominator, boundary, owner or evidence class is missing or inconsistent.

COL-029 | Sources: C12, C13, C15, C21
Programs differ in accepted products, geography and accounting.

Carbon and lifecycle boundaries

COL-030

KEY

Preventing the loss of already processed material generally avoids more embedded value than treating the same mass after dilution, but avoided-carbon claims require a transparent counterfactual.

Documented + analytical

TECHNICAL BASIS

Product carbon analysis should include relevant raw materials, energy, transport, manufacturing, packaging and end-of-life stages. Reuse or recovery can create credits only under a declared method and should not be casually subtracted from inventory emissions.

DECISION INTERPRETATION

The decision hierarchy should first reduce virgin input and process loss, then reduce cleaning and treatment demand, then evaluate recovery and energy routes.

Product carbon intensity = lifecycle GHG / declared functional unit Functional unit must represent product function where mass is misleading.

Identify exposure

Locate source

Measure record

Normalize metric

Decide control

Verify evidence

SOURCE: Preventing the loss of already processed.

RECORD: Source record linked to the process event

DECISION: The decision hierarchy should first.

CONTROL ACTION

Define functional unit and lifecycle boundary.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when the process record, denominator, boundary, owner or evidence class is missing or inconsistent.

COL-030 | Sources: C08, C09
 GHG Protocol guidance is being updated; disclose method version.

Supplier and formulation data

COL-031

KEY

Supplier declarations are essential for composition and carbon analysis but do not eliminate the need for incoming-quality and process verification.

Documented + analytical

TECHNICAL BASIS

Required data may include density, solids, VOC content, hazardous constituents, recycled content, product carbon data, lot variability and packaging. Confidential formulations may require controlled data-sharing or third-party verification.

DECISION INTERPRETATION

Procurement should distinguish required specification, reported supplier data, independently verified data and assumptions.

Identify exposure

Locate source

Measure record

Normalize metric

Decide control

Verify evidence

SOURCE: Supplier declarations are essential for.

RECORD: Source record linked to the process event

DECISION: Procurement should distinguish.

CONTROL ACTION

Create a minimum supplier-data specification.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when the process record, denominator, boundary, owner or evidence class is missing or inconsistent.

COL-031 | Sources: C04, C08, C09
 Confidentiality and regional classification can constrain data access.

CEPA TECHNICAL INTELLIGENCE BRIEF | MEASUREMENT SYSTEM

KPI system and executive dashboard

COL-032

KEY

A useful dashboard links production yield, cleaning, pollutant load, dry solids, air emissions and verified destination instead of optimizing one metric in isolation.

Documented + analytical

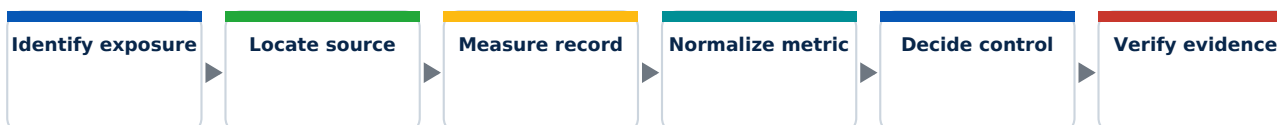
TECHNICAL BASIS

Recommended indicators include first-pass yield, formulation-loss intensity, wash-water intensity, cleaning-solvent intensity, product-to-drain, COD load, sludge dry solids, rework success, verified recovery and unaccounted mass.

DECISION INTERPRETATION

Each indicator requires owner, calculation, exclusions, period, confidence and escalation threshold.

Indicator	Preferred unit	Control question
Formulation loss	kg/t product	Where did inputs leave value?
COD load	kg/t product	What load entered treatment?
Verified recovery	% accepted and used	Was the route completed?
Unaccounted mass	% input	Is the balance credible?



CONTROL ACTION

Report absolute and normalized quantities together.

REQUIRED RECORDS

Unaccounted mass

AUDIT TRIGGER

Escalate when the process record, denominator, boundary, owner or evidence class is missing or inconsistent.

COL-032 | Sources: C08, C16, C18
 Targets require a validated facility baseline.

Statistical control and benchmark eligibility

COL-033

KEY

Control limits describe process behavior; they are not regulatory limits, specifications or external benchmarks.

Documented + analytical

TECHNICAL BASIS

Batch data should be segmented by product family, equipment and transition type. Means can conceal skewed loss distributions, while medians can conceal high-load events relevant to treatment capacity. Use production-weighted averages, percentile distributions and control charts where assumptions are met.

DECISION INTERPRETATION

External comparison requires aligned product, process, boundary, denominator, period and data quality.

Coefficient of variation = standard deviation / mean × 100 Use only when the mean is meaningful and non-zero.

Identify exposure

Locate source

Measure record

Normalize metric

Decide control

Verify evidence

SOURCE: Control limits describe process.

RECORD: Source record linked to the process event

DECISION: External comparison requires aligned.

CONTROL ACTION

Report median, mean, dispersion and high-percentile events.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when denominator, boundary, product family, period or confidence differs between compared datasets.

COL-033 | Sources: C05, C08, C16
 Statistical methods require adequate sample size and stable measurement.

Integrated route decision matrix

COL-034

KEY

The preferred route is the highest technically, legally and economically credible use—not the route with the most attractive label.

Documented + analytical

TECHNICAL BASIS

Decision factors include identity, contamination, moisture, solids, hazardous classification, flash point, metals, halogens, calorific value, storage stability, transport, receiving specification and outlet evidence.

DECISION INTERPRETATION

The matrix should score prevention, internal reuse, material recovery, external use, treatment and disposal with hard disqualifiers for safety and legality.

Gate	Pass evidence	Fail consequence
Legal	Authorization/classification	Route prohibited
Technical	Specification and trial	Reject or downgrade
Economic	True cost and scale	Alternative route
Evidence	Mass acceptance/use	No recovery claim

Prevention
 Direct reuse / food
 Material or ingredient recovery
 Biological conversion
 Treatment
 Disposal

CONTROL ACTION

Use non-negotiable safety and legal gates.

REQUIRED RECORDS

Specification and trial; True cost and scale

AUDIT TRIGGER

Escalate when a route lacks receiving specification, mass acceptance, legal authorization or proof of actual.

COL-034 | Sources: C10, C11, C16
 Route scoring must be reviewed for each jurisdiction.

Maturity model

COL-035

KEY

Circularity maturity progresses from unknown flows to controlled prevention and verified displacement; collection alone is not the highest stage.

Documented + analytical

TECHNICAL BASIS

Level 1 facilities record disposal. Level 2 measures major streams. Level 3 reconciles source-level losses. Level 4 controls prevention and internal reuse. Level 5 verifies external recovery, lifecycle effects and continuous improvement.

DECISION INTERPRETATION

Advancement requires data quality, ownership, technical validation and independent challenge.

Level	Defining capability	Evidence
1 Reactive	Disposal records	Invoices
2 Measured	Stream quantities	Meters/scales
3 Reconciled	Mass/load balance	Batch linkage
4 Controlled	Prevention/reuse	Validated controls
5 Verified	Outlet and lifecycle	Downstream proof

Verified value / lifecycle
 Controlled prevention / reuse
 Reconciled source-level flows
 Measured streams
 Disposal accounting

CONTROL ACTION

Assess each process area separately.

REQUIRED RECORDS

Disposal records; Meters/scales

AUDIT TRIGGER

Escalate when the process record, denominator, boundary, owner or evidence class is missing or inconsistent.

COL-035 | Sources: C08, C10, C22
 Maturity is a management model, not certification.

CEPA TECHNICAL INTELLIGENCE BRIEF | IMPLEMENTATION

90-day implementation protocol

COL-036

KEY

A credible first 90 days should establish measurement and source control before major capital investment.

Documented + analytical

TECHNICAL BASIS

The first month defines boundaries, maps flows and verifies meters. The second quantifies concentrated losses, cleaning events and outlet evidence. The third implements sequencing, segregation, recovery trials and a controlled dashboard.

DECISION INTERPRETATION

Capital projects should follow validated data rather than precede it.

DAYS 1-30

Baseline

Boundaries, flow map, meters, source codes

DAYS 31-60

Isolate

High-value losses, first-rinse, route evidence

DAYS 61-90

Control

Sequencing, trials, dashboard, owner review

SOURCE: A credible first 90 days should.

RECORD: Source record linked to the process event

DECISION: Capital projects should follow.

CONTROL ACTION

Name process owners and review cadence.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when the process record, denominator, boundary, owner or evidence class is missing or inconsistent.

COL-036 | Sources: C01, C08, C16
 Ninety days establishes control; it does not complete all engineering changes.

Executive action agenda

COL-037

KEY

The immediate value opportunity is to prevent concentrated material from becoming dilute waste while strengthening evidence for every claimed recovery route.

Documented + analytical

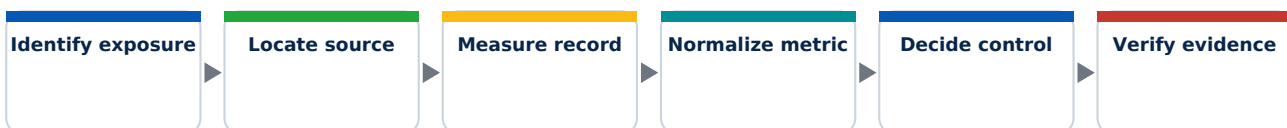
TECHNICAL BASIS

Executive authorization should establish a cross-functional loss-reduction program led jointly by operations, quality, environmental, engineering, procurement and finance. The program should use one controlled data model and resolve high-value loss before optimizing end-of-pipe treatment.

DECISION INTERPRETATION

The first governance cycle should approve boundaries, top ten loss streams, route evidence requirements, targets and correction policy.

Priority	30-day deliverable	Executive test
Material balance	Top streams reconciled	Is value location known?
Cleaning control	First-rinse data	Is dilution prevented?
Route evidence	Outlet dossiers	Is recovery demonstrable?
Dashboard	Normalized metrics	Can trend be trusted?



CONTROL ACTION

Approve a facility material-loss charter.

REQUIRED RECORDS

Source record linked to the process event; Declared denominator and reporting period

AUDIT TRIGGER

Escalate when the process record, denominator, boundary, owner or evidence class is missing or inconsistent.

COL-037 | Sources: C08, C10, C22
 Implementation priorities should follow site risk and value.

Source register A

COL-038

KEY

Source quality is controlled by authority, methodological transparency, boundary relevance and direct support for the claim—not by citation volume.

Documented

C01 Paint Formulating Effluent Guidelines. U.S. Environmental Protection Agency. Use: Industry process, batch scale, cleaning methods and zero-discharge requirement for covered sol.

C07 AP-42 Chapter 4 - Waste Solvent Reclamation and Tank Cleaning. U.S. Environmental Protection Agency. Use: Solvent reclamation, tank/drum cleaning and evaporation-loss source categories.

C02 Development Document for Paint Formulating Point Source Category. U.S. Environmental Protection Agency. Use: Tank-cleaning taxonomy, wastewater characterization and historical control-technology basis.

C08 Product Life Cycle Accounting and Reporting Standard. GHG Protocol. Use: Product lifecycle boundary, inventory and reduction-opportunity discipline.

C03 Ink Formulating Effluent Guidelines. U.S. Environmental Protection Agency. Use: Ink mixing, milling, thinning, packaging and solvent/water cleaning boundaries.

C09 Scope 3 Standard. GHG Protocol. Use: Value-chain category and supplier-data boundary for downstream treatment and purchased inputs.

C04 Surface Treatment Using Organic Solvents BREF. European Commission Joint Research Centre. Use: BAT context for coating, printing, cleaning, degreasing and solvent-emission management.

C10 Wastewater and Sludge Guidelines V1. ZDHC Foundation. Use: Testing, sludge documentation, root-cause and pathway-evidence principles; not directly applic.

C05 AP-42 Compilation of Air Emissions Factors. U.S. Environmental Protection Agency. Use: Emission-factor purpose, limitations and source-category inventory methods.

C11 Document Sludge Disposal V1. ZDHC Foundation. Use: Manifest, authorized contractor and disposal-pathway documentation principles.

C06 AP-42 Chapter 6 - Paint and Varnish. U.S. Environmental Protection Agency. Use: Paint and varnish source-category process and emissions context.

Complete URLs and access dates are retained in the exported source register.

Source register B

COL-039

KEY

Source quality is controlled by authority, methodological transparency, boundary relevance and direct support for the claim—not by citation volume.

Documented

C12 Paintback - National Product Stewardship Scheme. Paintback Ltd. Use: Reported collection, separation and treatment pathways for unwanted architectural paint and pa.

C18 Air Emissions Factors and Quantification. U.S. Environmental Protection Agency. Use: Definition and appropriate use of representative emission factors.

C13 Paint Circular Economy Headquarters. Paintback Ltd. Use: Reported processing capacity, separation and repurposing objectives; stewardship example, not.

C19 Wastewater and Sludge Guidelines V2 - Sludge Testing. ZDHC Foundation. Use: Percent-solids testing and pathway-dependent characterization as forward-looking practice; V2.

C14 Paintback Recycled Products. Paintback Ltd. Use: Examples of reclaimed water-based paint and packaging products; reported program evidence.

C20 Paintback Research and Development. Paintback Ltd. Use: Reported treatment pathways and research objectives for solvent and water-based paint.

C15 PaintCare Oregon 2023 Collection Report Summary. PaintCare Inc. Use: Stewardship collection-scale example; not manufacturing-waste benchmark.

C21 Paintback PaCE HQ Opening. Paintback Ltd. Use: Reported 2025 facility capabilities and >90% repurposing target.

C16 Industrial Effluent Guidelines. U.S. Environmental Protection Agency. Use: Technology-based wastewater regulatory context and industry-category structure.

C22 Effluent Guidelines Program Plan. U.S. Environmental Protection Agency. Use: Pollution-prevention, technology and economic-achievability considerations for regulatory revi.

C17 Learn About Effluent Guidelines. U.S. Environmental Protection Agency. Use: BPT/BAT/NSPS framework and technology-performance basis.

Complete URLs and access dates are retained in the exported source register.

Page-specific claim index

COL-040
KEY

The claim index provides a rapid audit trail from page purpose to evidence classification and source set.

Controlled

- | | |
|--|--|
| <p>01 COL-001 This executive review manuscript contains forty controlled logical... [C01,C02,C04,C08]</p> <p>02 COL-002 The issue is decision-grade only when every quantitative statement... [C16,C17,C22]</p> <p>03 COL-003 The most effective control sequence is prevention, concentration... [C01,C08,C10]</p> <p>04 COL-004 Paint and ink formulation are batch systems in which mixing... [C01,C03]</p> <p>05 COL-005 Loss prevention begins with reconciling delivered, accepted,... [C01,C05]</p> <p>06 COL-006 Powder handling can create simultaneous material loss, occupational... [C05,C06,C18]</p> <p>07 COL-007 A solvent or resin balance is credible only when storage losses,... [C05,C06,C18]</p> <p>08 COL-008 Mill heels and retained dispersion are high-value losses because... [C01,C06]</p> <p>09 COL-009 Corrective additions should be treated as process signals, not... [C01,C03]</p> <p>10 COL-010 Filling losses combine retained product, filter solids, overfill,... [C01,C03]</p> <p>11 COL-011 Laboratory waste is small in mass but can be chemically diverse,... [C03,C07,C16]</p> <p>12 COL-012 Off-specification generation, successful rework and final disposal... [C01,C08]</p> <p>13 COL-013 Solvent wash, caustic wash and water wash are distinct process... [C01,C02,C03]</p> <p>14 COL-014 Spent solvent should be managed as a recoverable material stream... [C01,C03,C07]</p> <p>15 COL-015 The first aqueous rinse can contain far more recoverable product and... [C01,C02,C16]</p> <p>16 COL-016 Caustic cleaning can solubilize or detach resin and pigment residues... [C02,C16]</p> <p>17 COL-017 Concentration preservation creates the best opportunity for product... [C01,C02]</p> <p>18 COL-018 Final discharge sampling demonstrates treatment outcome but cannot... [C16,C17]</p> <p>19 COL-019 Concentration without flow cannot quantify pollutant load, and a... [C16,C17]</p> <p>20 COL-020 Treatment efficiency is not a substitute for preventing product... [C16,C17,C19]</p> | <p>21 COL-021 Wet sludge tonnage is not a comparable performance measure unless... [C10,C11,C19]</p> <p>22 COL-022 Emission factors support screening and inventory development, but... [C05,C06,C07,C18]</p> <p>23 COL-023 Resource-recovery decisions are unacceptable when they create... [C04,C07,C16]</p> <p>24 COL-024 Container recyclability depends on residual content, material type,... [C12,C13,C14]</p> <p>25 COL-025 Production sequencing can reduce cleaning frequency and incompatible... [C01,C03,C08]</p> <p>26 COL-026 Solvent recovery is a quality-separation process; recovery... [C01,C07]</p> <p>27 COL-027 A concentrated solid is not automatically a usable feedstock;... [C10,C13,C14,C19]</p> <p>28 COL-028 A transfer note proves movement; it does not prove beneficial use,... [C10,C11,C12]</p> <p>29 COL-029 Product-stewardship collection data demonstrate system scale and... [C12,C13,C15,C21]</p> <p>30 COL-030 Preventing the loss of already processed material generally avoids... [C08,C09]</p> <p>31 COL-031 Supplier declarations are essential for composition and carbon... [C04,C08,C09]</p> <p>32 COL-032 A useful dashboard links production yield, cleaning, pollutant load,... [C08,C16,C18]</p> <p>33 COL-033 Control limits describe process behavior; they are not regulatory... [C05,C08,C16]</p> <p>34 COL-034 The preferred route is the highest technically, legally and... [C10,C11,C16]</p> <p>35 COL-035 Circularity maturity progresses from unknown flows to controlled... [C08,C10,C22]</p> <p>36 COL-036 A credible first 90 days should establish measurement and source... [C01,C08,C16]</p> <p>37 COL-037 The immediate value opportunity is to prevent concentrated material... [C08,C10,C22]</p> <p>38 COL-038 Source quality is controlled by authority, methodological... [C01,C02,C03]</p> <p>39 COL-039 Source quality is controlled by authority, methodological... [C12,C13,C14]</p> <p>40 COL-040 The claim index provides a rapid audit trail from page purpose to... [C01]</p> |
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