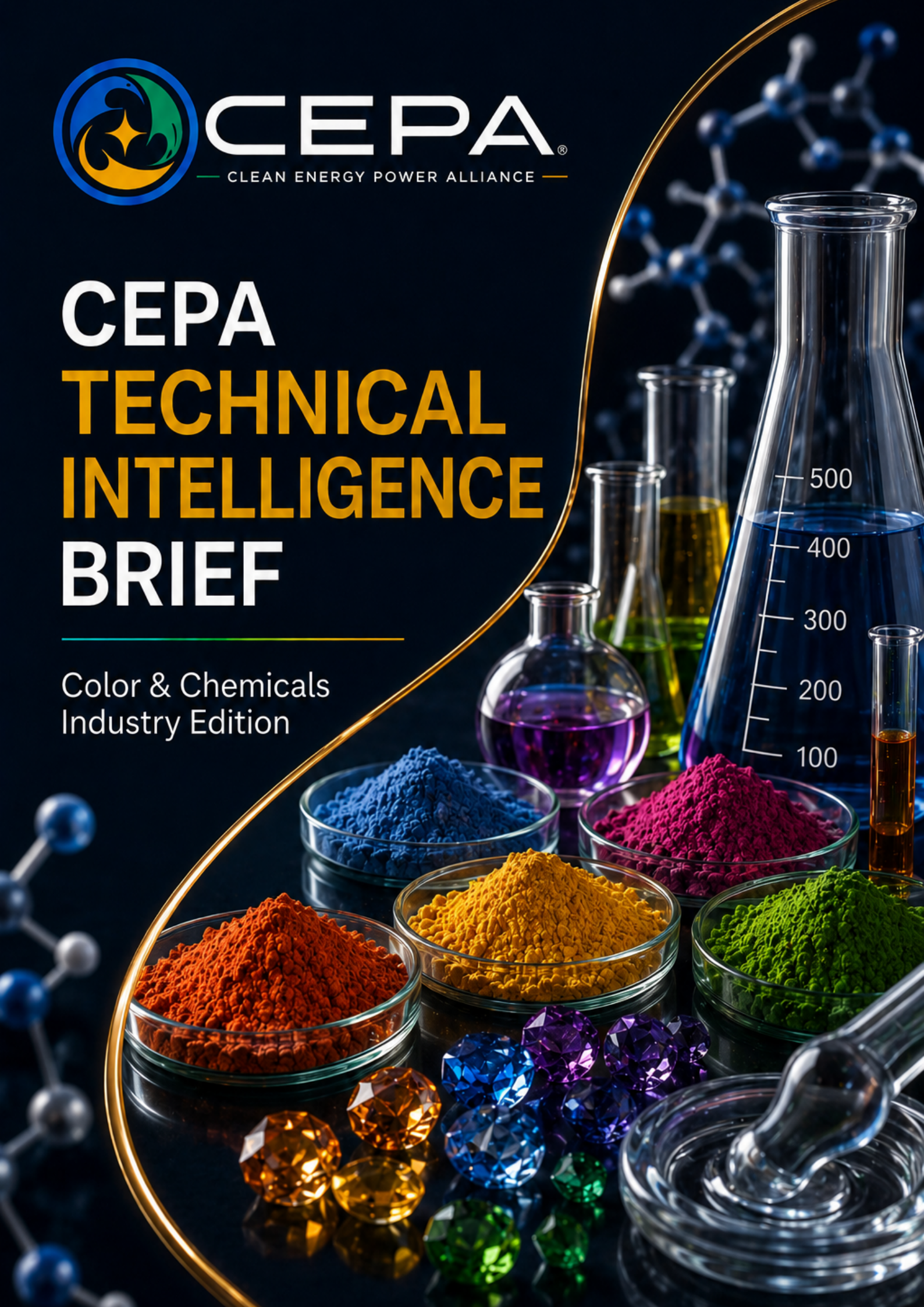




CEPA TECHNICAL INTELLIGENCE BRIEF

Color & Chemicals
Industry Edition





CEPA
— CLEAN ENERGY POWER ALLIANCE —



CEPA TECHNICAL INTELLIGENCE BRIEF

COLOR & CHEMICALS INDUSTRY EDITION

Waste, Carbon & Resource Value Across the Global Color & Chemicals Economy

Material loss, route evidence, carbon boundary, recoverable value and benchmark readiness for expert decision-makers.



Published by **CEPA**



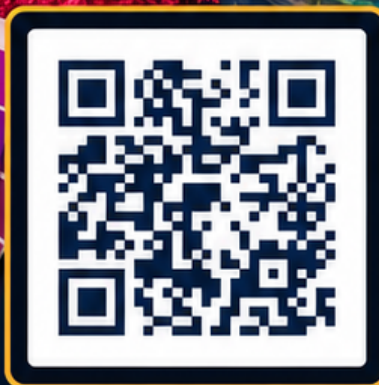
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5 July 2026



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Publication issue for expert waste, carbon and resource-value intelligence.

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CEPA TECHNICAL INTELLIGENCE BRIEF

Publication Identity, Scope & Evidence Standard

Definition, boundary and claim confidence for public use

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This issue defines practical measurement logic for material loss, carbon, recoverable value, route evidence and data confidence across color-bearing and color-adjacent chemical systems. Market figures establish materiality; source-level records establish benchmark readiness.

Documented

official law, standard, regulatory inventory or published record

Reported

company, association, stewardship or program disclosure

Estimated

market estimate, modelled figure or calculated value

Observed

operational signal or industry pattern

Recommended

CEPA control action or benchmark discipline

Uncertain

incomplete, boundary-limited or non-comparable

Claim control standard

Every material claim must show source, evidence class, boundary, date, metric definition and caveat.

Not covered

Not a certification, ranking, universal benchmark, global waste estimate or substitute for local legal compliance.

Boundary note

Focused on color-bearing systems where material loss, wastewater, sludge, packaging, application loss and lifecycle claims create measurable exposure.



Evidence rule

Company disclosures and stewardship statistics are directional unless boundaries, denominators, assurance status and comparability conditions are clear.

Executive Technical Intelligence Summary

Executive findings for professionals across the color and chemicals value chain

01

Material loss is margin leakage before it is waste.

Off-spec, heel loss, wash-water, sludge, solvent variance, packaging residues, overspray and rework are controllable loss pathways.

02

Market scale makes small losses material.

A global coatings market estimated at 48.9bn liters and USD 202bn creates large financial exposure even when loss rates appear small.

03

Regional competitiveness is shifting.

Asia anchors growth and volume; North America retains premium channel and technology strength; Europe faces cost, policy and import pressure.

04

Public ESG data are signals, not benchmarks.

Comparison requires common product family, boundary, denominator, reporting period, route evidence and confidence level.

05

CEPA value is decision-grade waste-carbon intelligence.

The first action is not a dashboard. It is a source-record map connected to operating decisions.

Commercial relevance

Margin leakage, disposal cost, route risk, claim exposure, procurement leverage and customer credibility.

Technical relevance

Source-level wastewater, dry-solids correction, solvent reconciliation, transfer efficiency and route-confirmed recovery.

First action

Build a source-record map before building a dashboard.

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Priority

The technical priority is not more sustainability language. It is comparable, traceable, source-level waste-carbon data.

Market Scale, Boundary & Materiality

Scale context explains materiality - it is not a waste estimate

48.9bn L

Global paint and coatings market estimate, 2024 (R01)

USD 202bn

Estimated market value, 2024 (R01)

3 core groups

Decorative architectural, OEM and special purpose coatings (R01)

APAC signal

Largest architectural coatings consumption region in source market analysis (R01)

CEPA Measurement Boundary

#	Boundary block	Exposure measured	First record	Executive decision
1	Raw-material inputs	supplier chemistry and packaging	SDS, PCF/LCA, purchase record	procurement leverage
2	Formulation/batch losses	mix, mill, tint, QC and fill	batch sheet + QC log	yield and SKU discipline
3	Cleaning/changeover	water or solvent cleaning by campaign	cleaning log	campaign sequencing
4	Wastewater/sludge	source streams before commingling	source flow + lab result	treatment route
5	Solvent/VOC	purchase, recovery, waste and emissions	solvent balance	cost, VOC and carbon
6	Application loss	overspray, rework and booth sludge	job card + transfer efficiency	customer performance
7	Stewardship/EOL	returns, collection and route evidence	manifest/outlet evidence	producer responsibility
8	Carbon/LCA	Scope 1, 2 and relevant Scope 3	boundary statement	claim defensibility

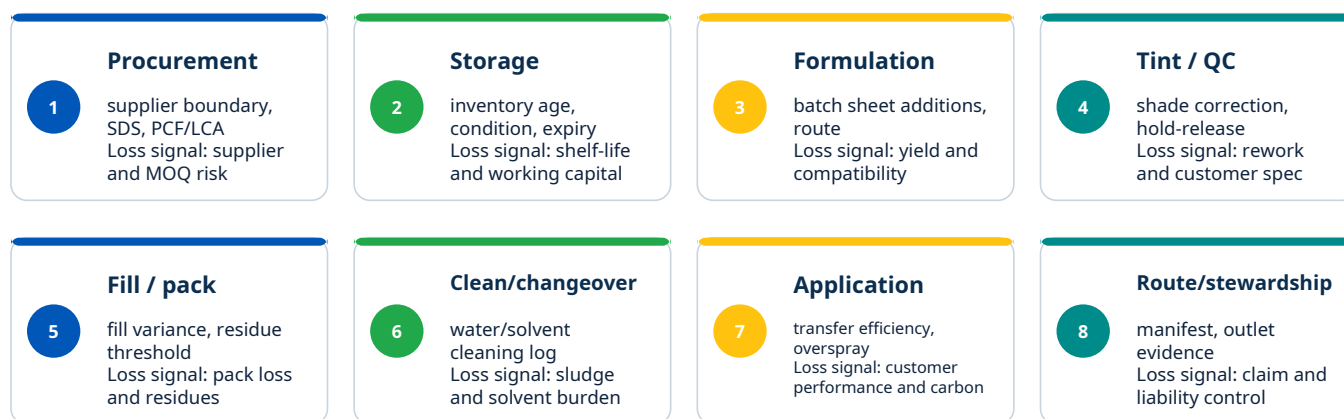


Evidence limit

Market scale establishes materiality. It does not authorize extrapolation to global waste volume, sludge volume, wastewater intensity or carbon intensity.

Color & Chemicals Operating Model

Where margin leakage, waste-carbon exposure and route risk enter the operating system



Operating driver	What it changes	First record	Primary owner
Product mix	loss profile and denominator	product-family code	technical + commercial
Batch frequency	heel and cleanout loss	batch/campaign log	plant manager
Changeover discipline	water, solvent and sludge	cleaning log	production + EHS
Source segregation	recoverability and route risk	stream code	EHS + waste vendor
Application method	overspray, VOC and rework	job card + TE	customer/application team



Operating insight

Waste profiles are driven by product mix, batch frequency, changeover discipline, shade correction, campaign sequence and source segregation - not annual production volume alone.

Segment Loss Profiles - Coatings & Application

Segment-specific loss logic for denominator-controlled benchmarking

Segment	Operating pattern	Primary loss	Denominator rule	Commercial exposure
Architectural	SKU variety; tinting; returns	tint residues; off-spec; wash-water	liters/tinted batch by color family	SKU churn and channel credibility
Industrial/protective	solventborne project campaigns	solvent cleaning; unused mixed material	project/campaign mass + surface area	project overruns and VOC exposure
Marine	heavy film builds; field constraints	overspray; weather rework; solvent	surface area and weather rework	high film-build and field boundary risk
Automotive OEM	line controlled; quality coded	booth sludge; filters; rework	production unit and defect code	line downtime and defect cost
Automotive refinish	small-batch color match	leftover mix; masking waste	job-level mix record	job-level loss and color-match rework
Powder coatings	reclaim dependent	finer; booth dust; filters	applied mass and reclaim quality	quality-adjusted reclaim value

Core denominator discipline

Segment comparability fails when product family, application boundary, campaign structure or denominator differs.

Application boundary

Facility, contractor, customer, OEM line and field application losses must not be combined without boundary notes.

Powder reclaim rule

Reclaim percentage must be quality-adjusted; unusable fines are not equivalent to recovered product.



Segment rule

Comparable data begin with the operating pattern. A long-campaign OEM line and a high-churn tinting site should not be benchmarked with identical denominators.

CEPA TECHNICAL INTELLIGENCE BRIEF

Pigments, Inks, Dyes, Resins, Additives & Solvents

Color-chemical residuals require chemistry-aware benchmarking

System	Material state	Primary residual	First record	Strategic risk
Printing inks	liquid / solvent-bearing	wash-up waste; solvent; containers	campaign cleaning log	changeover allocation and VOC
Pigments/colorants	powder / slurry / filter cake	filter cake; dust; wastewater solids	filter/cake mass + analysis	TiO ₂ /trade risk; metals/TSS
Dyes	bath / rinse liquor	colored effluent; salt load; sludge	bath/rinse flow + chemistry	wet-processing boundary and treatability
Resins/binders	viscous liquid / polymer	heel loss; flush residues	batch closeout + heel record	polymer family and fouling
Additives	small mass; high function	expired inventory; residues	usage and expiry log	risk not captured by mass alone
Solvents	liquid / volatile	emissions; waste; variance	purchase/inventory/recovery log	unaccounted gap is control failure

Material-state risk key

State	Main risk	Benchmark control
Liquid	COD/VOC, route compatibility	source flow and chemistry
Powder	dust, metals, contamination	containment and analysis
Wet solids	water content distorts mass	dry-solids correction
Filter cake	chemistry and moisture drive route	lab profile and DS%
Packaging	residue and chain-of-custody	threshold and route evidence



Expert signal

Wet mass, purity, compatibility and contamination profile determine recovery route more than material name alone. Route evidence determines whether recovery is credible.

Formulation, Batch Discipline & Changeover Loss

Where formulation complexity becomes measurable yield loss, solvent burden, sludge and rework exposure

Loss theme	Where it happens	First diagnostic record	First intervention	Benchmark caution
Shade correction	tinting/final adjustment	tint-addition log by batch	tighten tint window; sequence shades	aggregate off-spec hides color volatility
Heel loss	tank, mill, line, tote	theoretical vs recovered closeout	heel recovery SOP by chemistry	short campaigns distort mass basis
Cleanout loss	tank, pump, line, filter, gun	water/solvent per changeover	campaign sequencing by resin/color	annual totals hide failures
Filter loss	filtration/bag change	filter change linked to batch size	optimize cut-point and spec	not comparable across product families
QC reject/rework	lab release and hold area	batch disposition + rework yield	rework compatibility matrix	rework is not automatically zero loss

M05 Cleaning loss per campaign = cleaning residual mass / campaign or batch

Do not average across incompatible product families.

Campaign variables

product family; resin type; water/solvent system; color transition; batch size; cleaning method; line/tank configuration; rework compatibility

1

same resin family?

2

same color family?

3

compatible rework route?

4

cleaning method approved?

5

burden expected?

6

sequence approved?

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Diagnostic trigger

Repeated shade correction, rising cleanout solvent, high heel variance or repeated rework should trigger formulation/process review before disposal review.

Where Material Loss Actually Happens

Loss points are controllable only when owner, record, denominator and route are assigned

Step	Loss signal	Record required	Record owner	CEPA metric link	Decision supported
Procurement	wrong grade; excess MOQ	supplier spec + purchase record	Procurement	supplier confidence	qualify supplier / rationalize SKU
Storage	expired or settled material	inventory age and condition	Warehouse	inventory variance	FIFO / shelf-life controls
Mix/mill	retained heel; dispersion loss	batch sheet + transfer yield	Production	material balance	equipment cleanout / yield review
QC/tint	shade correction; rejected batch	QC hold/release log	Quality	M01	root-cause / rework matrix
Filling	line flush; pack residue	fill variance and packaging count	Production	pack loss	line clearance discipline
Cleaning	wash-water; solvent; sludge	cleaning log by campaign	Production + EHS	M02-M05	sequence / segregate streams
Application	overspray; booth waste	job usage + transfer efficiency	Applicator	TE / overspray	gun setup / method selection
End-of-life	returns; leftover product	return source + route evidence	Stewardship	M06-M07	recovery route

Record-owner principle

Benchmarking fails when record ownership is implied rather than assigned. Every loss point needs an owner, period, denominator and confidence level.



Decision rule

A loss point is not benchmark-ready until the stream, product family, period, denominator, route, record owner and confidence level are all visible.

Commercial Exposure Map

How material loss becomes margin, compliance, claim and customer-performance risk

Exposure	Business effect	First control metric	Executive decision	Evidence required
Raw-material loss	excess purchase; yield loss	inventory variance	working capital + formulation review	purchase + batch records
Off-spec and rework	labor; downtime; downgrade	M01 off-spec disposition rate	quality and margin control	QC disposition log
Wastewater treatment	chemicals; sludge; discharge risk	M02 source wastewater intensity	cost + compliance	source meters + lab data
Sludge disposal	transport; solids; classification	M03 dry sludge intensity	route and dewatering decision	wet mass + DS test
Solvent loss	raw material; VOC exposure	M04 solvent accountability ratio	EHS + carbon control	solvent reconciliation
Cleaning/changeover	water, solvent and sludge burden	M05 cleaning loss per campaign	campaign sequencing	cleaning logs
Packaging residues	special handling; failed returns	M06 residue threshold rate	stewardship + supplier control	container count + threshold
Application overspray	excess coating; booth waste	transfer efficiency	customer performance + carbon	job card + surface area
Supplier data gaps	unsupported claims	supplier data confidence	procurement leverage	SDS, PCF, LCA, EPD

Gross margin

lost material, labor, downtime

Working capital

excess purchase and obsolete stock

Compliance

route, VOC, discharge and waste exposure

Claim fragility

unsupported ESG, LCA and recovery claims



Executive lens

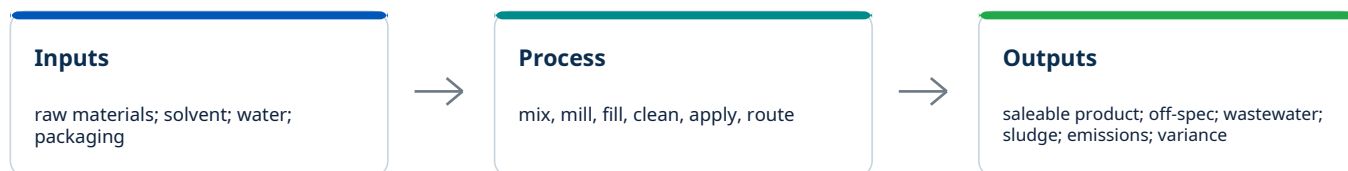
Loss is not only waste cost. It is unrecovered margin, compliance exposure, claim fragility, supplier leverage loss and customer performance risk.

Material Balance & Loss Accounting

Every kilogram must be saleable, recovered, emitted, discharged, disposed, stored or explained

Inputs + energy + water + packaging = saleable output + emissions + wastewater + sludge + solid waste + off-spec + inventory variance

Illustrative CEPA example - not an industry benchmark.



Flow	Quantity	Record source	Confidence
Raw materials	10,000 kg	purchase + batch sheet	A/B
Solvent	1,200 kg	purchase + inventory	B
Water	6.0 m3	meter/log	B
Packaging	520 units	packaging count	B
Saleable product	9,250 kg	production record	A
Off-spec	220 kg	QC disposition	B
Wastewater	4.1 m3	source meter/log	B
Wet sludge	460 kg	scale ticket	B
Dry sludge	161 kg	460 kg x 35% DS	B/C
Recovered solvent	180 kg	recovery log	B
Estimated emitted solvent	140 kg	estimate/material balance	C
Inventory variance	55 kg	reconciliation	C

M01 Off-spec 2.38% of saleable	M02 Wastewater 0.44 m3/t saleable	M03 Dry sludge 17.4 kg DS/t saleable	M04 Solvent recovered 15.0%	Variance 55 kg
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Control signal

The illustrative example uses saleable product mass as the denominator for M01-M03. Persistent inventory variance remains an operating signal until explained.

CEPA Material Loss Index I

Specification blocks for production, water, sludge and solvent metrics

M01 Off-spec disposition rate

Purpose: identify rejected, reworked, downgraded, stored or disposed product
 Formula: off-spec mass by disposition / saleable product mass
 Records: batch record; QC release/reject log; rework ticket
 Misuse: treating rework as zero loss
 Decision: rework, downgrade, reformulate

M02 Source-level wastewater intensity

Purpose: link cleaning/process water to product family or campaign
 Formula: source wastewater volume / saleable mass
 Records: source meters; campaign logs; lab results
 Misuse: using final discharge only
 Decision: segregate, equalize, pre-treat

M03 Dry sludge intensity

Purpose: separate water content from captured solids
 Formula: wet sludge mass x dry-solids fraction / saleable mass
 Records: scale tickets; moisture/solids test
 Misuse: comparing wet sludge mass
 Decision: dewater, segregate, route

M04 Solvent accountability ratio

Purpose: test whether solvent purchases are explained
 Formula: accounted solvent mass / purchased solvent mass
 Records: purchase, inventory, recovery, waste, emissions estimate
 Misuse: ignoring solvent in sludge/wipes
 Decision: close gaps, tighten cleaning



Metric rule

Every metric must report numerator, denominator, unit, reporting period, product-family segment, record owner, exclusion rule and confidence level.

CEPA Material Loss Index II

Loss, recovery, packaging, cost, carbon and readiness metrics

M05 Cleaning loss per campaign

Purpose: expose changeover discipline by chemistry and color family
 Formula: cleaning residual mass / campaign or batch
 Records: cleaning log; changeover record
 Misuse: averaging unlike product families
 Decision: campaign sequencing, cleaning SOP

M06 Packaging contamination rate

Purpose: identify streams requiring cleaning, return or disposal
 Formula: containers above residue threshold / total containers
 Records: residue threshold SOP; container counts
 Misuse: counting containers without threshold
 Decision: returnable packaging, redesign

M07 Recovery rate with outlet evidence

Purpose: avoid counting unevidenced recovery as value
 Formula: recovered mass / total residual mass
 Records: recovery tickets; quality/outlet evidence
 Misuse: counting stored material as recovered
 Decision: recover, reprocess, route

M08 Carbon intensity by product family

Purpose: connect material, energy, route and supplier data
 Formula: kg CO₂e / tonne product family
 Records: energy, supplier, process and route data
 Misuse: intensity without allocation method
 Decision: product claims, investment



Benchmark warning

Apparent performance differences often reflect accounting differences before they reflect operating performance. CEPA therefore treats confidence level as part of the metric.

Minimum Dataset for CEPA Benchmarking

Required records for waste-carbon comparability

Dataset block	Required record	Record owner	Benchmark failure if missing
Facility profile	facility type; product family; process route; production mass	Operations	no product-family denominator
Water/wastewater	water input; wastewater by source; discharge route; source flow method	EHS / wastewater operator	final discharge only
Sludge/solids	wet mass; dry-solids %; origin; classification; route	EHS / lab	wet mass only
Solvent balance	purchased; recovered; disposed; estimated emitted; variance	EHS / production	unreconciled solvent
Product loss	off-spec generated; reworked; downgraded; stored; disposed	Quality	rework counted as zero loss
Packaging	container type/count; residue threshold; return/reuse route	Warehouse / stewardship	no residue threshold
Waste routing	classification; treatment route; disposal route; recovery evidence	EHS / waste vendor	no route evidence
Carbon data	Scope 1 energy; Scope 2 electricity; relevant Scope 3 flags	Sustainability	no boundary statement
Confidence	measurement method; record owner; period; confidence level	Data owner	no record owner or period

Automatic benchmark failure

No production denominator, no reporting period, no product family, no source stream, no route evidence, no confidence level or no record owner.

Invoice-only

waste invoice exists; source and route unclear

Diagnostic

some source streams and records exist

Internal trend

denominator, period and major streams visible

Benchmark-ready

route evidence, confidence and comparability controls complete



Minimum viable benchmark package

A facility is not benchmark-ready unless it provides a production denominator, stream source, mass/volume basis, route evidence, confidence level, reporting period and record owner.

Benchmark Eligibility Test

Gatekeeping criteria for comparable CEPA data

product family defined 1	process route identified 2	production mass recorded 3
wastewater measured by source 4	wet sludge and dry solids separated 5	solvent balance reconciled 6
off-spec disposition recorded 7	packaging residue threshold defined 8	recovery route evidenced 9
supplier data confidence assigned 10	carbon boundary stated 11	record owner assigned 12

Score	Readiness class	Use
10-12	External anonymized benchmark-ready	suitable for anonymized comparison if omissions do not affect the metric
7-9	Internal trend-ready	good for site tracking; not external benchmarking
4-6	Diagnostic only	core records incomplete
0-3	Disposal-level only	invoice-level data only

No denominator, no benchmark. No route evidence, no recovery claim. No record owner, no audit trail.



Benchmark gate

Missing production denominator, reporting period, record owner, route evidence or source-level stream distinction blocks external comparison. Scoring uses 1 point per satisfied criterion.

False Comparability Failure Modes

The fastest way to make a wrong decision is to compare non-equivalent data with false precision

Severity	Signal	Common error	Consequence	Correction method
Critical	Wastewater	final discharge used instead of source data	hidden high-strength streams	meter by source or campaign
High	Sludge	wet sludge reported without dry-solids correction	false sludge intensity	require wet mass and dry-solids fraction
Critical	Solvent	purchases not reconciled to product, recovery, waste and emissions	understated VOC/cost exposure	complete solvent balance
High	Off-spec	reworked material counted as zero loss	inflated yield signal	record disposition and rework yield
Critical	Recovery	material counted without outlet evidence	inflated recovery performance	require quality and outlet records
Medium	Packaging	container units counted without residue threshold	weak stewardship data	define residue threshold
High	Supplier data	declarations accepted without boundary review	unsupported claims	review boundary and assurance
High	Carbon claims	intensity reported without product family or allocation method	non-comparable claim	state denominator and allocation logic

Severity	Meaning
Critical	blocks external comparison
High	allows internal diagnosis only
Medium	allows trend tracking with caveat
Low	correctable metadata weakness



Fastest correction

False precision is worse than missing data when it creates confidence in the wrong decision. Better benchmarking starts with boundary logic, traceable records and consistent treatment of reworked, recovered, mixed or disposed material.

Waste Stream Taxonomy

Decision-grade classification for color-bearing operations

Code	Stream	Typical source	Control variable	Route condition	Benchmark status
WW-CLEAN	wash-water	cleaning/changeover	source segregation	low contamination	source-coded
WW-PIG	pigment-rich rinse	mill/filter cleanout	TSS/color/metals	solids capture	lab profile required
WW-BINDER	binder-rich wash-water	mix vessel wash	COD/turbidity	recover if clean	batch record required
SOLV-WASTE	solvent waste	purge/wipe-down	solvent balance	purity/reuse path	reconciliation required
SLUDGE-FC	sludge/filter cake	treatment/filtration	dry solids %	dewatered/classified	DS% required
PIG-FC	pigment/TiO ₂ -rich cake	pigment process or filtration	metals, moisture, purity	analysis before route	chemistry required
OFFSPEC-QC	off-spec product	QC/tint/batch error	rework route	compatible family	disposition required
APP-BOOTH	booth sludge/filters	application	transfer efficiency	segregated composition	boundary note required
PACK-RES	contaminated packaging	pails, drums, IBCs	residue threshold	returnable/cleanable	chain-of-custody required
TEXT-WET	textile effluent	dyeing/finishing	bath/rinse segregation	treatability	not coatings proxy



Taxonomy rule

Stream codes are CEPA data-structure labels, not regulatory classifications. Legal classification remains jurisdiction-specific. Mixed residuals destroy recovery value and obscure root causes.

Wastewater Route Selection Matrix

Source-level stream decisions before final discharge

Stream type	Likely source	Critical parameter	Route decision	Cost driver	Record owner
Waterborne wash-water	tank/line cleaning	COD/BOD, TSS, pH	segregate, equalize, pre-treat	chemicals + sludge	Production + EHS
Pigment-rich rinse	mill/filter cleanout	TSS, color, metals	solids capture/coagulation	dry-solids handling	Lab + wastewater operator
Dye bath/rinse	wet processing	color, salt, COD	bath/rinse separation	salt + treatability	Wet process owner
Binder carryover	mix vessel wash	COD, turbidity	recover product if clean	fouling + sludge	Production
Solvent-contaminated water	mixed cleaning	VOC, flashpoint	separate solvent stream	route caution	EHS
Acid/alkaline cleaning	CIP/manual cleaning	pH, conductivity	neutralize/equalize	salt load	Maintenance
Metal pigment residue	inorganic pigments	metals/TSS	analyze before route	classification risk	Laboratory

Route sequence

Segregate high-strength streams first. Analyze chemistry before route selection. Verify treatment, recovery or discharge evidence before benchmarking.

Economic rule

The highest-value wastewater decision is usually made before streams are mixed. Once streams are mixed, recovery value falls and treatment cost rises.



Non-negotiable

Final-discharge compliance data are not sufficient for CEPA benchmarking. Source-level data are required for route selection and comparison.

Sludge and Solids Routing Logic

Classification before disposal, recovery before assumption

Dry sludge mass = wet sludge mass x dry-solids fraction
Dry sludge intensity = dry sludge mass / saleable product mass

Source segregated?

If no: classify conservatively and improve source separation.

Dry solids measured?

If no: test before benchmarking.

Chemistry profile known?

If no: analyze before route decision.

Hazardous classification required?

If yes: follow jurisdictional route.

Dewatering possible?

If yes: evaluate cost and solids reduction.

Recovery viable?

If yes: confirm quality and outlet.

Route evidence available?

If no: do not count as recovered.

Recover

Dewater

Stabilize

Classify/treat

Dispose with evidence



Core formula

Wet mass drives invoices. Dry solids drive process insight. Chemistry drives route. Recovery without route evidence is not recovery.

Solvent Operating Model

From purchase to product, recovery, waste, emissions and variance

Purchased solvent = product solvent + recovered solvent + solvent waste + estimated emissions + solvent in wastewater/sludge + inventory variance

M04 Solvent accountability ratio = accounted solvent mass / purchased solvent mass

Operating node	What to record	Record source	Decision supported
Inventory	opening stock, deliveries, closing stock	warehouse + purchasing	mass accountability
Product incorporation	solvent retained in product	batch formula and saleable output	product VOC/carbon basis
Cleaning use	flush/purge/wipe-down solvent	cleaning log by campaign	changeover discipline
Recovery	distillation/reuse stream	recovery volume + purity	reuse eligibility
Waste	spent solvent/wipes/sludge	waste manifest + route	cost and compliance
Emissions estimate	open handling, drying, curing	AP-42/material balance/monitoring	VOC and carbon estimate
Variance	unexplained residual	full reconciliation	control gap



CEPA control band

Illustrative bands: >95% strong control; 85-95% reconciliation gap; <85% high-risk accounting failure. A solvent accountability ratio is a reconciliation control, not an emissions factor.

VOC and Application-Loss Intelligence

Transfer efficiency as a waste-carbon control variable

Transfer efficiency = coating mass deposited on target surface / total coating mass applied

Report by job, surface area, dry film thickness, product family, application method and boundary.

Method	Residual pathway	Metric to add	Control lever
Conventional spray	overspray, booth sludge, cleaning waste	overspray mass; booth sludge	gun setup; operator discipline
HVLP	lower overspray, still cleaning loss	TE %; solvent/job	air pressure; nozzle setup
Airless	overspray, bounce-back, tip wear	waste/job; rework rate	tip selection; maintenance
Electrostatic	lower overspray potential, residues	transfer efficiency	grounding; part geometry
Powder coating	reclaim fines, booth dust, filters	reclaim yield %	powder quality; booth control
Dip/flow	drag-out, bath contamination	drag-out kg/job	bath control; drainage
Field application	masking waste, leftovers, weather losses	waste/job; rework	job sizing; film-build control

Application boundary options

facility-controlled

contractor

customer

field

OEM line

repair/refinish

substrate geometry

rework event



Boundary logic

Transfer efficiency should never be generalized across methods, geometries or field conditions without boundary notes. Application loss changes coating consumption, VOC exposure, booth waste and embedded carbon.

Packaging, Leftover Product & End-of-Life Data Discipline

A container count is not stewardship data without residue threshold, route and chain-of-custody

Returnable packaging

Which pails, drums, IBCs, liners or pallets can be returned, cleaned or reused?

Residue threshold

What residue level converts a container into special-treatment waste?

Customer returns

Are returns tracked by source, product family, age and condition?

Leftover product

Is leftover material reworked, donated, recycled, fuel-blended or disposed?

Stewardship cost

Is cost known per unit sold, collected, processed and disposed?

Documentation

Are processing, recovery and disposal routes evidenced?

M06 Packaging contamination rate = containers above residue threshold / total containers

Residue threshold, container count, route evidence and chain-of-custody are required.



Sell



Use



Leftover



Return



Sort



Reuse / recycle /
recover



Residual route



Report



Control principle

A container count is not stewardship data unless residue threshold, route and chain-of-custody are known.

Product Stewardship Systems

End-of-life color material as a data, cost and recovery system

91.4M gal

PaintCare estimated paint collected to date (R11)

3,000+ sites

PaintCare drop-off network, mostly retailers (R11)

1,061,821 gal

Washington paint collected in 2025 (R11)

65M+ kg

Paintback unwanted paint and packaging (R12)

1

Collection

2

Transportation

3

Sorting

4

Reuse/recycled content

5

Energy recovery / treatment

6

Residual disposal

7

Program reporting

Reader	Decision relevance	Evidence signal	Comparability caveat
Producer	fee and obligation exposure	sales and collection data	jurisdiction-specific
Retailer	collection participation	drop-off site records	accepted materials differ
Recycler	outlet quality	processing and recovery route	quality specification varies
Regulator	program reporting	annual report data	rules differ
CEPA	route-evidence precedent	source code and caveat	not direct benchmark

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Implication

Stewardship program data are not directly comparable across jurisdictions because accepted materials, fee structures, collection networks, processing routes and reporting rules differ.

Textile Dyeing & Adjacent Wet Processing

Parallel wet-processing discipline, not a proxy benchmark

Included boundary

Dyeing, printing and finishing where color-bearing wastewater and sludge are central to the waste-carbon profile.

Primary signals

Color, turbidity, COD/BOD, salt load, surfactants, auxiliaries, pH and sludge characteristics.

System	Primary loss/waste signal	Benchmark caution
Coatings systems	formulation residues; cleaning/changeover; sludge; solvent; application loss	batch and campaign boundaries dominate
Textile wet processing	bath exhaustion; rinse intensity; color discharge; salt load; auxiliaries	wet-processing boundaries differ

Comparison rule: Coatings losses are often batch, cleaning, solvent, sludge and application driven. Textile wet-processing losses are often bath, rinse, salt, color and auxiliary driven.



Guidance relevance

ZDHC wastewater and sludge guidance informs wet-processing wastewater and sludge discipline. It does not define a universal benchmark for all color-bearing industries. Source code: R13.

Carbon Boundary

Facility decarbonization plus material and downstream fate

Scope 1

combustion, process emissions, onsite treatment facility operations

Scope 2

electricity, steam and purchased energy procurement

Scope 3

raw materials, packaging, logistics, application, waste treatment and end-of-life value-chain exposure

Boundary chips

Facility

Scope 1/2, onsite treatment

Product

functional unit and allocation

Supplier

raw materials and packaging

Application

transfer efficiency and rework

End-of-life

treatment route and residual fate

Claim type	Required boundary	Evidence required
Facility reduction	Scope 1/2, onsite treatment, purchased energy	energy records, emissions method
Product carbon claim	functional unit, allocation, supplier data, process energy	PCF/LCA, route assumptions
Recovery claim	source stream, route, outlet, carbon implication	outlet evidence and chain-of-custody
Stewardship claim	collection, processing, residual disposal, accepted material scope	program records and route evidence



Boundary discipline

The boundary must match the claim. Facility reductions cannot support product claims unless upstream, application and end-of-life assumptions are addressed where material. Source codes: R06-R08.

LCA Data Quality & Product Claims

Claim credibility depends on boundary, data quality and review discipline



Claim defensibility	Condition	Permitted use
Defensible	reviewed, product-specific, current data, clear functional unit	public claim with source caveat
Conditional	supplier-specific but incomplete review or mixed data age	technical disclosure, not broad claim
Weak	generic proxy data or unclear allocation	internal screening only
Unusable	no boundary, no functional unit, no review status	no claim support

Claim support test

- functional unit defined
- allocation method stated
- supplier data source known
- review status disclosed
- end-of-life assumption evidenced
- data age disclosed
- recycled content traceable
- claim wording aligned with boundary



CEPA interpretation

An LCA dataset is not a marketing claim. Claim wording must be narrower than or equal to the study boundary. Source codes: R07-R09.

Supplier Data: Procurement Intelligence

Where color-chemicals carbon and recovery evidence begin

Supply area	Minimum evidence package	Claim/control relevance	Leverage category
Pigments	SDS; origin; metals/residue profile; PCF/LCA where used in claims	upstream material and treatment risk	mandatory + claim support
Resins/binders	process route; VOC profile; energy mix; off-spec data	product footprint and cleanout behavior	preferred
Solvents	source; purity; recovery compatibility; hazard profile	VOC, reuse and route decisions	mandatory
Additives	function; hazard; biodegradability/treatment compatibility	risk not captured by mass alone	mandatory if claim/risk relevant
Packaging	residue threshold; recycled content; return route	stewardship and supplier control	preferred + route evidence
Treatment vendors	route certificates; recovery/disposal evidence	claim defensibility and audit trail	mandatory
Recyclers/recovery partners	outlet certainty; quality specification; chain-of-custody	route-confirmed recovery	mandatory

Supplier-data confidence scale

Level	Definition
A	Product-specific, current, reviewed or assured
B	Supplier-specific with limited review
C	Sector average or proxy
D	Declaration without boundary
U	Unavailable or unsupported



Procurement rule

No boundary, no claim support. No outlet evidence, no recovery claim. Supplier data should be treated as controlled input, not marketing collateral.

Peer Market & Disclosure Signals

Scale, portfolio and public disclosure signals - not rankings

This page maps public measurement and market signals. It does not rank companies and does not create direct benchmark comparability.

Company	Scale signal	Strategic signal	CEPA interpretation
Sherwin-Williams	USD 23.6bn net sales; 4,900+ stores/facilities	architectural channel and performance coatings footprint	scale and distribution context
PPG	USD 15.9bn net sales; 50+ country market reach	broad global multi-end-market coatings portfolio	portfolio and regional exposure
Nippon Paint	JPY 1,774,231m FY2025 revenue; decorative weight	Asia-led growth and platform expansion	regional growth signal
AkzoNobel	about EUR 10.7bn latest cited revenue	Europe-based decorative and performance coatings incumbent	European incumbent signal
Axalta	USD 5.276bn FY2024 net sales; 130+ country customer reach	refinish, mobility and industrial coatings platform	application and refinish signal

Boundary

Different fiscal years and portfolio boundaries prevent ranking.

Use

Signals support context, not direct facility benchmarking.

Control

Normalize by product family, boundary, period and confidence level.



Not a ranking

Public disclosure is a signal map. CEPA uses these disclosures to show direction of measurement, not direct cross-company comparability. Source codes: R14-R24.

CEPA TECHNICAL INTELLIGENCE BRIEF

Disclosure Comparability Limits

Public reporting is useful; benchmarking requires common boundaries

Disclosure element	Comparability risk	CEPA response
Baseline year	different starting points	tag baseline in every metric
Boundary	corporate vs facility mismatch	state boundary explicitly
Product mix	intensity shifts reflect portfolio	normalize by product family
Denominator	sales, mass and volume differ	standardize unit basis
Geography	regional grids and laws differ	tag region and facility type
Assurance	self-reported vs verified	record confidence level
Scope 3 selection	category coverage varies	flag included categories
Supplier coverage	largest suppliers vs all suppliers	define coverage basis
Waste route classification	route labels differ	use route evidence

Denominator	Appropriate use
liters produced	architectural coatings volume
tonnes saleable product	manufacturing material balance
kg DS/t product	sludge intensity
m3/t product	wastewater intensity
kg solvent/t product	solvent intensity
kg CO2e/t product	product-family carbon
surface area coated	project/application performance
job card	refinish/application loss

Comparable benchmark = common denominator + common boundary + common product family
 + common reporting period + route evidence + confidence level



Professional implication

A disclosure can be useful and still be non-comparable. Public disclosure is not benchmark data unless normalized.

Association & Benchmarking Precedents

Public frameworks for measurement discipline and market context

Precedent	What it contributes	What it does not solve	CEPA use
ChemQuest / WCC / ACA	market scale, segmentation and regional context	waste or carbon intensity	market materiality
CEPE LCI Project	raw-material and manufacturing inventory logic	facility waste benchmarking	boundary discipline
BCF Coatings Care	coatings-sector KPI precedent across HSE	harmonized global facility data	KPI governance
PaintCare / Paintback	EPR and post-consumer paint examples	direct jurisdictional comparability	route evidence
ZDHC Wastewater & Sludge	wet-processing wastewater and sludge discipline	coatings proxy benchmark	adjacent wet-processing logic
ACC / Cefic	broader chemistry and regional competitiveness context	CEPA boundary equivalence	feedstock/regional signal

Regional competitiveness matrix

Region	Demand signal	Cost/regulatory pressure	CEPA opportunity
Asia-Pacific	high volume and decorative growth	mixed feedstock and rising controls	source-level data and route discipline
North America	premium channel and technology strength	regulatory and disclosure pressure	benchmark-ready facility controls
Europe	high-specification and regulatory leadership	energy, import and policy pressure	cost leakage and claim defensibility
MEA	emerging demand and mixed capability	variable regulatory maturity	early measurement architecture
Latin America	moderate demand and fragmented controls	variable infrastructure	route evidence and stewardship design



CEPA use

These precedents support source coding, data confidence, facility comparability and sector-level collaboration. They do not create a universal benchmark.

EMS and Standards Controls

Turning waste-carbon data into operational discipline

Aspects register

identify material, wastewater, solvent, sludge, emissions and packaging aspects
Link: waste stream taxonomy

Define metric

select M01-M08 and assign unit, denominator and period
Link: Material Loss Index

Assign owner

make record responsibility explicit
Link: minimum dataset

Collect record

track source-level data, not only disposal or final discharge
Link: benchmark dataset

Review variance

use rework, sludge, solvent and inventory gaps as triggers
Link: data failure modes

Correct process

close loop through prevention, recovery and verified disposal
Link: recovery hierarchy

Preserve evidence

retain route, supplier, LCA and correction records
Link: governance pack

Cadence	Review focus
Daily / shift	abnormal loss, spills, high cleanout, failed batches
Weekly	off-spec, cleaning, solvent variance
Monthly	wastewater, sludge, route evidence, packaging residue
Quarterly	supplier data, LCA/PCF updates, benchmark readiness
Annual	source register, public claims, source corrections

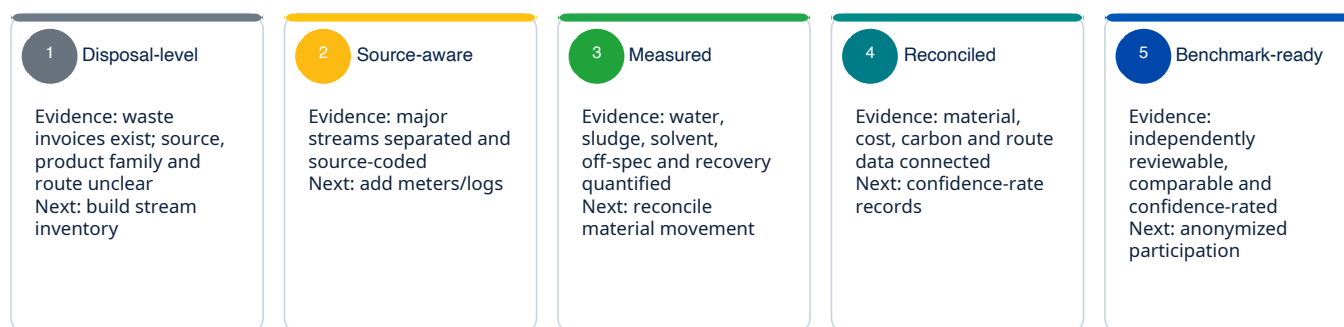


Standard logic

Management systems make technical data repeatable. They do not make unsupported claims defensible. Source codes: R07-R08.

CEPA Waste-Carbon Maturity Model

From disposal invoices to benchmark-ready intelligence



Timeline	Primary task	Target state
Days 0-15	stream inventory, owner assignment, record map	source-aware structure
Days 16-30	source logs, sludge DS testing, solvent template	measured key streams
Days 31-60	product-family denominators, route evidence, off-spec disposition	internal trend data
Days 61-90	internal dashboard, readiness test, claim-boundary review	Level 3/4 maturity
Post-90 days	confidence rating and anonymized dataset preparation	Level 5 pathway

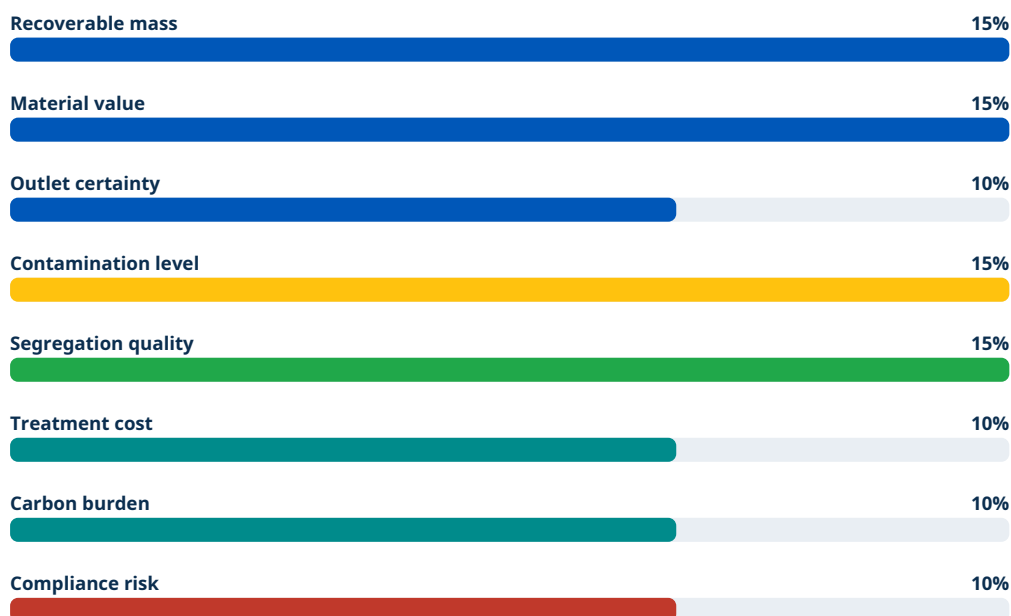


Maturity signal

Most facilities can reach Level 3 with production records, waste invoices, water records, sludge-solids testing and a solvent balance. Cross-company benchmarking requires Level 5.

CEPA Resource Value Index

Why recoverability depends on more than material type



Value potential: 40%
Recoverability control: 60%

Scoring band	Interpretation
80-100	high-value recovery candidate
60-79	conditional recovery candidate
40-59	treatment optimization candidate
<40	responsible disposal or process redesign candidate

Required evidence before scoring

stream composition; mass and unit basis; contamination profile; segregation quality; treatment requirement; classification status; outlet evidence; cost estimate; carbon implication; confidence level



Index logic

Illustrative CEPA prioritization tool - not a financial valuation, legal classification or guaranteed recovery outcome. Scores support prioritization only.

Recovery Hierarchy for Color-Bearing Residuals

Prevention first, disposal only when responsible



Decision gates

Can loss be prevented? Can residual be source-segregated? Can material be reworked safely? Can solvent or water be recovered? Can packaging be reused? Can sludge be dewatered? Is the outlet confirmed? Is disposal documented?



Technical rule

Recovery is credible only when stream segregation, chemistry, quality specification, outlet evidence, route documentation and carbon implications are clear.

Compliance & Technical Governance

Route evidence, records and controls that survive scrutiny

Stream code register

source and data-structure label

Wastewater records

source flow, lab results, treatment/discharge route

Solvent reconciliation

purchase, recovery, disposal, emission estimate, variance

Supplier declarations

boundary, assurance, product family, data age

Stewardship records

collection, sorting, processing, cost and residual route

Waste classification

analysis and jurisdictional route

Sludge records

wet mass, dry solids, chemistry, route

Manifests/certificates

transport, treatment, recovery or disposal evidence

PCF/LCA support

functional unit, allocation, supplier data, review

Correction log

source corrections and updated disclosures

Watch area	Why it matters
TSCA inventory and reporting	substance data and U.S. chemical compliance context
REACH/CLP	EU substance classification and hazard communication
TiO2 trade remedies	pigment sourcing and cost exposure
VOC rules	solventborne systems and application loss
Wastewater permits	discharge route and source-stream control
Product stewardship laws	end-of-life cost and producer responsibility



Governance principle

Compliance is local. Technical discipline is transferable: classify streams, document routes, reconcile material movement and preserve evidence.

Shared Waste-Carbon Language

How CEPA enables comparison without exposing formulation secrets

CEPA COMMON DATA MODEL

common units + stream codes + product-family denominators + source records + route evidence + confidence levels + boundary notes

Manufacturers

source records;
product-family
denominator

Suppliers

SDS; PCF/LCA; material
profile

Applicators

job card; transfer
efficiency

Labs

chemistry; DS%; COD;
metals; VOC

Waste managers

classification;
manifests; route

Recyclers

outlet evidence; quality
specification

Associations

anonymized
governance

Regulators

local compliance
context

LCA specialists

functional unit and
allocation

Stewardship programs

collection and
processing records

Benchmarking principle

Benchmarking does not require disclosure of proprietary formulation. It requires compatible residual data: common units, source codes, denominators, route evidence, boundary notes and confidence levels.



Coordination logic

Different actors can contribute compatible evidence without revealing proprietary formulation. The common language is units, source codes, boundaries, route evidence and confidence.

Role-Specific Decision Map

How professionals use the brief

Role	First question	First CEPA tool	First action
CEO / Board	where is strategic exposure?	executive intelligence summary	set source-record discipline
COO / Operations	where is margin leaking?	commercial exposure map	require material balance
CFO	what is avoidable cost?	route-cost evidence	quantify loss and treatment burden
Plant manager	which campaign loses most?	M01 + M05	identify highest loss campaign
Technical director	which product families drive loss?	segment loss profile	segment records by product family
Quality manager	what is rework really costing?	M01 disposition	separate reject, rework and downgrade
EHS manager	are routes defensible?	taxonomy + route evidence	verify classification and manifests
Sustainability lead	are claims defensible?	carbon boundary	test claim boundary
Procurement lead	which suppliers create gaps?	supplier confidence	request evidence file
Association executive	what can be benchmarked safely?	minimum dataset	prepare anonymized dataset



Use principle

Different roles need different entry points, but all credible decisions return to the same record base: reduce, segregate, recover, substitute, classify, benchmark or redesign.

Technical Recommendations

A 30/60/90-day path for benchmark-ready waste-carbon control

Timeframe	Measurable action	Output
0-30 days	Build source-record map; identify product-family denominators; assign owners; start off-spec disposition tracking	source-aware record architecture
31-60 days	Add source wastewater logs; test sludge DS%; reconcile solvent; define packaging residue threshold; collect route evidence	measured and route-evidenced data
61-90 days	Build internal trend dashboard; classify readiness; test claim boundaries; request supplier evidence; identify top recovery candidates	internal trend-ready control pack
90+ days	Submit anonymized benchmark dataset; participate in CEPA working groups; update source corrections	benchmark pathway and sector intelligence

MEASURE

campaign-level material balances; source wastewater; wet/dry sludge; solvent reconciliation

CONTROL

off-spec disposition; packaging thresholds; application boundary; campaign sequencing

VERIFY

supplier data; route evidence; claim boundary; public disclosure caveats

PARTICIPATE

anonymized benchmarking; working groups; structured assessments; corrections



Final technical position

Waste-carbon intelligence is built from records, not claims. The strongest metric is the one a facility can define, evidence, reproduce and improve.

Source Register & Evidence Caveats

Audit trail for factual claims and CEPA interpretations

Code	Source / use	Evidence class and caveat
R01	WCC / ACA / ChemQuest - Global Market Analysis 2024-2029; market scale and segmentation	Estimated; market context, not waste/carbon total
R02	US EPA - Paint Formulating Effluent Guidelines; batch production and wastewater logic	Documented; U.S. technical/regulatory context
R03	eCFR - 40 CFR Part 446; paint subcategory scope	Documented; U.S. regulatory scope only
R04	US EPA development document; wastewater constituents and route logic	Documented; technical context, not universal benchmark
R05	US EPA AP-42; VOC estimation and material balance	Documented; estimation requires boundary clarity
R06	GHG Protocol Scope 3 Standard; value-chain boundary and category coverage	Documented; scope coverage varies
R07	ISO 14040 / 14044; LCA goal/scope, inventory and reporting	Documented; standard access limits detail
R08	ISO 14067:2018; product carbon footprint requirements	Documented; PCF must align to boundary
R09	CEPE LCI Project; coatings/inks inventory precedent	Documented; precedent, not CEPA benchmark
R10	BCF Coatings Care Programme; sector KPI benchmark precedent	Reported; association scope-specific
R11	PaintCare reports; collection network, gallons and program records	Reported; jurisdiction-specific program data
R12	Paintback publications; unwanted paint and packaging collected/treated	Reported; Australia program-specific
R13	ZDHC wastewater and sludge guidance; wet-processing discipline	Documented; textile wet-processing context
R14-R18	Company annual/sustainability reports: AkzoNobel, PPG, Sherwin-Williams, Nippon Paint, Axalta	Reported; directional, not cross-company benchmark
R19-R22	ACC, Cefic, TSCA/EPA and trade-remedy sources; broader chemistry/regulatory/trade context	Documented/Reported; not coatings-only unless stated
R23	Global Color Chemicals Industry Report supplied to CEPA production	Reported/Estimated; source-level caveats retained
R24	CEPA control specification; metric, confidence and benchmarking definitions	Recommended; CEPA framework, not regulatory standard



Evidence rule

Company disclosures, market figures and stewardship statistics are directional unless boundaries, baselines, denominators, assurance status and comparability conditions are clear. CEPA frameworks are technical control specifications, not regulatory classifications or universal industry benchmarks.

Participate in CEPA Technical Intelligence Development

Color & Chemicals Industry Edition | Issue 001 | 5 July 2026

Document Code: CEPA-TIB-COLCHEM-001-20260705

1

Submit technical observations

field evidence, process lessons and source corrections

2

Contribute anonymized benchmark data

use the minimum dataset and confidence levels

3

Join technical working groups

wastewater, sludge, solvent, packaging, application and LCA

4

Request structured assessment pathways

facility-level waste, carbon and resource-value diagnostics

5

Submit corrections

updated disclosures, source corrections and technical clarifications

6

Nominate priority waste streams

identify high-value streams for future CEPA analysis

7

Propose regional benchmark cohorts

define comparable facilities, product families and reporting periods



Scan for CEPA resources

Verified target:
<https://etersolis.com>

Correction policy: CEPA welcomes source corrections, updated disclosures and technical clarifications for future editions.

The next standard of waste-carbon intelligence will be built from comparable records, route evidence, source corrections and disciplined technical participation - not broad claims.

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