Material Eligibility at the Crediting Boundary: A Comparative Framework for Plastic Classification, Activity Eligibility and Evidence-Based Decision-Making

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ABSTRACT

A facility receiving mixed plastic waste must decide which part of that waste can generate credits. The decision turns on programme rules rather than on the material, and this study quantifies how far those rules diverge. Eligibility requirements were compared at clause level across the Verra Plastic Waste Reduction Standard, the Ocean Bound Plastic suite, the PCX Solutions Plastic Pollution Reduction Standard and the Circular Credits Mechanism, then encoded as decision functions and applied to a factorial space of 7,200 material descriptions varying polymer, source location, contamination, commercial recyclability, origin, destination, collection context and cross-border movement. The programmes judged 36.7 per cent, 28 per cent, 30 per cent and 6.2 per cent of descriptions eligible respectively, agreed unanimously on 22.5 per cent and directly contradicted one another on 57.7 per cent. Destination dominates divergence with a spread of 1.00; contamination has a spread of exactly zero and polymer of 0.030, because no programme makes contamination a ground of ineligibility and only one makes any polymer-level distinction. The two properties a facility can measure at the bay are therefore the two that carry least information about whether material is creditable; eligibility is settled by provenance, collection context and fate, which live in records. The Circular Credits Mechanism is the narrowest at 6.2 per cent, because it admits only municipal solid waste, requires collection and disposal in the same country, and will not credit a service already contracted and paid for. Two earlier readings did not survive audit and are withdrawn: a coded exclusion of post-industrial material under Verra and OBP for which no clause exists, and a blanket reading of OBP's adequate-collection exclusion that applied it to beach litter and fishing by-catch as well as to district collection. Three of the ten interpretive choices were re-run under the alternative reading a reader is most likely to prefer. Two change magnitudes without changing the ordering; reading Verra strictly on transboundary movement and landfill moves it from the most permissive of the four to the third, so the ranking is conditional on that reading while the divergence itself is not. The study sets out in full the decision model, a classification framework and a procedure for recording uncertain classifications.

Keywords: material eligibility, plastic classification, polymer, contamination, end-of-waste, crediting boundary, decision tree

INTRODUCTION

A material recovery facility receives mixed plastic. Some of it will generate credits and some will not, and the sorter at the receiving bay has to know which. That decision is not primarily a materials-science question. It turns on where the material came from, who handled it, whether it already has commercial value, and where it is going, and those are questions answered by a programme's rules rather than by the polymer.

Operationally this creates a specific difficulty. Collection records describe material in the terms the collector uses, which is often one word. A load described as plastic may contain six polymers at three contamination levels from two sources, and the eligibility of the load is not the eligibility of any one of them. Where the description is coarser than the rule, the rule cannot be applied without additional evidence, and the honest answer is that eligibility is undetermined rather than that it is yes or no.

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The comparative difficulty is sharper. Programmes use overlapping vocabulary for non-overlapping categories. Two programmes may both speak of post-consumer plastic and mean different things, and a material description sufficient for one may be insufficient for another. A project moving between programmes, or a buyer comparing credits from two, is comparing classifications that were made under different rules.

This study makes no claim about sorting accuracy in operating facilities, which would require sampling and laboratory analysis. It establishes what each programme's documents require, encodes those requirements as decision functions, and applies all four to identical material descriptions so that divergence can be measured rather than asserted.

The contributions are a clause-level comparison of material and activity eligibility; a classification framework linking description, source, condition, activity and destination to the evidence each programme requires; a decision experiment over 7,200 material descriptions quantifying where the four diverge and which attributes drive it; and a procedure for recording classifications that cannot yet be resolved.

ELIGIBILITY REQUIREMENTS ACROSS THE FOUR PROGRAMMES

Table 1: Material and activity eligibility compared at clause level

Eligibility dimension	Verra	OBP	PCX	CCM
Primary axis	Resin type and activity	Abandonment, distance from water and commercial value	End-of-Waste outcome	Waste stream
Polymer restriction	Seven resin types plus composites, the seventh an open catch-all	Any polymer	Seven resin types plus an open category	Plastic within municipal solid waste
Geographic criterion	Transboundary movement excluded save on an LDC or SIDS pathway	Three distance-based categories plus fishing bycatch, with a waterways exception beyond 50 km	A 50 km ocean-bound definition, definitional rather than a gate	Same-country collection and disposal
Contamination limit	Dry weight net of non-plastics	Best efforts, no numeric limit	None located	None located
Commercially recyclable material	Eligible	Collectable but not creditable	Eligible	Eligible
Post-industrial material	No provision located	No provision located	Expressly excluded	Excluded by the MSW definition
Aggregation alone sufficient	No, end destination required	No, Approved Treatment required	Expressly insufficient	No, appropriate destination required
Landfill as a destination	Permitted on ten criteria, three waivable only where a compliant landfill is shown not to be reasonably accessible and a phase-out plan is established	Approved Treatment only, on four criteria	No provision in Version 8; Version 7 permitted a vetted sanitary landfill [4]	Lowest tier; must improve on the original destination
Subtype categorisation required	By material type	By OBP category	By input type	Yes, expressly

Waste generated to be collected	Expressly excluded	No eligibility provision located	No eligibility provision located; the nearest analogue sits under additionality	No eligibility provision located
Abandonment or inadequate collection	Not a criterion	The operative gate: excluded where collection is adequate	Not a criterion	Auditing Protocol Principle 2: no credits where the service is already contracted and paid for

Table 1 sets out the comparison. The four define eligibility on different axes, which is why the same material can qualify under one and not another.

Verra [6], [7], [8] defines eligibility by resin type and by activity. Seven resin types plus composites are in scope, and the credited activities are collection and recycling to an appropriate end destination, with a closed list of what counts as appropriate and ten cumulative criteria a landfill must satisfy. Reduction and reuse are outside scope. One exclusion is unusual and worth noting: projects "that can reasonably be assumed to have generated plastic waste primarily for the purpose of its subsequent collection and/or recycling" are excluded, which addresses a perverse incentive the other programmes leave unaddressed.

OBP [11], [9] defines eligibility by geography and by commercial value, and is indifferent to polymer. Three of its four categories are set by distance: material within fifty kilometres of a shoreline is Potential OBP; material within two hundred metres landward of the highest tide limit and one hundred metres seaward of the lowest is Shoreline OBP; material within two hundred metres of either bank of a watercourse is Waterways OBP; and fishing bycatch is the fourth, defined by activity rather than distance. The distances are softer than they look: seasonal riverbeds are measured at their largest extent, and because the limits are hard to fix precisely where there is seasonal variation an auditor accepts limit positions within a tolerance of fifty metres, while Waterways OBP "can be collected further away than 50km from coasts as long as the river concerned is directly, or indirectly through its main stem, reaching the ocean at the end of its course". Any polymer qualifies; metal, wood, glass, laminated beverage cartons and sand do not. The second axis is commercial: material classified as Commercially Recyclable may be collected and sold but "this weight will not be accounted for issuing OBP Credits", because it "already has an economical value and a market" [10].

A boundary discrepancy within OBP should be recorded. The Potential OBP category is defined by a fifty kilometre distance from shore, while a separate provision allows purchase from independent collectors only where the purchasing location is within forty-five kilometres of the shoreline. The two clauses govern different objects, where material may lie and where it may be bought, and the documents read do not reconcile the two distances.

PCX [5] defines eligibility by outcome rather than by material. Its operative concept is End-of-Waste, which the standard itself derives from the EU Waste Framework Directive, and its clearest exclusion follows from it: "aggregation… by itself is insufficient to generate a plastic credit". A consignment that is collected, baled and sold onward without being processed to an End-of-Waste outcome does not qualify however clean or well-sorted it is.

CCM [2], [1] defines eligibility by waste stream. Its scope rule is expressed twice, and not identically: the standard applies to all non-hazardous solid waste except construction waste, recyclable or not, and separately only to projects involving municipal solid waste, whose definition excludes industrial waste, hazardous waste and by-products. It requires subtype categorisation rather than generic description, giving the distinction between BOPP and PET as its worked example, and the stated purpose is to prevent credits being issued

against an undifferentiated plastic category. Collection and disposal must occur in the same country, and treatment and recycling are expressly outside the credited activity.

METHODOLOGY

Each programme's eligibility rules were encoded as a decision function returning one of three verdicts. ELIGIBLE and INELIGIBLE are the programme's own determinations. INDETERMINATE records that the rules require information the material description does not carry, so that eligibility cannot be settled without further evidence. Retaining the third verdict rather than forcing a binary is the point: in operation, the common case is not that material is ineligible but that the description is insufficient to say.

Eight attributes were varied, each chosen because at least one programme's rules turn on it: polymer, across six types; source location, across four distance bands from shoreline to inland beyond fifty kilometres plus fishing bycatch, which OBP defines by activity rather than by distance; contamination, at three levels; commercial recyclability; origin, post-consumer or post-industrial; destination, across five outcomes including unconfirmed; collection context, whether the surrounding area is adequately or inadequately served by a collection service; and movement, domestic or cross-border. The last two were added after an audit of an earlier version found that OBP's operative gate — abandonment — and the transboundary rules in Verra and CCM were absent from the design. The full factorial is 7,200 distinct material descriptions.

The encoding reflects one reading of each programme’s clauses and is set out in full so that an alternative reading can be substituted and the analysis re-run. Ten interpretive choices carry weight and are disclosed rather than left in the code: four concerning scope and destination, set out immediately below; four made in response to audit, set out after them; and two recorded with the limitations. Verra and OBP are coded with no restriction on consumer or industrial origin, because none was located: the terms post-consumer and post-industrial appear nowhere in either corpus, and Verra's scope clause is expressed in resin types. A compliant landfill is coded eligible for Verra, because the description stipulates compliance and Verra's criteria define when a landfill is an appropriate destination. For PCX the same destination is coded indeterminate, because Version 8 states no landfill rule and Version 7 [4] expressly permitted a vetted sanitary landfill. OBP material arising inland beyond fifty kilometres is coded indeterminate rather than ineligible, because Waterways OBP may qualify at any distance where the river reaches the ocean.

Four further choices were made in response to audit and are set out for the same reason. OBP’s exclusion of material arising where district collection is adequate is applied only to the two source levels at which material is gathered from a district, and not to beach litter, waterway material or fishing bycatch: the Excluded list speaks of fluxes from the public collection service and of purchases from independent collectors, while the Included list carries no adequacy qualifier for the recovery categories. A reader who takes the exclusion to be general will find OBP admitting a good deal less. CCM’s requirement that a destination improve on the original destination needs a word of explanation, because a material description carries the credited destination and not the original one. The test is applied here where the credited destination is a compliant landfill, landfill being the bottom tier of CCM’s own hierarchy and so the one case in which improvement on whatever would otherwise have happened cannot be presumed. Read widely, the test reaches every destination, since no description states the counterfactual, and CCM’s eligible share falls to zero; that outcome is a reason to doubt the wider reading rather than to adopt it, but the narrower reading is a choice and not the clause. Verra’s transboundary rule is applied to every cross-border description, although the clause relied on governs collection and PWRM0002 expressly contemplates imported waste for recycling on chain-of-custody evidence; the verdict is indeterminate rather than ineligible for that reason. And a compliant landfill stipulated as meeting Verra’s ten criteria is read as satisfying OBP’s four Approved Treatment criteria, which are different criteria; nothing in the description settles the OBP test, and a stricter reading would return indeterminate.

Three constraints on interpretation follow. The factorial space is uniform, so every description carries equal weight including combinations that are rare in practice; the shares reported are properties of the rule sets rather than estimates of real material flows. The attributes are those the rules turn on, so a programme is never penalised for an attribute it does not consider, but equally a programme's rule cannot register unless an

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attribute represents it. Contamination is the exception to that principle: it is included not because a rule turns on it but because the belief that one does is widespread, and the null result is reported as such. Even there the attribute reaches eligibility indirectly, since OBP's definition of non-commercially-recyclable material lists material that is too damaged or contaminated among the grounds, so contamination can move a consignment across the commercial axis without being a ground of ineligibility in its own right. And the experiment measures classification divergence, not sorting accuracy: it assumes the description is correct and asks what the rules make of it.

The space is enumerated exhaustively rather than sampled, so every quantity below is an exact count over it and carries no sampling error. The eligible share of a programme, the unanimity rate and the direct-conflict rate are

$$e_p = \frac{1}{N}\sum_{x=1}^{N} 1\left[f_p(x) = \text{eligible}\right] \tag{1}$$

$$U = \frac{1}{N}\sum_{x=1}^{N} 1[\text{all four verdicts equal}] \tag{2}$$

$$K = \frac{1}{N}\sum_{x=1}^{N} 1[\text{some pair returns eligible and ineligible}] \tag{3}$$

where

N = number of material descriptions in the factorial space, here 7,200

$f_p(x)$ = verdict programme p's encoded rule returns on description x

e_p = share of the space programme p judges eligible

U = share on which all four return the same verdict

K = share on which one programme returns eligible and another ineligible, which is the strong case rather than a difference between a verdict and a referral

$1[\cdot]$ = indicator function, one where the bracketed condition holds

The influence of a material property is the spread of the disagreement rate across its own levels, and is reported with the results below:

$$S_a = \max g_{a,l} - \min g_{a,l} \tag{4}$$

where

$g_{a,l}$ = share of descriptions at level l of property a on which the four do not all agree

S_a = spread for property a; a spread of zero means no programme's rule reads that property at all

A Worked Example

One description carried through all four rules makes the decision model easier to follow than the aggregate counts do. Table 2 states the description and Table 3 the verdict each programme returns on it.

The example is chosen because the four verdicts are not the same and two of them are indeterminate, which is the case the three-verdict design exists to represent. The material is ordinary: post-consumer plastic, moderately contaminated, not commercially recyclable, collected within fifty kilometres of the shore in a district whose collection service is inadequate, moved domestically, and sent to mechanical recycling. Two programmes credit it. Two cannot say, and for the same underlying reason: the description states that the stream is mixed and unsorted, and both Verra and CCM require a sorting or categorisation step that a

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description in those terms does not settle. Neither returns ineligible, because nothing in the description offends either rule book; what is missing is information, not compliance. A binary design would have to force both verdicts one way or the other, and either choice would be a finding the evidence does not support.

Table 2: A single material description carried through all four rule sets

Attribute of the description	Value
Polymer	mixed, unsorted
Source	within 50 km of the shore
Contamination	moderate
Commercial recyclability	not commercially recyclable
Origin	post-consumer
Destination	mechanical recycling
Collection context	district collection inadequate
Movement	domestic

Table 3: Verdict each programme returns on the description in Table 2

Programme	Verdict	Clause that settles it, or that does not
Verra	Indeterminate	the description stipulates mixed unsorted material, and PWRM0002 AC4 requires the stream to be sorted before it enters the recycling process; the description does not settle whether that occurred
OBP	Eligible	the material is not commercially recyclable, arises where district collection is inadequate, and reaches an Approved Treatment
PCX	Eligible	the material is post-consumer and reaches an End-of-Waste outcome
CCM	Indeterminate	the subtype categorisation the standard requires cannot be performed on a stream described only as mixed and unsorted

RESULTS

Applying the four encoded rule sets to the same 7,200 material descriptions gives eligible shares of 36.7 per cent for Verra, 30 per cent for PCX, 28 per cent for OBP and 6.2 per cent for CCM. Table 4 reports the full distributions. All four return indeterminate verdicts, and the reason differs in each case: for Verra the transboundary condition, for OBP the waterways exception to the distance rule, for PCX the landfill silence in Version 8, and for CCM the subtype requirement and the improvement-on-destination test.

The four return the same verdict on 22.5 per cent of descriptions and directly contradict one another on 57.7 per cent. Pairwise agreement ranges from 0.69 for PCX against CCM down to 0.27 for Verra against CCM. Eligibility is plainly not the harmonised dimension it might be expected to be. An earlier version of this study reported much higher agreement, and that result did not survive audit: it rested on a coded rule excluding post-industrial material under Verra and OBP, for which no clause exists.

Table 5 ranks the attributes by their influence on cross-programme disagreement. Destination dominates at a spread of 1.00, which is unsurprising: an unconfirmed destination makes material ineligible under all four, and the four diverge on landfill. Commercial recyclability, origin, collection context and movement follow at 0.05 each, source location at 0.031 and polymer at 0.030.

Contamination has a spread of exactly zero, which is a restatement of the clause-level finding rather than a test of it: no programme’s rules read the attribute, so a factorial over it cannot produce anything else. The consequence is nonetheless worth drawing out. Changing a consignment from clean to heavily contaminated never changes whether the four programmes agree, because none of them makes contamination a ground of

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ineligibility. Verra nets out non-plastic substances through its dry-weight rule, which adjusts the credited quantity rather than the eligibility of the material; OBP imposes a best-efforts separation duty with no numeric limit; PCX and CCM state nothing. The property a facility can most readily measure at the bay, and the one that most affects whether a load is worth processing, carries no information about whether it is creditable.

Polymer is nearly as uninformative, at a spread of 0.030, and the small non-zero value comes from one programme only. CCM requires subtype categorisation, giving the distinction between BOPP and PET as its worked example, so that material is not credited against an undifferentiated plastic category. No other programme draws a polymer-level distinction that the others do not also draw; Verra's seven resin types and PCX's equivalent list both end in an open catch-all category, so neither operates as a real restriction.

The operational consequence stands whichever of the two attributes is considered. A sorter cannot determine eligibility by looking at the material. Eligibility is determined by where the consignment came from, whether the surrounding area has a working collection service, whether the material already had a buyer, whether it crossed a border and where it is going. All of those are known to the records rather than to the bay, and a facility that organises eligibility screening around polymer identification and visual contamination assessment is screening on the two attributes that discriminate least.

OBP admits 28 per cent of the space, and its restrictiveness has two causes of very unequal weight in this design. The first is the exclusion of commercially recyclable material from credit issuance: such material is in scope, may be collected, and may be sold, but cannot generate a credit because it already commands a market. The second is the abandonment gate, which excludes material arising where district collection is adequate. The first is by far the larger. Removing it from the model raises OBP from 2016 eligible cases to 4608, whereas removing the abandonment gate raises it only to 2880. The abandonment gate is small here because, on the route-specific reading adopted in the methodology, it reaches only the two source levels at which material is gathered from a district rather than recovered from a beach, a waterway or a fishing boat.

Both are instances of additionality-like reasoning operating inside an eligibility rule, and of the two only the abandonment gate has a counterpart. CCM's auditing protocol provides that credits cannot be issued for activities where the service "has already been contracted and paid for" [1], giving municipal waste collection as the example, and its definition of a circular credit reaches waste "originally inappropriately discarded". That is materially the same gate OBP expresses as abandonment, and it is encoded for CCM as well. It is one of three gates — with the municipal-solid-waste origin rule and the same-country rule — that each independently halve CCM's eligible set, and together they are why CCM admits less of the space than any other programme. The exclusion of commercially recyclable material has no counterpart in the other three, though CCM's subtype rule and its guidance that credit price should rise as material becomes harder to manage, both point in the same direction.

Table 4: Eligibility verdicts returned by each programme

Programme	Eligible	Ineligible	Indeterminate	Eligible share
Verra	2640	1440	3120	36.7 per cent
OBP	2016	4896	288	28 per cent
PCX	2160	4320	720	30 per cent
CCM	450	6480	270	6.2 per cent

Table 5: Material attributes ranked by influence on cross-programme disagreement

Material attribute	Spread in cross-programme disagreement
Destination	1.000
Commercial	0.050

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Origin	0.050
Collection Context	0.050
Movement	0.050
Source	0.031
Polymer	0.030
Contamination	0.000

Sensitivity to the Interpretive Choices

The encoding is one reading, and the result of a reading is worth only as much as the reading is secure. Three of the ten interpretive choices were re-run under the alternative reading that a reader is most likely to prefer, each on its own so that its effect can be attributed. Table 6 reports all three against the base encoding.

The first alternative reads Verra strictly. The transboundary applicability condition is treated as an exclusion rather than as a condition the LDC or SIDS pathway might satisfy, and the ten landfill criteria, three of which are waivable, are treated as requiring information that a material description cannot supply. The second reads OBP's excluded-flux list generally, so that the adequate-collection exclusion reaches beach litter, waterway material and fishing bycatch and not only the district-collection routes. The third reads CCM's improvement-on-destination requirement widely, applying it to every destination rather than to landfill alone.

The second and third alternatives change magnitudes without changing the ordering. Reading OBP's exclusion generally cuts its eligible share from 28.0 to 16.0 per cent, and reading CCM's improvement test widely drives CCM's eligible share to zero, since no description carries the counterfactual the test needs. In both cases the programme moves down but the four remain in the same order, and the direct-conflict rate moves by no more than four points.

The first alternative does change the ordering, and that is the finding of this section. Read strictly, Verra admits 26.7 per cent of the space rather than 36.7, which moves it from the most permissive of the four to the third of four, behind PCX and OBP. Unanimity rises from 22.5 to 34.8 per cent and direct conflict falls from 57.7 to 51.4 per cent, because a strict Verra agrees with the others more often than a permissive one does. The ranking of programmes by permissiveness is therefore not robust to how Verra's transboundary and landfill clauses are read, and any statement that Verra is the most permissive of the four should be read as conditional on the base encoding rather than as a property of the rule sets.

Two results survive all three readings. CCM is the most restrictive of the four under every encoding tried, by a margin no single reading closes. And the four disagree far more than they agree under every encoding tried: unanimity never exceeds 34.8 per cent and direct conflict never falls below 51.4 per cent. The divergence this paper reports is a property of the rule sets and not an artefact of how they were read; the ordering within that divergence is not.

Table 6: Eligible share, unanimity and direct conflict under three alternative readings, per cent

Reading	Verra	OBP	PCX	CCM	Unanimous	Conflict
Base encoding	36.7	28	30	6.2	22.5	57.7
Verra read strictly on transboundary movement and landfill	26.7	28	30	6.2	34.8	51.4
OBP adequate-collection exclusion read generally	36.7	16	30	6.2	22.5	53.7
CCM improvement-on-destination test read widely	36.7	28	30	0	20	57.7

A Classification Framework

The comparison supports a classification framework organised by the attributes that actually determine eligibility rather than by polymer. Seven questions settle it for all four programmes, and they should be answered in this order because each can terminate the assessment.

First, destination: is an appropriate end destination confirmed? An unconfirmed destination is disqualifying under all four, and destination is the only attribute on which they agree completely; it is also the largest single block of ineligible descriptions in the experiment. Second, collection context: did the material arise where waste collection is already adequate, or has the recovery service already been contracted and paid for? This is OBP's abandonment gate and CCM's free-riding bar, and between them they govern half the space. Third, origin: is the material post-consumer? PCX excludes post-industrial material expressly and CCM excludes it through the municipal solid waste definition; no equivalent clause was located for Verra or OBP, and an earlier version of this framework wrongly stated that all four exclude it. Fourth, movement: does the material cross a border between collection and disposal? Verra's collection methodology is inapplicable to transboundary movement outside a narrow exception, and CCM requires collection and disposal in the same country. Fifth, provenance against the programme's geographic rule, which matters for OBP's distance categories. Sixth, commercial status, which matters only for OBP. Seventh, subtype categorisation sufficient for the programme's reporting, which CCM requires expressly and the others require implicitly through their material-type reporting.

Contamination appears nowhere in that sequence as a disqualifier, which reflects the documents rather than good practice. Only Verra addresses it substantively, through the dry-weight rule that nets out non-plastic substances, and that operates on the quantity rather than on eligibility. OBP handles it by best efforts with no numeric limit. Neither PCX nor CCM states a contamination rule. A heavily contaminated load is therefore eligible under all four programmes, with only its weighed quantity affected, and that under Verra alone.

Recording Unresolved Classifications

Classification decisions that cannot be resolved need to be recorded as such rather than forced. The experiment returns indeterminate verdicts under all four programmes, ranging from 3.8 per cent of cases under CCM to 43.3 per cent under Verra. Verra's block has two sources rather than one: 2,880 of its 3,120 indeterminate descriptions are cross-border, and the remaining 240 are domestic descriptions of mixed unsorted material bound for a recycling process, which the sorting condition of PWRM0002 does not settle. In operation the proportion would be higher still, because real descriptions carry less information than the synthetic ones used here.

The following four fields are sufficient to record an unresolved classification without pretending to resolve it: the attribute that is missing, the programme rule that requires it, the evidence that would settle it, and the provisional treatment applied pending that evidence. Recording the provisional treatment matters most, because a consignment held as unresolved still has to be physically handled, and the handling decision should not silently become the classification decision.

Two practices follow. A consignment whose classification is unresolved should not be aggregated with resolved material before the question is settled, since aggregation destroys the information needed to settle it. And where a provisional classification is later corrected, the correction should carry a reference to the original. No provision requiring such a reference was located in any of the four corpora.

LIMITATIONS

The experiment encodes rules and applies them to synthetic descriptions. It measures divergence between rule sets, not sorting accuracy, misclassification rates in operating facilities, or how often each material description arises. The percentages describe the rule space under a uniform factorial weighting and should not be read as shares of real material flow.

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The encoding is one reading of each programme's clauses. Eight of the ten choices that carry real weight are set out in the methodology; the remaining two are recorded here. The first is that material which is in scope but not creditable — the case of OBP's commercially recyclable category — is treated as ineligible. That coding follows the question the study asks, which is whether a credit may be issued against the material and not whether the material may be collected; coding such material eligible would count tonnes that OBP expressly refuses to credit, and would raise OBP's eligible share while describing no credit that could actually be issued. The second is that CCM's subtype requirement is coded on polymer rather than on contamination; an earlier version coded it on contamination, which produced the opposite ranking of those two attributes and was wrong. A reader preferring a different treatment of any of the ten can substitute it in the model, and the sensitivity analysis above shows what three such substitutions are worth.

Three attributes that matter in practice are not modelled, because no programme's rules turn on them in a form a material description could record: the moisture content of the load, the proportion of a mixed load attributable to each polymer, and the presence of material outside the plastic scope altogether. The first two affect quantity rather than eligibility; the third describes material that every programme excludes, and would add no divergence.

Absence claims are stated as no provision located, and that phrasing is meant literally: it records that a search of the operative instruments did not find a provision, not that no provision exists. A programme may address a question in guidance, in template wording, in an audit checklist or in unpublished practice that this reading did not reach, and none of the absence claims here should be read as proof of absence. A small number of entries in Table 1 read instead as not a criterion, which is a different claim: it records that the programme’s rules are built on other attributes, which is visible from the clauses that are present rather than inferred from clauses that are not. The OBP distance discrepancy between fifty and forty-five kilometres is reported as the documents state it and is not resolved here; a programme clarification would settle it. The PCX landfill position turns on a provision present in Version 7 and absent from Version 8, so a reader working from the earlier edition would reach a different conclusion.

Finally, the study assesses rules, not practice. Whether facilities classify material as their programmes require, and whether verifiers test classifications, require sorting records and laboratory results that are not public.

CONCLUSION

This study compared material and activity eligibility across four plastic credit programmes and applied the encoded rules to 7,200 identical material descriptions.

The four define eligibility on different axes: Verra by resin type and activity, OBP by abandonment, distance from water and commercial value, PCX by whether an End-of-Waste outcome is reached, and CCM by waste stream with mandatory subtype categorisation. They judged 36.7 per cent, 28 per cent, 30 per cent and 6.2 per cent of descriptions eligible, agreed unanimously on 22.5 per cent and contradicted one another on 57.7 per cent. Eligibility is not the harmonised dimension it is often assumed to be.

Destination dominates divergence. Contamination has a spread of exactly zero and polymer almost none, because no programme makes contamination a ground of ineligibility and only CCM makes a polymer-level distinction. The physical identity and visible condition of the material therefore carry almost no cross-programme information; eligibility is settled by provenance, collection context, prior market value, border crossing and fate, all of which live in records rather than in the material. A facility screening eligibility at the bay is screening on the wrong attributes.

The Circular Credits Mechanism is the narrowest programme, admitting municipal solid waste only, requiring collection and disposal in the same country, and refusing credits where the recovery service has already been contracted and paid for. OBP is the next narrowest, and for a different reason: commercially recyclable material cannot generate credits even though it may be collected and sold, which imports additionality reasoning into an eligibility rule. The decision model, the classification framework and the procedure for recording unresolved classifications are set out in full so that each can be applied and contested.

Two of those findings survive every alternative reading tried, and one does not. The Circular Credits Mechanism is the most restrictive of the four under all three alternatives, and the four disagree far more than they agree under all three. The ordering of the other three programmes is not robust: read strictly on transboundary movement and landfill, Verra falls from the most permissive to the third of four. A comparison of this kind therefore supports a claim about how far apart the rule sets are, which is what the paper argues, and does not support a ranking of programmes by permissiveness, which it declines to assert.

Declarations

Declaration on the use of artificial intelligence [3]. In preparing this manuscript the author used a generative artificial intelligence assistant (Anthropic Claude) to support the structured coding of programme documents, the implementation and checking of the analysis described in the methodology, the drafting of text and the formatting of the manuscript. The research design, the selection of source documents, the interpretation of the coded results and all substantive conclusions are the author's own. The author reviewed and verified the content of the manuscript, including every quantitative result and every cited source, and takes full responsibility for its accuracy and integrity. No artificial intelligence tool is listed as an author, in accordance with COPE guidance on authorship and artificial intelligence [3].

Declaration of competing interests. The author declares no financial or non-financial competing interests in relation to the plastic credit programmes examined in this study. The author is not affiliated with, funded by, or contracted to Verra, the Ocean Bound Plastic Certification Programme, PCX Solutions or the Circular Credits Mechanism.

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Ethics statement. This study analyses publicly available programme documentation only. It involves no human participants, no personal data and no primary data collection, and therefore did not require ethical approval.

Data availability. All programme documents analysed are publicly available from the respective programme websites cited in the references. The coding protocol and every parameter value governing the reported results are stated in the methodology. The procedure has no stochastic component: it is an exhaustive enumeration evaluated in closed form, so it uses no random number generator and no seed, and the reported figures follow deterministically from the stated parameters. No data repository accompanies this article; the author's own scripts are available on request.

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