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1.0 Definitions

2.0 Regulatory Definitions

“battery” means a product that,

(a) is a container consisting of one or more voltaic or galvanic cells, in which chemical energy is stored as electricity or converted into electricity and used as a source of power; and

(b) weighs five kilograms or less.

“primary battery”, means a battery that can be used only once (i.e., a single-use battery).

“rechargeable battery” means a battery that can be recharged to be used more than once.

“battery processor” means a person who processes, for the purpose of resource recovery, primary and/or rechargeable batteries used by a consumer in Ontario.

“recycling efficiency rate” (RER), means the ratio of the weight of resources recovered from batteries received by a battery processor, to the weight of batteries received by that battery processor.

3.0 Additional Definitions and Terminology for the Purpose of the Procedure

"designated batteries” are batteries, as defined in the regulation and reiterated above, to which the regulation applies. To be considered designated, batteries also must have been used by a consumer in Ontario.

“downstream processor” is a person or facility that receives recoverable resources that were generated from batteries used and collected in Ontario from a battery processor for the purpose of further processing. All processing activities are considered in scope of this definition, until the resources can be considered a recovered resource.

“preparing for processing” are activities that are carried out prior to processing batteries, including sorting, blending, mixing, and repackaging. A person who only prepares materials for processing would not be considered a battery processor.

“primary processor” is the first person/facility that receives batteries used and collected in Ontario and processes these.

“processing” are activities that alter the characteristics of materials derived from batteries for the purpose of resource recovery.

“recoverable resource” is understood as a resource derived from batteries that is sent downstream to be further processed.

“recovered resource” is understood as a resource derived from batteries that will not undergo further refining, and is used as a new product, or as a material in the manufacturing of a new product.

4.0
Examples Of Recoverable and Recovered Resources

Table 1: Examples Of Recoverable and Recovered Resources

Examples of Recoverable Resources	Examples of Recovered Resources
Black mass	Fertilizer (Zinc and Manganese sulphate hydrates and oxide) Coating ingredient Metal production additive
Contaminated or mixed metals sent to a smelter	Steel sent to a smelter for steel production
Shredded plastics sent for further processing	Plastic pellets sent for manufacturing of new products

5.0 Calculation of the RER

All battery processors must determine their RER according to this procedure.

6.0 Methods for Determining the RER

For the determination of the recycling efficiency rate, processors must calculate the RER **through mass balancing** the total weight of materials received and processed during two consecutive quarters of a calendar year in accordance with this procedure. The mass balance calculation must be done annually.

Where a processor cannot determine their RER through mass balancing, they may instead calculate the RER using data generated through a **field test** executed in accordance with this procedure. This could, for example, be the case when a downstream processor does cannot obtain the information required to attribute process performance to a particular primary processor.

The field test must be completed on an interval that is the lowest of the following:

a. Once every three years; or
b. When material changes are made to the recycling process; or
c. When material changes occur in the feedstock.

For any processor opting to use the field test option, it must be demonstrated in the Field Test Report why the processor was unable to confirm their RER through mass balancing.

7.0 General Calculation Guidance

Using either method, the RER must be calculated for each facility separately. If the processor's facility processes both single-use and rechargeable batteries, the RER must be calculated separately for single-use and rechargeable batteries.

All weights used in calculating the RER must be based on measurements using calibrated scales. Scales must be calibrated in accordance with the National Institute of Standards and Technology (NIST) calibration standards.

This procedure recognizes that some batteries that are not designated may be identical in their material composition to designated batteries, and therefore including them in the RER calculation does not impact the RER outcome. Therefore, for the purposes of determining the RER, a processor may include the weight of batteries received and recovered that are not designated under the regulation if their composition is identical to the designated batteries. For example, if a load of batteries received from a source outside Ontario is identical in composition to typical loads received from an Ontario source, the weight can be included in the RER calculation. Similarly, if a battery of more than 5 kg is identical in its composition to one that is less than 5 kg, its weight can be included.

If non-designated materials (NDM) are not identical in composition to designated batteries, their weight must be removed from the total weight received and recovered and be excluded from the RER calculation. For example, electric vehicle lithium-ion batteries are of different composition to designated lithium batteries, as are lead-acid batteries, hence those must remain excluded in the weight.

It is important to remember that non-designated materials cannot be included in producer performance management reporting to the Authority.

8.0
Recycling Efficiency Rate (RER) Calculation Formula

The RER is to be calculated in accordance with the following formula:

(R / (TW + AM)) X 100%

More guidance on the inputs to this calculation will be provided in the "Determination of the weight of batteries received for processing (TW)" and "Determination of the weight of recovered resources (R)" sections of this procedure.

For the mass balancing approach:

R: the weight of the recovered resources derived from all batteries received by the processor in the timeframe specified in this procedure

TW: the total weight of all batteries received by the processor in the timeframe specified in this procedure

AM: the weight of any materials added during processing processor in the timeframe specified in this procedure

For the field test approach for batteries:

R: the weight of the recovered resources derived from all batteries processed through the field test

TW: the total weight of all batteries processed during through the field test

AM: the weight of any materials added during processing

A Mass Balance Template has been developed to be used in parallel with those using the mass balance approach. The template allows processors to conduct a mass balance of all materials that are received, stored, and shipped from their facility in a year to facilitate the calculation of their RER. This calculation is completed at Step 5 of the Mass Balance Template.

9.0
Determination Of the Weight Of Batteries Received For Processing (TW)

The determination of the weight of batteries received for processing (TW) difference between the mass balancing and field test approach.

10.0
Mass Balance Approach

The total weight of batteries received (TW) is considered the total of the weight of batteries sent for processing following the preparation for the processing stage (see **Figure 1** for processing).

The items for the determination of the weight of batteries received for processing are included in the Mass Balance Template at Steps 1, 2 and 3.

11.0
Timeframe

The total weight must be determined for batteries received during a specified timeframe of two subsequent quarters and processed within three (3) months after the end of the specified timeframe.

12.0
Calculation guidance

If the total weight of batteries received is not measured by itself using a calibrated scale, the weight is to be derived using the following formula:

TW = Total weight of received and processed batteries = WI – NDM – Bx – Bnp – Bru – Bf

Where,

TW: Total weight of batteries received and processed during the specified timeframe (including the weight of the electrolyte)
WI: Weight of all inbound materials (including opening inventory, as well as materials received from haulers or batteries received from ITT/AV processors)
NDM: Material not designated under the Regulation (packaging, garbage, moisture, etc.)
Bx: Batteries sent for processing at another facility
Bnp: Batteries stored, meaning received but not processed, within the specified timeframe +3 months. This is the closing inventory of batteries.
Bru: Batteries sent for reuse.
Bf: Batteries sent for refurbishing.

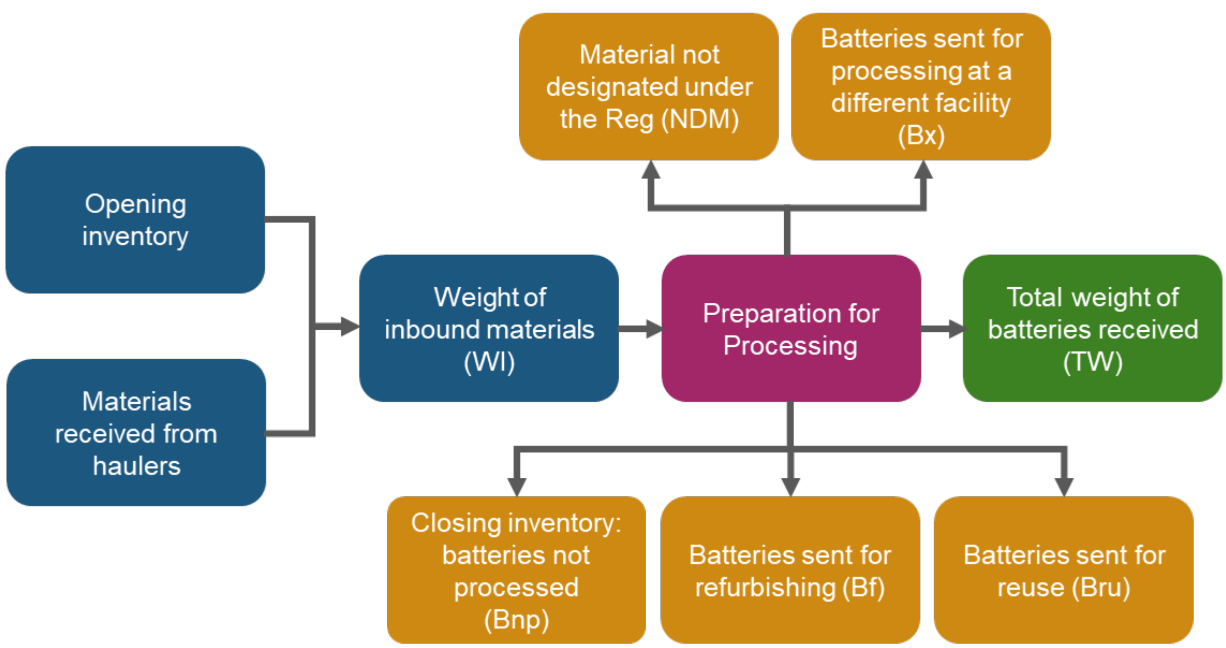

Figure 1: Process Flow Diagram for The Mass Balance Preparation for Processing Stage.

13.0
Field Test Approach

When using the field test method, the total weight (TW) used to calculate the RER will be the weight of the feedstock used to run the field test. The total weight must only include batteries that are designated under the Regulation, or derived from batteries that are designated under the Regulation. Any non-designated materials must be excluded from the field test, except where they are identical in composition to designated materials as explained in the "General Calculation Guidance" section.
See also the guidance on the feedstock composition in the "Field Test Plan" section of this procedure.

14.0
Determination Of the Weight Of Recovered Resources (R)

The determination of the weight of recovered resources is the same when using either the mass balance or field test approach.

Resources can be considered recovered when:

- They are sold for a particular use or for the manufacturing of a product or material; and
- They undergo no further refining.

Figure 2 illustrates the processing stage, with TW as the input. If using the mass balance approach, the items for the determination of the weight of recovered resources are included in the Mass Balance Template at Step 4.

In case any added materials (AMs) are used in the process and are incorporated into, and thus accounted for, in the outbound recoverable or recovered resources, their weight must be included in the calculation of the total weight (TW). Such materials may include reactants and additives. Any materials added to the process, that do not become part of outbound recoverable or recovered resources, such as water used to control the temperature of the process, must not be included in the total weight, nor in the recovered resources and shall remain excluded from the RER calculation.

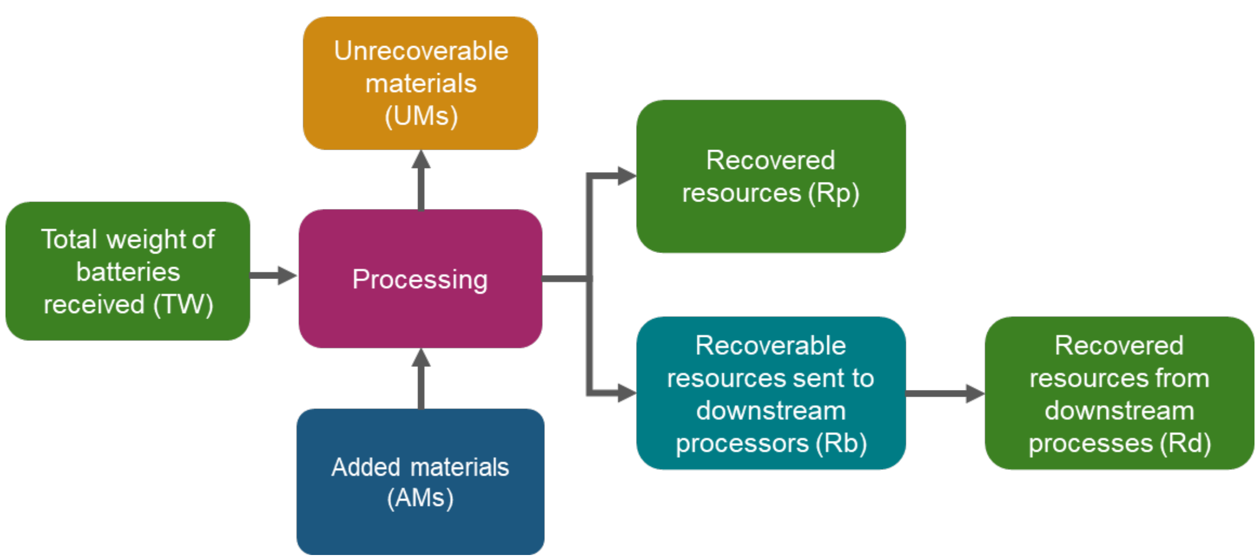

Figure 2: Process Flow Diagram for the Processing Stage

Resources can be recovered by the battery processor, or by a downstream processor. The total weight of recovered resources (R) is to be calculated as the total weight of resources recovered by the battery processor (Rp), in addition to the total weight of recoverable (Rb) outbound materials multiplied by their respective downstream RERs.

Resources can be considered recoverable (Rb) when sent to a downstream processing facility that further processes the material in order to produce a recovered resource.

Unrecoverable materials (UMs) are products from batteries that are not recovered or recoverable resources, and are landfilled, incinerated, used as fuel or fuel supplement, or deposited on land. It may also include process losses. While UMs are not directly used to calculate the recovered resources, they must be accounted for in the mass balance, see step 5 of the mass balance template.

Recovered, recoverable and unrecoverable materials must be summed in groups corresponding to their next processing/disposal destination.

The calculation of R is as follows:

R = Rp + Rd1 + Rd2 + Rd3 + Rd4

Where,

R: Total weight of recovered resources associated with the weight of batteries received for processing (TW) and any added materials (AM)
Rp: weight of recovered resources from the battery processor
Rdi (i=1,2,3,4,...): Weight of recovered resources per downstream processor

For the purpose of this procedure,

Rdi = Rbi x RERdsi (i=1,2,3,4,...)

Where,

Rbi (i=1,2,3,4,…): Weight of recoverable resources sent to the downstream processor
RERdsi (i=1,2,3,4,...): The RER of the downstream processor

For a material to be considered a recovered or recoverable resource, the processor must be able to demonstrate a basis for the allocation of that material into one of these categories. For example: a material that is classified as a recovered resource must be accompanied by proof of sale demonstrating it was provided to a manufacturer of new products, where a recoverable resource would be accompanied by proof of sale or transfer to a downstream processor.

Outbound materials may include:

- Recoverable materials (Rb):
    - Metals that undergo further processing, such as:
        - Aluminum;
        - Copper and copper cobalt;
        - Mixed metals;
        - Iron;
        - Silver;

        - Mercury;
        - Manganese;
        - Lead;
        - Nickel and nickel cobalt;
        - Brass;
        - Steel;
    - Plastics that undergo further processing;
    - Black mass (largely Zinc and Magnesium);
- Recovered resources (Rp);
    - Metals that undergo no further refining, such as:
        - Aluminum;
        - Copper and copper cobalt;
        - Iron;
        - Silver;
        - Mercury;
        - Manganese;
        - Lead;
        - Nickel and nickel cobalt;
        - Brass;
        - Steel;
    - Fertilizer;
    - Coating ingredients;
- Unrecoverable materials (UMs);
    - Unaccounted losses (evaporated water);
    - Materials sent to landfill (including dust and carbon);
    - Materials that are land disposed; and
    - Material sent for energy recovery (incineration, fuel or fuel supplement).

15.0
Determination of the Downstream RER

The downstream RER (RERds) factor is to be determined by each downstream processor using the mass balance approach or field test approach as laid out in this procedure. Where a downstream processor sends materials to a further downstream processor, this section must also be followed for determining the RER of the further downstream processor. All processing activities are considered in scope of this definition, until the resources can be considered a recovered resource.

The downstream processor is to provide a letter, including:

- A statement of:
    - The RER of the facility to which the materials from the processor were sent;
    - A list of products or materials that were targeted for recovery;
    - A statement of the average yield per targeted material; and
- A signature of the site manager or equivalent.

A processor who is unable to obtain the RER of a downstream processor must contact RPRA for guidance.

16.0
Verification of the RER

The verification of the RER differs between the mass balance and the field test approach. For the mass balance approach, the verification will be done after the mass balance calculation has been completed, whereas, the for the field test approach, the verification will take place ahead of the running of the field test during the development of the field test plan. Given this, the mass balance approach has a verifier, while the field test approach has a Field Test Verifier.

17.0
General Guidance for the Verification of RER

18.0
Verifier/Field Test Verifier Credentials

The verifier/Field Test Verifier may be either a first party or third-party. The verifier must have the following competencies:

- If the facility is located in Canada, the verifier/Field Test Verifier must be a licensed engineering practitioner who holds a license, limited license or temporary license under the Professional Engineers Act or equivalent in other Canadian provinces;
- If the facility is located outside of Canada, the verifier/Field Test Verifier must be an engineer having at least:
    - An M.Eng. or M.Sc. degree in a relevant engineering discipline with three years of demonstrated engineering experience in an operational setting; or
    - A B.Eng. or B.Sc. degree in a relevant engineering discipline with five years of demonstrated engineering experience in an operational setting; or
    - A verification certification from an accredited body relating to national or international environmental standards;
- The verifier/Field Test Verifier must have physically toured the facility that is being assessed, and possesses technical expertise and ability to assess the following:
    - The processes within the boundary of the RER, the modeling approach and assumptions, as well as the magnitude of potential errors, omissions, and misrepresentations; and
    - Internal information systems for gathering and reporting data, including quality control procedures.

When using the mass balance approach, the verifier cannot be the same person that initially calculated the RER.

19.0
Material Error Thresholds

Material errors may be qualitative and quantitative in nature.

From a quantitative perspective, an error is considered to be materially misleading if its value exceeds 5% of the total weight processed (TW).

Qualitative materiality refers to intangible issues that affect the RER statement. Examples include:

- control issues that erode the verifier’s confidence in the reported data;

- difficulty in locating requested information; and
- non-compliance with regulations indirectly related to RER.

20.0

Record keeping

All data informing the field test design, including relevant information on inbound and outbound loads over the prior year, must be kept for a period of five (5) years.

21.0

Verification of the Mass Balance Calculation

22.0

Objectives

The verifier and client shall agree on the verification/validation objectives at the beginning of the verification engagement. Verification objectives shall include reaching a conclusion about the accuracy of the RER and the conformity of the RER with the criteria set out in the calculation guidance in this procedure.

At the conclusion of the verification process, the verifier must be able to confirm that no material errors were found in the determination of the reported RER. If material errors are found, the RER cannot be relied upon by the processor and must be corrected. The verifier must consider the materiality thresholds as detailed below when determining if any material errors exist.

23.0

Scope

The verifier and client shall agree on the verification/validation scope at the beginning of the verification process. The scope, as a minimum, shall include the following details:

- facilities and processes;
- battery types and chemistries; and
- time period.

24.0

Verification Execution Procedure

The verification process shall involve:

1. Assessing the completeness, consistency, and accuracy of the data/information provided, as well as the reliability and credibility of data sources;
2. Where multiple methodological choices, equations, or parameters are available to the user, determining whether adequate justification for the selected choice has been provided;
3. Checking whether all the assumptions and data used are clearly disclosed along with references and sources as well as whether justifications are provided (where required) that are reasonable and supported by evidence; and
4. Identifying issues that require further elaboration, research, or analysis.

25.0

Step A: Data and Calculation Verification

The following has to be obtained and verified:

1. The weight of all inbound materials:
    a. Obtain a list of all incoming loads that make up the total weight of inbound material received (WI);
    b. Verify the total weight of inbound material received (WI) by recalculating the sum

   - **c.** Select a sample of inbound shipments in accordance with the sampling procedure in **Appendix A;**
   - d. Verify the weight of each sample through comparison with bill of ladings or manifests;
2. The weight of materials to exclude from the total inbound weight, being: material not designated under the Regulation (packaging, garbage, moisture, etc.) and batteries of different chemistry;
   - a. Obtain one or multiple lists of statements of weights of material not designated under the Regulation;
   - b. Verify the inputs;
      - i. If these are estimated, for example through a composition study or tracking system assessment, assess the methodology to determine the inputs in accordance with **Appendix B;**
      - ii. If they are measured, verify the calibration log of the scale;
   - c. Verify the total weight of material not designated under the Regulation by recalculating the sum;
   - d. If non-designated materials were deemed to be identical in composition to designated materials and included in the mass balance for RER, verify that non-designated materials are identical;
3. The weight of all outbound materials;
   - a. Obtain a list of all outbound loads that make up the total weight of materials shipped to a third party, including materials sent for disposal, for reuse, and for (further) treatment by other (downstream) processors;
   - b. Verify the total weight of outbound loads by recalculating the sum;
   - c. Select a sample of outbound shipments in accordance with the sampling procedure in **Appendix A;**
   - d. Verify the following data points through comparison with bill of ladings or manifests, focusing on:
      - i. Weight of each sample;
      - ii. Categorization in the dataset (recoverable or unrecoverable materials). In case of hazardous waste, the categorization must align with mentioned disposal code;
      - iii. Destination (business legitimacy, management type, for hazardous materials ensure the destination is licensed to receive those materials);
4. The weight of unprocessed batteries;
   - a. Obtain a statement of the weight of materials received but not processed within the timeframe Y+3 months of following year;
   - b. Verify the source of the inputs:
      - i. If these are derived, assess the methodology to determine the inputs;
      - ii. If they are measured, verify the calibration log of the scale;
   - c. Verify the total weight of unprocessed batteries by recalculating the sum;
5. The weight of recoverable materials (Rb);
   - a. From the list of outbound materials:
      - i. Verify the categorization of materials;
      - ii. Recalculate the sum per recoverable material type;
   - b. Verify composition audit data to confirm the relative amounts of potential recovered materials generated;

6. The downstream RER;
    a. Verify the statement and signature corresponds with requirements;
    b. Verify the downstream RER used with the RER stated by the downstream processor;
7. The mass balance;
    a. Verify that the weight of all inbound materials equals the weight of all outbound materials minus the weight of unprocessed batteries; and
8. Recalculate the RER

26.0

Step B: Evaluation and Conclusion

The verifier shall evaluate the RER statement, considering:

- sufficiency and appropriateness of evidence;
- material misstatements;
- conformity with the calculation guidance requirements; and
- changes compared to prior reporting periods.

27.0

Step C: Verification Reporting

The verifier shall develop a verification report, that is no more than 5000 words in length. The report must contain the following sections:

1. A description of the verifier and their competencies related to the required credentials described in this procedure;
2. Scope of verification;
3. Sampling methodology;
4. Assessment of data management systems and controls;
5. Summary of verified RER calculation inputs and outputs using the International System of Units (SI units);
6. Summary of assumptions or other data considerations:
    a. Including a description of any estimation methodologies used;
7. Summary of errors meeting the materiality threshold and recommended corrective action;
8. Verification Statement;
    a. Statement of the RER and other key findings from the verifier; and
9. Review declaration:
    a. Statement of acknowledgement by the site manager.

28.0

Verification of the Field Test Approach

29.0

Field Test Verifier

Given the nature of the field test, where the preparation and planning for the field test determine the reliability of the derived data, the field test must be overseen by a Field Test Verifier who will also be responsible for verifying the accuracy of the RER calculation. The Field Test Verifier must meet the requirements set out in the “Verifier/Field Test Verifier Credentials” section.

The Field Test Verifier is expected to develop a Field Test Plan that will ensure that an RER can be determined for the processor and that is free from material errors as set out in the "Material Error Thresholds" section.

30.0
Field Test Plan

All field tests must be initiated with a Field Test Plan which includes the test run design considerations including:

- The feedstock composition:
    - The feedstock must have a composition representative of an average sample of obligated materials collected from consumers in Ontario in one year;
    - If the average material composition is identical regardless of the source, then for the purpose of the field test the feedstock may include materials sourced from outside Ontario. If the average material composition is not identical, then the feedstock must be Ontario materials only;
    - If a methodology is used for deriving the feedstock composition, it must be verified in accordance with **Appendix B** by the Field Test Verifier;
- Operational settings that are representative of normal operating conditions considered based on average daily capacity;
- A batch size and test duration that allows for the test results to be representative of normal operating conditions; and
- A data collection approach.

The Field Test Verifier and Facility Manager must sign off on the Field Test Plan.

31.0
Field Test Verification Report

All processors relying on the field test method must prepare a Field Test Verification Report. The Field Test Verification Report must include the following:

- An explanation for why the processors cannot verify their RER using the mass balance method;
- A description of the Field Test Verifier and their competencies as related to the required credentials described in the procedure;
- A description of the field test process, including a statement of the feedstock and products targeted in the design of the process, and including:
    - An explanation of how the feedstock composition was determined to be representative of a typical load for the prior year;
    - An explanation of how the operational settings, and the resulting products that are the recovered and recoverable resources, are representative of normal operating conditions in the prior year;
- A summary the RER calculation inputs and outputs generated through the field test outputs using the International System of Units (SI units);
- The Field Test Plan as an appendix;
- A verification statement of the Field Test Verifier, confirming the RER of the processor and the accuracy of the data submitted in the report; and

- A review declaration from the facility/site manager.

Appendix A

Sampling Methodology

When sampling inbound and outbound loads, samples equivalent to at least 50% of the total weight inbound/outbound from that facility must be reviewed. Samples must also be taken for each of the inbound source types, outbound material types and outbound destinations. This may mean that more than 50% by weight of the loads will need to be verified.

This sample size is considered a recommended sample size. The sample size may be reduced at the discretion of the verifier.

The following risk elements should be considered by the verifier:

- Weight audits undertaken by other competent third parties, demonstrated through:
    - Audit report(s); or
    - Certification(s).

The verifier should ensure that the scope of such audits overlap with relevant parts of the verification execution scope, and the risk adjustment should only apply to the previously audited inputs.

Appendix B

Methodology Verification

These factors must be considered when a processer relied on a methodology, such as a composition study, an allocation method or a tracking system.

In assessing the reasonableness of the methodology, the verifier or Field Test Verifier shall consider the following factors:

1. The methodology is appropriate for the process being considered and is based in an understanding of the actual material flow of the facility;
2. The methodology must be reflective of the feedstock average composition and variation and total quantities received and processed;
3. Whether the inputs into the methodology were generated in the timeframe for which the RER is being calculated; and
4. The methodology has been updated to reflect relevant process changes, if any.