

MRF Acceptance Testing Guidelines

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Disclaimer This report is provided as opinion for discussion only and is **not** designed to replace qualified engineering, architectural or legal advice in any way. Municipalities are cautioned to obtain qualified advice and certified/approved drawings and plans prior to undertaking or adopting any recommendations that may affect their programs or facilities.

Background

The Continuous Improvement Fund has identified a need to assist municipalities that have chosen to construct and/or operate a blue box material recycling facility (MRF) during the commissioning and start up stage. Therefore, this guideline has been produced in an effort to provide municipalities with a starting point and guidance while drafting their facility specific initial operation and acceptance testing plan.

This plan, in most cases, describes the sequence of operations and any tests that will be performed during the initial operation and acceptance period. The plan is used to verify that the MRF is producing marketable product in accordance with identified design, staffing, throughput, quality and residue specifications and to satisfy the municipality that all requirements of the contract have been fulfilled.

Although each MRF is unique, these guidelines attempt to assist municipalities by suggesting possible terms and procedures for inclusion within the individual municipal acceptance plan. These guidelines should not be considered to be all inclusive and municipalities are strongly encouraged to contact the CIF for further assistance and review of their specific MRF acceptance plan.

Overview

Plan Overview

This sample plan is divided into five sections, pretest preparation and four stages covering the following requirements generally considered necessary to demonstrate that a new MRF is operating to design specifications:

Pretest Preparation

Stage I ~ Dry Run;

Stage II ~ Initial Operation and Capacity Testing;

Stage III ~ Acceptance Testing;

Stage IV ~ Product Quality Testing.

Each of these stages will be reviewed below along with sample protocols illustrating how the MRF equipment/operating contractor may satisfy the plan requirements.

Since each municipal MRF and each contract for supply of equipment, buildings and operations is unique, these guidelines and protocols should be adapted for use by the municipality as required. The municipality and equipment supplier(s) and MRF operator will normally work together to develop a comprehensive facility acceptance plan.

Pretest Preparation

Purpose

The purpose of pretest preparation is to insure that all MRF equipment is installed satisfactorily by the individual equipment supplier/installer and is ready for production capacity testing and subsequent reliability (continuous operation) and output product quality testing. Satisfactory pretest preparations help avoid safety infractions, critical omissions and unnecessary damage to equipment during the full production stage II and stage III testing procedures.

Pretest preparations are not usually verified by the municipality but in most cases are observed and/or monitored by the municipality and the MRF supplier.

A sample of pretest preparation terms follows but is not intended to be an all inclusive list. Individual equipment suppliers and subcontractors will be required to supply details of all prestart and/or preproduction dry run conditions for incorporation into the operation and acceptance plan.

Pretest Preparation (Dry Run) Terms

1. Inspect each piece of equipment individually.
2. Dry run each piece of equipment individually, for the period of time deemed necessary by the equipment manufacturer, to ensure that it has been installed and operates correctly. During this run in period, note the following:

Conveyors:

- a) Check for debris and tools on unit
- b) Check belt tracking and belt tension. Adjust until correct.
- c) Lubricate head and tail bearings.
- d) Check and insure all guards are in place and no pinch points are observed.
- e) Check to see that gear boxes have been initialed for oil level. If they have not, check oil level and then initial.
- f) Check and record motor amperage draw and record
- g) If the motor is on a VFD, run to the upper limit and down to the lower limit and then back to 60 Hz.
- h) Record belt speed
- i) Check operating controls and emergency stops
- j) Sign conveyor off using agreed forms

Screens:

- (a) Check for debris and tools in unit
- (b) Record rotor rpm @ 60Hz
- (c) Check and insure all guards are in place and no pinch points are observed.
- (d) Check to see that gear boxes have been initialed for oil level. If it has not, check oil level and then initial, that it has been checked.
- (e) Check and record motor amperage draw and record
- (f) If the motor is on a VFD, run to the upper limit and down to the lower limit and then back to 60 Hz.
- (g) Check operating controls and emergency stops
- (h) Sign screen off using agreed forms

Balers:

- a) Check for debris and tools in unit
- b) Record motor rpm
- c) Check and insure all guards are in place and no pinch points are observed.
- d) Check to see that gear boxes have been initialed for oil level. If they have not, check oil level and then initial, that it has been checked.
- e) Check hydraulic fluid levels, tanks, hoses and fittings
- f) Check and record motor amperage draw
- g) Check wire tie system
- h) Check operating area clear
- i) Check operating controls and emergency stops
- j) Initial baler operation will be baler dry cycling
- k) Dry cycle sign off using agreed forms

3. Inspect all of the electrical controls including panels. The purpose of this testing procedure is to check the controls for manual starting of each piece of equipment and to check the auto start system. The emergency stop system will also be checked at this time. All testing described in this section will be documented.

Testing will be in accordance to the procedures described below:

- a) Manually start and stop equipment as an individual component.
- b) Cycle auto start and observe the sequential starting of each piece of equipment.
- c) Correct any out of sequence starting.
- d) Auto start the system as many times as required to demonstrate correct and complete auto start sequence.

- e) Cycle each emergency stop lanyard and stop button to verify that the system stops and its button or switch is illuminated.
- f) Restart the system after each stop.
- g) Complete record forms.

**Pretest
Preparation
(Production Test)
Terms**

Prior to any full scale production performance testing, the following conditions shall be achieved:

1. Completion of equipment installation, modifications and repairs, including all materials, systems and accessories in accordance with design specifications.
2. Inspection and approval by the facility, engineering and audit supervisors of all installations, modifications and repairs.
3. Training of all employees, including equipment operators, sorters, line leaders, auditors and supervisors. All employees will have completed all necessary safety training and a signed record of such training shall be included in their personnel files.
4. To prove the performance of the processing system, sufficient recyclable test material must be made available in quantities stipulated by the audit supervisors.
5. The equipment to be performance tested shall be activated from the control panel or at each equipment location and adjusted to accept test material.
6. During the test, the facility manager shall supply sufficient staff and mobile equipment necessary to deliver and remove test material, residue and sorted recyclable materials to and from the system.
7. During the initial operation testing, all operations will be conducted in accordance with the approved operations plan. The specific sorter staffing levels and their specific locations in the plant for the operations testing are to be submitted to the municipality in advance of any testing. Except for authorized test auditors, observers and maintenance personnel, MRF staffing levels shall not be increased beyond design specified numbers during any testing period.
8. In case of failure of equipment to perform due to any cause whatsoever, the test will be suspended and all defective parts shall be replaced and corrections made. Testing may resume immediately upon completion of repairs, provided that the test can still be conducted in compliance with the terms of the acceptance plan.

9. The test shall continue until the supplier demonstrates that the installed equipment has successfully passed the specified performance criteria and is ready for full scale operation.

10. During the test period the facility will be operated in a routine manner. Material shall be received and stored on the tipping floor in a manner so that ordinary, continuous and uninterrupted operations can occur during the test period. Excepting authorized observers and audit personnel, extra staff shall not be permitted in the facility.

11. The test period shall only begin on a day when sufficient materials for processing are available. If insufficient test material requires temporary test delays and interruptions, the clock shall be stopped for those periods. Upon receipt of sufficient additional test material, testing shall continue and the test day extended as deemed necessary by the facility manager and audit supervisors.

12. The facility shall insure that the processing areas, including all conveyors, all mobile and stationary equipment, roll-off containers, hoppers, trailers and process floor shall be free of all material prior to the start of the test period to avoid cross contamination and enable a fresh start for each test.

13. Material received and unloaded on the tip floor will be stored at least one (1) workday previous to the first day of the Stage II testing. All materials will be weighed, and if needed, these materials will be segregated from any other materials that may be stored in the receiving area. Additional materials received on the two testing days will also be weighed and included as test material. The total of all weigh scale tickets shall be recorded for the total tonnage processed.

14. The facility manager and audit supervisors shall each have at least one full time representative on site throughout the test period to make decisions regarding any issues including verification of test data.

15. Cleanup shall occur in a routine manner during the hours comprising the test day. Materials collected during cleanup shall be considered processed and shall be added to the rejects/residue, added to the recyclable materials or fed back into the infeed bunker area, depending upon the nature of the material cleaned up. The facility manager and audit supervisors must confirm the destination of the cleaned up materials prior to relocation.

16. The procedures listed below shall be performed by the facility manager in advance of startup each day:

- a) All data sheets shall be obtained and all preliminary information i.e. tests dates, auditor names, and test numbers shall be filled in.
- b) All areas surrounding the processing system shall be free of recyclables and reject material.
- c) All test material ready for testing shall be inspected and both the facility manager and audit supervisor shall approve the quantity.
- d) The facility shall be ready to begin testing a minimum of 30 minutes prior to test start.
- e) The facility manager and audit supervisors shall meet to review the test procedures thirty minutes prior to startup of each test day as necessary.
- f) All facility and test personnel shall obtain their required safety gear and shall confirm their understanding of their duties and ability to perform the work safely to the facility manager or designate.

17. All material coming into the MRF for initial operations testing, will be tracked separately through weigh scale tickets. It will be separated from all other materials on the tipping floor. Once the required amount of incoming material has been received, the system will run according to the initial operations plan schedule until all the segregated material has been processed.

18. The facility manager and audit supervisors shall meet to review the results of each daily test. The facility manager shall provide a copy of the day's performance data sheets to the audit supervisors at the end of each test day or prior to the start of the next test day. The test data sheets shall be checked each day by the audit supervisors and, upon agreement of the accuracy of the recorded data, shall be signed by the facility manager and audit supervisors to verify that the data recorded on the test sheets is accurate.

19. At every break period, selected pieces of equipment must be inspected and any maintenance concerns reported to the supervisor. An example of a reportable maintenance concern would be debris jammed in equipment, or a belt tracking off center. Tag out and lock out practices are to be used by all employees.

Other MRF Items

1. Commissioning of items other than supplier sorting equipment is not subject to an initial operations stage or an acceptance testing stage but is subject to start up/dry run testing. These items will be pre start inspected prior to dry run testing to insure the installation is satisfactory. Start up/dry run will be performed (where applicable) in the presence of the relevant supplier or sub contractor, the municipality and any required inspection agencies.

Items in this category include, but are not limited to:

Receiving doors and traffic control lighting

Compactors

Rolling stock

CO monitoring systems

General HVAC and sorting station HVAC

Fuel dispensing systems (diesel, LPG, LNG, etc.)

Scalehouse and weigh scale operations

Plumbing and sewer

Fire control, alarm systems and emergency exits

Process monitoring camera systems

Site security camera systems

Site and building security equipment

Telephone and communication wiring/equipment

2. Equipment operators and supervisors of all acceptance tests must have attended and completed all training sessions, including general safety and evacuation training, prior to operating any equipment. Training records must be placed into personnel files.

3. As a minimum, all electrical and mechanical equipment and building HVAC systems shall be operated for four (4) consecutive hours and the supplier and manufacturer shall verify that the equipment fully meets its intended purpose .

4. Prior notice must be given to the required trainers and to the municipality of the training sessions. Municipal staff may be present to witness completion of any training the municipality deems appropriate. Details of the training sessions will be provided as part of the final acceptance testing report.

5. As-built drawings, product literature, maintenance manuals, warranties and specification drawings for all installed systems will be provided to the municipality after acceptance testing is complete.

6. The supplier must provide details of a preventative maintenance plan, (PMP) preferably electronic based, following any as-built or testing equipment modifications.

7. Prior to starting initial operation testing, the required approvals and inspections including, but not limited to, the following are to be obtained:

- a) Occupancy permit
- b) Certificate of Approval (MOE)
- c) Fire Inspection
- d) Pre-Start Health and Safety Review

Stage I ~ Dry Run Testing

Purpose

The first stage of acceptance testing will be performed without passing recyclables through the system to confirm that all of the mechanical and electrical components of the equipment function properly both individually as well as part of an integrated system.

Each municipality will have specific supplier contract terms describing the initial MRF start up/dry run procedures. These terms should be detailed fully in the MRF acceptance plan and agreed to by all parties before starting. Samples of some of these dry run terms are set out below:

Sample Dry Run Test Terms

1. On completion of installation and prior to dry run, all equipment shall be thoroughly cleaned of all packing, tie downs, debris, tools and any loose items etc.
2. All installed equipment shall be inspected by the manufacturer's representative prior to dry run to ensure the installation is satisfactory and to instruct the operating personnel in its proper starting methods, operating procedures, emergency and normal shut off and maintenance.
3. The municipality shall be notified, at least three (3) working days in advance, of any manufacturer's final inspection or training visits and be provided with a detailed schedule of activities. The municipality will have the right to witness such visits, and if proper notice is not given, the supplier shall, at no cost to the municipality, repeat the manufacturer's visit in the presence of the designated municipal staff.
4. After completion of the installation, the supplier shall notify the municipality in writing, at least three (3) working days in advance, of any dry run of the equipment, in whole or in part. Dry run shall be performed in the presence of the municipality and the manufacturer's representative, only after approval has been given by the manufacturer and the municipality. The manufacturer shall complete a Certificate of Installation verifying the equipment was satisfactorily installed and is ready for any operational testing.
5. During the dry run, the supplier shall provide qualified personnel and all equipment, materials, rolling stock, supplies, etc., necessary to properly operate the equipment and monitor the test.

6. The supplier shall be entirely responsible for the equipment and its operation during this dry run period. Should any equipment be damaged during start up and/or dry run, the supplier shall repair or replace such equipment to the satisfaction of the municipality.
7. Dry run of any recyclables transfer system and site works equipment shall include, as applicable, checking of equipment speeds, motor current and voltage, excessive vibration or noise, gear box and bearing temperatures, etc., and satisfactory demonstration to the municipality of all control functions.
8. MRF dry run shall include checking of conveyor and rotating equipment speeds, motor current and voltage, excessive vibration and noise, conveyor tracking, gear box and bearing temperatures, etc., and satisfactory demonstration to the municipality of all control functions.
9. As a minimum, all MRF electrical and mechanical processing systems and building HVAC systems shall be operated for two (2) consecutive days, all equipment operating at least 6 hours each day for the two day period and the supplier and manufacturer shall verify that it is ready for initial operation as specified in stage II testing.
10. During the dry run period, the supplier shall make all changes and adjustments to the equipment deemed necessary, and shall demonstrate to the municipality that the equipment is capable of proper, safe and uninterrupted operation and is ready for initial operation capacity testing.

Stage II ~ Initial Operation and Capacity Testing

Purpose

Stage II of the MRF acceptance testing plan will normally be performed while passing recyclables through the system to confirm that it is operating properly as a total processing system and is able to receive and successfully sort material at various throughput tonnages up to the specified maximum design capacity. This stage of the plan should describe the sequence of operations and any tests that will be performed during the initial operation period, the proposed schedule for material deliveries and the plan for residue disposal and recovered materials (final product) handling and storage.

Sample Initial Operation Terms

1. Following the successful dry run of equipment and components and correction of any identified deficiencies, the supplier shall notify the municipality in writing, at least ten (10) working days in advance, of the date that the MRF will be ready to receive recyclables and be ready to proceed with an initial operation test. The municipality will advise the supplier in writing whether or not the initial operation stage can begin on the date proposed by the supplier.
2. Prior to notifying the municipality that the MRF is ready for the start of initial operation, the supplier shall turn over to the municipality copies of all permits, materials/equipment test reports, Certificates of Installation, governing authorities' inspection reports/certificates, Certificates of Approval from MOE and all else required to demonstrate to the municipality that the equipment has been properly installed, that the MRF conforms to the rules and regulations of the governing authorities and that the MRF is ready to process material.
3. The supplier shall be solely responsible for ensuring that all equipment conforms to all applicable regulations and has been inspected by all authorities having jurisdiction prior to initial operation.
4. During the initial operation, the supplier shall demonstrate to the municipality that the equipment supplied and installed is capable of processing recyclable materials at design feed rates and staffing levels without overloads, plugs, electrical or hydraulic trips, excessive spillage, dust or odour release, etc. The supplier will make all modifications to equipment necessary to correct any problems that become evident, during the initial operation period, prior to commencement of the next stage of testing.

5. The supplier shall provide, at no additional cost to the municipality, the required staff or operating personnel, consumable items, materials and fluids to operate the MRF and equipment (fixed and mobile) during the initial operation period. In addition, the supplier shall provide all product and residue containers and vehicles required to transport products to disposal or to the marketplace. All costs associated with the storage, loading, transportation, unloading, and disposal of the products and the residue shall be borne by the supplier.
6. The municipality will permit the residue generated during the initial operation period to be disposed of at the municipality's nearest landfill or transfer station with no waste management fee to be charged to the supplier. Only those residue materials generated during the initial operation period will be permitted to be disposed of with no solid waste management fee.
7. The municipality shall supply the MRF with test material generally in accordance with the requirements of the acceptance testing plan and the specified notification constraints. The municipality shall have the right to stockpile material within the MRF receiving/storage area, if required, to minimize disruptions to the recycling collection systems.
8. Marketing and receipt of revenues associated with all sorted and recovered recyclables will be as per the MRF operations terms described elsewhere in the RFP. The municipality will not pay the supplier any processing, or operating fees or other charges whatsoever during the initial operation testing.
9. Throughout the initial operation, the municipality shall have unrestricted access to inspect, witness and record the operation of the MRF as they see fit.
10. As per mutual agreement subsequent to any conditions in the RFP, the Stage II testing will be conducted during at least two (2) consecutive days and shall demonstrate a minimum average (calculated daily) processing capacity, measured in tonnes/hour, of the specified design capacity. The testing will also demonstrate the maximum design processing capacity for a sustained period, as agreed between the parties, sufficient to verify the maximum design throughput of the MRF. The MRF must also achieve proper separation and capture of recyclables in accordance with the design specifications to satisfy this stage of testing.

Each day shall consist of at least a single eight (8) hour shift during which a minimum of seven (7) operating hours at the tonnes/hr. design rate must be demonstrated. The initial operation testing shall demonstrate that all equipment and systems operate satisfactorily as a system and that the MRF is ready for commencement of the acceptance testing stage of commissioning.

11. All procedures during initial operation shall be conducted in accordance with all applicable laws, standards and regulations. At no time will operation of the equipment be permitted with any safety or emission control system being out of service or bypassed.

12. Operating test record sheets, deficiency lists and system performance data accumulated during the initial operation shall be compiled and forwarded to the municipality for review. The documentation shall be sufficient to demonstrate that all critical deficiencies have been corrected, or have been identified subject to correction, and that the MRF and all its components have operated, or are capable of operating, satisfactorily at the specified design rates.

13. The initial operation stage shall continue until any deficiencies in MRF performance have been identified and have been corrected to the municipality's satisfaction before the municipality will authorize commencement of the acceptance testing stage.

14. The initial operation testing is not completed until the municipality notifies the supplier in writing that the MRF is ready to begin the acceptance testing stage.

Stage III ~ Acceptance Testing

Purpose

The acceptance testing stage will include all tests required to demonstrate that the MRF meets all of the contract specified performance requirements for sustained production capacity plus sorted product quality. Details of sorted product quality sampling and analysis protocols are described in the next stage of this guideline. Sorted product sampling and analysis is normally carried out throughout stage III testing. All acceptance tests will be conducted at the expense of the supplier.

The municipality will not issue any Certificate of Substantial Performance until the requirements of acceptance testing have been met in full, including correction of any construction, installation, control or operating deficiencies.

The test plan should include details for monitoring and recording MRF emissions (if any), processing rates and sorted product and residue quality during the duration of the acceptance testing.

Sample Acceptance Testing Terms

1. The acceptance test stage will include all tests required to demonstrate that the MRF meets all of the specific performance requirements of the contract. All acceptance tests will be conducted at the expense of the supplier.
2. The supplier shall notify the municipality and the MOE at least two (2) weeks prior to the commencement any acceptance testing. The supplier, with this notification, shall specify the schedule for recyclable materials to be delivered to the MRF during the test. Testing shall begin on the date proposed by the supplier and accepted by the municipality.
3. The municipality will supply to the MRF tipping floor the total recyclable material tonnage required to conduct uninterrupted acceptance testing.
4. The municipality will witness the acceptance tests and be permitted unrestricted access to observe all aspects of the operation.
5. The acceptance test stage shall be considered as being successfully completed only after all the requirements of this section have been completed and only after the operation of all system components have been shown to have performed at specified design capacity and after all other specified requirements have been demonstrated to the satisfaction of the municipality and, if applicable, the MOE and/or other regulatory agencies.

6. Without limiting the scope of the above, the acceptance test requirements specified hereafter shall represent the minimum requirements for acceptance testing. The municipality reserves the right to have its staff present for any testing. All operations during acceptance testing shall be conducted in accordance with applicable laws, standards and regulations.

7. Pursuant to the RFP, the acceptance test shall consist of a minimum of five (5) days of operation achieving a daily average processing throughput at the rated design capacity measured in gross tonnes/hour. Each day shall consist of a single ten (10) hour shift during which a minimum of nine (9) operating hours at the rated design capacity must be demonstrated with a residue rate not exceeding design specifications measured in percentage of gross tonnes processed. (e.g. 20 tph. gross throughput with < 5% gross residue) and all other material recovery rates and product quality specifications being met in accordance with the contract requirements.

8. During the acceptance testing stage, the supplier will operate the MRF in accordance with normal operating procedures. All staffing levels and hours are to be reported to the municipality. Staffing levels, excepting dedicated test monitoring and maintenance personnel, shall not exceed normal design operating levels while the MRF is in operation.

9. The supplier will provide, at their cost, the required staff and operating personnel and consumable items, materials, and fluids to operate the MRF and equipment (fixed and mobile) during this testing. Normally scheduled operating breaks shall be included in the calculation of hourly production. In addition, the supplier shall pay for and coordinate the vehicles required to transport any recovered materials to the end market receivers. All costs associated with the transportation of the residue to disposal shall also be borne entirely by the supplier.

10. The residue generated during the acceptance tests may be disposed of (after weighing and required composition audits) at the municipality's landfill or transfer station with no tipping fee to be charged to the supplier. Only those materials generated during the test and collected in the normal system residue system will be permitted to be disposed of with no tipping fee.

11. Marketing of sorted test product and receipt of revenues generated from recovered recyclables will be handled as per the MRF operating agreement described in the municipal RFP. The municipality will not pay the supplier any processing or operating fees or other charges whatsoever during the acceptance testing stage.

12. Any and all sorted test material delivered to market must be transported in a sealed trailer and shall be examined by the receiver who is required to deliver a report directly to the municipality containing details of the quality of material received, compared to their market specifications. The municipality will subsequently deliver a copy of the market quality report to the supplier for review. Acceptance testing shall not be complete until recovered material meets end market quality specifications.

13. The supplier must notify the municipality in writing at the end of the test period whether or not the supplier considers the results of the test to be satisfactory. Alternately, the supplier, by further notification, may request that the initial results be disregarded and the supplier shall, after modification of the operation and/or the equipment, repeat the acceptance test stage. The supplier's notice to the municipality at the end of each testing period, accepting or rejecting the test results, will be final and binding on the supplier.

14. Each sorted product material that is recovered shall be weighed throughout the acceptance testing and shall be reported by the supplier in both tonnes and as a percentage of total materials received, on a daily, weekly and overall test program average basis.

15. Product recovery rate for each sorted recyclable shall be determined by weighing each day, the quantity of each product recovered and the quantity of the respective material in the residue. The specific time of day each product recovery efficiency test will be undertaken will be determined at random and without notice by the municipality. Under no circumstances shall the supplier modify the MRF processing speed, residue percentage level or staffing level prior to or during sample collection. The methods of determining the composition of the residue and the product recovery rates achieved shall be developed by the supplier and approved in writing by the municipality in advance of any testing or sample collection.

16. The supplier shall be required, as part of the test, to supply a certified portable scale, screening devices and all other equipment and labour required to sort and weigh the various test samples.

17. Prior to acceptance testing, all bunkers and silos will be cleaned out and all conveyors and equipment cleaned to fresh start the plant. Any bales remaining in the baler extrusion chamber will be noted and excluded from the analysis during acceptance testing.

18. All bales of recyclable materials will be weighed and recorded on bale summary sheets.

19. At the end of each test day, all conveyor belts will be emptied of material. All bunkers and silos will be cleaned out. Any bales remaining in the baler chambers will be noted and weighed the next day when they can be finished and their weights will be added to the material totals for the test day they were processed. All loose materials (i.e., glass, #8 paper and residue) will be weighed at the end of the test day and their weights recorded.

Reporting

1. Within five (5) working days of receipt of the material quantity and quality results produced during acceptance testing, the supplier shall advise the municipality whether or not the results were acceptable, with respect to:

- a) Did the system achieve the specified overall hourly design processing rate requirements?
- b) Were residue quantities less than the specified design percentage by weight of the incoming material stream?
- c) Did processing achieve the specified design sorted material recovery rates?
- d) Did all recovered materials meet the quality specifications supplied by the end markets?

2. Within fourteen (14) calendar days after completion of the acceptance testing program, the supplier shall furnish to the municipality five (5) written and one electronic copies of an acceptance test report describing the results of the acceptance test, including:

- a) all daily weigh scale data on sorted product and residue quantities;
- b) all residue and product quality data;
- c) market acceptance against stated specification with supporting test results, verified in writing, from each sorted product receiver;
- d) all operator log sheets used in the test;
- e) the staffing compliment used to complete the acceptance test;
- f) all air emission and recyclable water test results, if any;

- g) all of the supplier's calculations which demonstrate that the supplier has met or exceeded the acceptance test requirements;
- h) all of the deficiencies noted during the test period, the proposed modifications and the proposed schedule and methodology for demonstrating the modifications are successful;
- i) the supplier's certificate as to whether or not the requirements of the acceptance test program have been met.

3. If the municipality accepts the supplier's certification of successful test results, the acceptance test stage shall be deemed to be completed and the date of substantial performance shall be the date of completion of the acceptance test period, provided the criteria for substantial performance as stated in the Construction Lien Act have been satisfied.

4. Notwithstanding the satisfactory completion of the acceptance testing stage and municipal acceptance of the supplier's acceptance test stage report, acceptance shall not be deemed complete until the as-built MRF has complied with all laws, by-laws, regulations, rules and conditions which may be required by any government or regulatory body or municipality, whether Federal, Provincial, Municipal or otherwise.

5. If the municipality does not accept any part, or all, of the results of the acceptance testing report, the municipality shall so notify the supplier in writing.

6. In the event that any of the specified performance or any contract guarantee, is not achieved, the supplier shall modify the equipment and/or the operation and retest until the specified performance is achieved and demonstrated.

7. Excepting municipal weigh tickets for inbound and outbound materials, the supplier shall measure, record and maintain all information and data required for the testing of the equipment. Municipal personnel shall have complete access to all testing records.

Stage IV ~ Product Quality Testing

Purpose

Stage IV of testing is performed to verify that the MRF is capturing the specified percentage of each sorted recyclable product and to verify the quality of each sorted material stream produced. Recyclable material lost to residue is also measured in this stage. All quality testing must be done while the MRF is operating at designed production tonnage throughput with normal staffing levels and without exceeding designed residue percentage output.

In the operational testing stage, MRF throughput is tested to determine if the system will generate design quantities of sorted material. Material quality is subsequently tested by both examining end market delivered load analysis and conducting in plant sorted product auditing.

The MRF is not acceptable if it produces material with unacceptable levels of residue, cross contamination in sorted products or excess recyclables in residue.

Residue Quality Acceptance Testing

Sample Product Quality Terms (residue testing)

1. The total weight of each recyclable product in the residue stream (based on the collection, sorting and weighing of random daily samples) will be compared to the total weight of the respective recyclable product generated each day. Calculated recovery rates will be compared to the design specified rates for each of the sorted recyclable products.
2. The basic components of the residue stream audit procedure are:
 - a) Collection of a minimum of four (4) residue samples at random times each day during acceptance testing;
 - b) Ensure individual samples are of sufficient size to minimize bias (> 100 kg each) from the residue bunker or residue conveyor;
 - c) Minimization of cross contamination during sorting; and
 - d) Check data quality during sorting (verify closure on all samples sorted).
3. The objectives for the audit are to produce an accurate estimate of the composition (by weight) of the MRF residue recyclable components such that the estimate can be compared to the specific system design percentages specified by the municipality.

4. The size of samples collected should be sufficient to characterize the composition and variability of recyclables in the residue stream. Four (4) 100 kg. samples, randomly chosen by the municipality without notice, will be taken during four separate sampling events each test day yielding a total daily sample size of at least 400 kg.
5. The daily times for collection will be chosen randomly (considering scheduled breaks for operating staff) to minimize bias in the selection of samples. The time of day and duration of the sample collection will be recorded on an audit record sheet with a municipal representative present to verify all measurements and times. Both the container tare weight and the presorted sample weight will be recorded on the audit record sheet.
6. Each segregated sample will be manually sorted into the component recyclable material categories and a category for residue material.
7. Prior to any sample sorting, suitable containers will be tared and labeled with their respective recyclable component names. In addition, separate bins will be tared and labeled for use to weigh the residue remaining after sorting. The tare weights for each container will be obtained prior to the commencement of the acceptance testing period, and verified prior to each subsequent sample sort.

**Sample Residue
Sorting Protocol**

1. The sorting protocol will be carried out as follows under the supervision of the municipality and the supplier:
 - a) Transport the sample from the collection area to the designated sorting area;
 - b) After obtaining and recording the pre-sort sample weight, spread the contents of the sample onto a suitable clean sorting surface;
 - c) Manually sort the sample into its component recyclable materials with each material being placed into a labeled, tare weighed bin. In the case of composite items, separate them in accordance with the normal MRF sort line separation process.
 - d) To minimize unfairly biased results and cross-contamination, use best efforts to separate the recyclable components from organic contaminants including opening bags and other containers and shaking to remove organic materials not adhered to the surface of the container.

- e) The sample will be sorted until it is impractical to manually remove any more material.
- f) After the sample has been sorted and approved by the audit supervisors, the sorting tables and the surrounding floor area will be manually cleaned and the collected material will be placed into the residue bins or the proper recyclable product bin. Material placement is to be verified by the audit supervisors. The cleaning will be sufficient to remove material (e.g. dust, liquid, etc.) from the sort surface prior to the next sample sort.
- g) The sorted product material bins will be weighed and all weights recorded.
- h) Municipal audit supervisors will verify the pre-sorted sample weight and the sum of the sorted material weights and sign off the sample audit forms. All bins will then be emptied and cleaned prior to the next sample sort.

**Data Verification
Protocols**

1. The quality of the composition data for each sample is critical and will be confirmed at the time of sorting with the following checks:
 - a) The unsorted sample weight will be compared to the sum of the weights of the individual component materials (sorted recyclables) and the residue remaining.
 - b) A weight difference between the pre-sorted sample weight and the sum of the weights of the component materials will be added / subtracted from the residue weight and recorded separately.
 - c) Audit supervisors of the municipality and the supplier will sign each audit sheet.
 - d) On each day of acceptance testing, a record will be made of the total weight of residue material collected over the course of the test day and the total production time and production tonnage for the test day.
 - e) On each day of acceptance testing, a record will be made of the total weight of each sorted recyclable material recovered for that day (through a summation of bale weights and weigh scale tickets for any loose products such as glass, #8 fibre etc.).

Analysis

1. The recovery rate for each of the recyclable components will be calculated by:
 - a) For each of the four (4) 100 kg. samples collected during each test day, dividing the weight of the individual recyclable material recovered from the residue sample by the weight of the total residue sample collected. This provides the measured fraction (by weight) for that component in the residue stream.
 - b) Averaging the results of the four samples to provide a 400 kg. sample representative of residue production during the test day.
 - c) Multiplying this fraction by the total weight of residue collected that day to provide the estimated total weight of the recyclable content in the residue stream (i.e. the weight not captured in processing) on that day.
 - d) Dividing this quantity by the total weight of the recyclable component (sum of the weight of the recyclable recovered that day plus the weight of the recyclable not captured in processing as calculated above).
 - e) Subtracting the amount so calculated from 1.00 and multiplying by 100 percent to calculate the recovery rate as a percentage.
 - f) For each of the recyclable components, the calculated recovery rate will be compared to the MRF design rate specified for that component.

Interpretation

If the percentage recovery rate as calculated above is greater than the design rate specified by the municipality, the performance requirement for the MRF will be deemed to have been achieved for that recyclable component during acceptance testing.

If the percentage recovery rate as calculated above is less than the design rate specified by the municipality, the supplier will explain the reason for this result in a document for the municipality's review. Based on these reviews and explanations, the municipality may, in their sole discretion, conclude that the MRF system has performed to an acceptable level relative to recovery rates or may deem the test to have failed.

Factors which the municipality may consider as explanations include the recognition of the uncertainty in calculating recovery rates based on the variability of collection and measurement of non-homogeneous samples, the effect of weather conditions (which may introduce random

weight variances due to ice melt or rain absorption weight variables), seasonal or holiday material throughput variations (excess holiday glass or heat wave related PET, local special event collections) or any other explanations the municipality may deem reasonable under the specific circumstances.

Product Acceptance Testing

Product Acceptance Testing

Product acceptance testing is done to evaluate the sorted MRF output streams to determine if the system is achieving an acceptable level of product quality relative to specified market acceptability criteria and design specifications.

During acceptance testing, the composition (by weight) of each of the sorted product streams will be measured and compared to the market acceptability quality criteria specified for the particular stream.

The MRF is required to operate in a manner which achieves the specified product stream target quality over the five day acceptance testing period for the test to be deemed successful.

Sample Product Quality Terms (product testing)

Product quality testing is done by in house audits of sorted materials and review of end market reports of shipped recyclables.

The basic components of the product stream audit are:

- a) An unbiased collection procedure to obtain daily samples during acceptance testing for each of the product streams using randomly selected samples;
- b) Individual samples of sufficient size to minimize bias;
- c) Minimization of cross-contamination during sorting;
- d) Data quality checks during sorting.

The evaluation of the quality of the product streams can be achieved through the following steps:

1. During acceptance testing, measure the weight of the total non product components and any cross contamination components in a representative sample of each product stream;

2. Calculate the percentage weight of the uncontaminated product and the recovered cross contamination and any residue components in the collected sample for each product stream and compare to the market acceptability criteria specified for that product; and
3. Verify that no prohibited contamination is present in the samples of recyclable product.

Sample Product Quality Testing Protocols

A random sample will be collected from the product bunker of each of the recyclable streams. The sampling procedure will consist of the following steps:

1. A sample of the sorted product will be collected in a suitable tared container. To minimize the potential for cross contamination, no sample will be collected with tools used to scrape material from the surface of the conveyor belt.
2. The sample size will be approximately one (1) percent of the estimated daily throughput for the material in question but not less than 100 kg. Each sample will be separately transported to the sorting area for evaluation.
3. Each sample will be sorted and analyzed using the same protocols as previously described for the residue stream sorting and analysis. The sorting area will be cleaned and prepared between each sample sorting as previously described for the residue sample protocol and appropriate care will be taken to avoid cross contamination of recycled stream samples.
4. Each individual sample will be manually sorted into the recyclable product material and one or more contaminant categories. In addition, the audit will verify that no prohibited contamination is present within the sample. If prohibited material is identified within a sample, the sample will automatically be marked as having failed the required quality test.
5. Prior to any sample sorting, an appropriate number of suitably sized containers will be labeled to store any extracted contaminants. The tare weights for each container will be obtained and recorded prior to the commencement of every sample sort.
6. After obtaining and recording the presort sample weight, spread the contents of the sample onto a clean table or suitable sorting surface.

7. Manually sort the sample into its recyclable product material and any other material and place each into a labeled, tared bin.
8. The sample will be sorted until it is impractical to manually remove any more material.
9. After the sample has been sorted, the sorting table and the surrounding floor will be manually cleaned and the collected material will be placed into the appropriate material bin. The cleaning will be sufficient to remove material (e.g. ice, dirt, liquids, etc.) from the sorting area prior to the next sort.
10. The full weights of the component material bins will be recorded.
11. The sorting bins will then be emptied for reuse in the next recyclable product stream sort.
12. Throughout the acceptance testing, for all processed materials delivered to any end market, the supplier shall instruct the material receiver to provide the municipality directly and in writing, certification that the material was acceptable and documenting the material type, quantity and the price received, or cost charged, for receipt of the respective material. The material receiver and/or MRF supplier will provide the municipality with any comments, reports, penalties, downgrades or market quality corrections from the receiver of each marketed material as well as the name, location and contact information of each material receiver. The municipality shall have the right to direct sorted recyclable material be delivered to another receiver or market for additional evaluation if deemed necessary.

Reporting

1. The quality of each of the MRF product streams will be calculated by dividing the weight of each of the components by the total sample weight. These calculated values will be compared to the criteria established for market acceptability by the municipality.
2. The results of the five daily recyclable material audits conducted for each of the recyclable products will be averaged (for each product) and compared to the market acceptability criterion.

If the market acceptability criterion is achieved through the average of the five (5) sorted product samples, then the MRF will be demonstrated to be operating in an acceptable manner relative to the municipality's product quality requirements.

3. The completed recyclable product audit record sheets and the tabulated results of each of the product stream sample sorts will be included in a summary report produced by the supplier.
4. Upon completion of the audit, the supplier will report to the municipality including the following:
 - a) Measured composition data for all samples of each recyclable stream and other residue.
 - b) Data quality calculations.
 - c) Calculation of the daily composition, by percent weight, of the residue.
 - d) Calculation of the daily recyclable recovery rate.
 - e) Comparison of the actual recovery rate to design specification recovery rate for each product both daily and over the entire acceptance testing period.

End of document