RCA MRP-2
Mill Recycling Trial Protocol

1. Scope

1.1 This mill trial protocol is designed to characterize the recyclability of adhesives when introduced into the feed stream of a fully functioning commercial fiber recycling facility. The protocol was developed by the US Postal Service with input and consultation from industry representatives, and has been verified through 21 full-scale commercial recycling trials conducted in 1999-2000. [1][1]

2. Referenced Documents

2.1 RCA LRP - Laboratory Testing Protocol For Paper Labels Coated With Recycling Compatible Pressure Sensitive Adhesives
2.2 RCA IAP - Determination of Adhesives in Paper Handsheets by Image Analysis
2.3 RCA Specification for recycling compatible adhesives and labels
2.4 RCA standards are available on the TLMI web site, www.tlmi.com, Environmental Committee page.
2.5 Federal Executive Order 13148, Section 702

3. Commercial Recycling Facilities

3.1 Four commercial recycling facilities have been confirmed as qualified host sites for the mill recycling trials:
3.2 American Fiber Resources – Fairmont, WV
3.3 International Paper – Franklin, VA
3.4 Mississippi River Corporation – Natchez, MS
3.5 Westvaco Corporation – Tyrone, PA
3.6 Other commercial recycling facilities may host PSA recyclability trials, provided that the following criteria are met:
3.7 The recycling facility must prove capable of manufacturing recycled fiber suitable for printing/writing grade paper from a 100% reclaimed fiber feed sources, which is known to commonly contain adhesive contaminants.
3.8 The recycling facility employs the minimum hardware requirements as detailed in the Materials & Equipment section of this mill trial protocol.
3.9 The recycling facility performance must be suitably characterized through a Benchmark PSA Recycling Trial, using Benchmark PSA 34355 laminate (available through the USDA Forest Products Laboratory) or a suitable replacement.

4. Significance and Use

4.1 When the mill trials are conducted properly, PSA recyclability will be characterized using four trial criteria:
4.2 Did the recycling mill qualify the PSA seed level as a significant loading with respect to repulped fiber contamination levels?
4.3 Did the recycling mill experience productivity or process performance hardships as a result of the PSA trial?
4.4 Did the recycling mill experience product quality hardships as a result of the PSA trial?
4.5 Do the post-trial third-party image analysis results confirm the first and third findings?

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Panel Discussion, *Session 21: Mill Recycling Trials*, Tappi 2000 Recycling Conference, Potomac, MD, 2000.

4.6 The mill trials serve to qualify or confirm the recyclability of PSA products within true mill recycling environments. This final qualification stage, when successfully executed, provides supporting evidence that the adhesive laminate is recyclable within the industry's product specifications. This protocol is recommended only after the particular candidate PSA has been evaluated using the laboratory protocol. This protocol may prove most useful when the laboratory results are ambiguous or cannot sufficiently address PSA recyclability.

4.7 The mill trial objective is to demonstrate that PSA's submitted for EO 13148 recyclability qualification prove no hardship to the recycling community when present in typical wastepaper feed. Specifically, these PSA trials are designed to demonstrate that the PSA's prove an insignificant influence on process operability and product quality, when seeded into the feed stream in significant quantities. Therefore, a successful PSA trial will satisfy three specific objectives:

4.8 Ensure that the PSA loading to the pulper represents a significant quantity of adhesive contaminant to the system.

4.9 Ensure that the PSA loading presents no hardships to the recycling system, with respect to productivity and process performance.

4.10 Ensure that the PSA loading presents no hardships to the recycling system, with respect to final product quality.

5. Materials and Equipment

5.1 Full Scale Commercial Recycling Facility: the facility could include one of the four qualified commercial recycling facilities or an alternative facility satisfying all of the requirements listed below:

5.2 50-650 tons per day capacity.

5.3 Feed comprising 100% reclaimed fiber.

5.4 Capable of manufacturing recycled fiber for printing and writing or other fine grade paper products.

5.5 Pulping conditions consistent with typical fine paper-grade recycling facilities.

5.6 Pressure slotted screens, primaries □0.006".

5.7 Forward cleaners

5.8 System capabilities appropriately characterized via PSA Benchmark Performance Trial. [2]

5.9 Laminate Material for Paper Label Product Qualification:

5.10 Laminate preparation is to be consistent with Sample Preparation Method A as defined in RCA LRP, paragraph 4.1. Laminate must be in a post-consumer configuration, stripped of liner and adhered to paper substrate. The laminate may be converted to a paper substrate either as a full laminate roll or as discrete labels affixed to individual sheets of copy paper. Adhesive products without liner such as notepads may be tested in the padded form, that is, the pads may be fed directly into the pulper of the recycled paper mill.

5.11 The required laminate quantities are specific to the host site production rate, but will safely fall below 4 tons.[3] Product loading is to be consistent with the product loading of the laminate for adhesive. qualification. The laminate for adhesive qualification is about 20% adhesive by weight. For an adhesive loading of 0.02% to 0.2%, this requires a laminate loading of 0.1% to 1% without release liner. Therefore the required product loading for product qualification is 0.1% to 1% without release liner. Actual product loading is calculated by the method in Attachment 1.

5.12 Laminate Material for Adhesive Qualification:

5.13 Laminate preparation is to be consistent with Sample Preparation Method B as defined in RCA LRP paragraph 4.2. Laminate must be in a post-consumer configuration, stripped of liner and adhered to paper substrate. The laminate may be converted to the paper substrate either as full laminate roll or as discrete label affixed to individual sheets of copy paper. The required laminate quantities are specific to the host site production rate, but will safely fall below 4 tons.[4] Total PSA loading will be 0.02% to 0.2% as calculated by the method in Attachment 1.

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[2] Using Benchmark PSA Laminate 34355 or an acceptable substitute.

[3] Assumes a double-spike trial, 700 tpd, 0.2% PSA seeded for 3-hour trial, laminate supplied at 10% PSA with 50% excess available.

[4] Assumes a double-spike trial, 700 tpd, 0.2% PSA seeded for 3-hour trial, laminate supplied at 10% PSA with 50% excess available.

5.14 Trial Equipment
5.15 4 x 5 gallon shipping buckets
5.16 Stock sample bags
5.17 Stock dewatering mesh

6. Trial Methodology

6.1 The mill PSA trials are designed as double-spike PSA trials. PSA material is spiked into and tracked through the recycling system, purged from the system, and subsequently repeated as an identical spike. The repeat or
[5] sample should reflect stock that has not yet been subjected to any removal unit operations except scavengers/detrashers and/or HD Cleaners.
[6] either wet lap, dry lap, washer mat or press mat. If the site includes an integrated paper machine, this sample should not be paper machine reel sheets.
double spike approach is conducted in the event that excessive contamination from the carrier feed paper coincides with a spike.

6.2 The host sites must operate their facility using their conventional feedstock during the PSA trials. This carrier feedstock will, therefore, define the *background* contamination within the system. For both spikes, PSA is added at such a level as to prove significant with respect to the background contamination from the carrier stock. For qualification of an adhesive, the PSA load level is site-specific, but will fall within a 0.02% to 0.20% PSA range. For qualification of a PSA coated paper label product, the product load level will fall in the range of 0.1% to 1% product. The PSA estimator included in **Attachment 1** must be used to project PSA requirements. Spike duration is also site-specific, but should follow the guidelines set forth in **Attachment 1**.

6.3 The specific trial procedure is defined below:

6.4 Estimate PSA laminate loading requirements to conduct a single spike trial according to guidelines in Attachment 1.

6.5 Establish steady-state conditions at the host-site. Steady-state conditions should be certified by the host-site representatives, and should reflect an absence of operations or product quality upsets for the previous 12 hours.

6.6 Sample the system for the Pre-Trial Baseline. Process sampling is defined in Table 1. The host site must also collect their process-specific trial samples for in-house sample analysis.

Table 1. Process Sampling

Pre-trial Baseline	Pulper Dump Chest[5] (1 OD kg) Fine Screen Accepts (500 OD g) Final Product[6] (500 OD g)
Spike I	Pulper Dump Chest[5] (1 OD kg) Fine Screen Accepts (500 OD g) Final Product[6] (500 OD g)
Inter-Spike Baseline	Pulper Dump Chest[5] (1 OD kg) Fine Screen Accepts (500 OD g) Final Product[6] (500 OD g)
Spike II Pulper	Dump Chest[5] (1 OD kg) Fine Screen Accepts (500 OD g) Final Product[6] (500 OD g)

[5] sample should reflect stock that has not yet been subjected to any removal unit operations except scavengers/detrashers and/or HD Cleaners.
[6] either wet lap, dry lap, washer mat or press mat. If the site includes an integrated paper machine, this sample should not be paper machine reel sheets.

6.7 Spike I: feed the PSA laminate into the process pulper for the specified spike duration as shown in Table 2. PSA spike trials will be of sufficient duration as to allow predictable tracking of trial stock as it passes through the commercial process.
6.8 Sample the system at the appropriate time and location for Spike I. Process sampling is defined in Table 1. The host site will also collect their process-specific trial samples for in-house sample analysis.
6.9 Purge the process of PSA contamination by running the standard baseline stock through the process for a minimum of 12 hours.
6.10 Depending on Spike I on-site conclusions, an adjustment to PSA loading may be necessary. Spike II should not be pursued if the host site experiences unacceptable process or product hardships during Spike I that are clearly attributable to Spike I.
6.11 After purging the process, repeat steps 6.3.5 and 6.3.6 for Spike II.
6.12 Host sites are to operate all unit operations and process systems according to standard operating procedures during all phases of the PSA trial.

Table 2
Duration of Spike for RCA Commercial Recycling Trials

Tonnage	Spike Duration
< 100 tpd	1 hour
100 – 400 tpd	2 hours
> 400 tpd	3 hours

7. Trial Sampling

7.1 Given the brevity of these trials, PSA equilibrium within the system will typically not be attained. In fact, as many of these PSA's are designed to be screenable, little discernable impact on mill process quality numbers is noted beyond the screening stages. However, sufficient process sampling must accompany each spike (Table 1). Additionally, the host site must be instructed to conduct process analysis that specifically serves two objectives:
7.2 Ensure that the PSA loading to the pulper represents a significant quantity of adhesive contaminant to the system.
7.3 Ensure that the PSA loading presents no hardships to the recycling system, with respect to final product quality.
7.4 The PSA must, foremost, prove recyclable under the host site prime-quality guidelines. Therefore, the host-site quality control (QC) techniques are the primary gauge for trial success. These QC techniques are by no means common from site to site. Consequently, all samples collected for EO 13148 Benign Adhesive qualification must be analyzed using the above referenced RCA IAP Image Analysis Protocol.
7.5 Each sample must be properly identified with the following information:
7.6 Date and time
7.7 Host Site Location
7.8 Sample Location
7.9 Laminate Candidate Code Number
7.10 Trial phase (Pre-trial Baseline, Spike I, Inter-spike Baseline, Spike II)
7.11 Each set of samples must be shipped to a qualified independent testing laboratory with a complete master table sample list.
7.12 Samples are to be shipped to an RCA-approved laboratory capable of analyzing stock samples using the RCA IAP Image Analysis Protocol.

8. Reporting of Results

8.1 Each host-site is required to supply the following deliverables for each trial (see reporting form at the end of this document).
8.2 Certification that the PSA loading was appropriate and significant. Significance can be certified by three different methods: on-site analytical techniques, prior trial experience at equivalent PSA loadings, or post-trial image analysis protocol results.
8.3 Certification that the PSA trial caused no hardship with respect to process performance or process throughput. If hardships are encountered, such hardships should be documented and quantified.
8.4 Certification that the PSA trial caused no hardship with respect to product quality. If hardships are encountered, such hardships must be documented and quantified. Additionally, the host site must certify that the product quality hardships are not attributable to non-trial related process upsets. To do so, the host site must certify that the specific unit operation controls were consistent between baseline and spike trial periods. Such controls may include, but are not limited to: reject rates, pressure differentials, passing speeds for all screens and cleaners.
8.5 Suitable information regarding screen/cleaner/floatation/washing stickies removal efficiencies from the trials.
8.6 Brief report issued by the host site summarizing process performance during the trial.

8.7 Additionally, for those laminate suppliers who wish to submit the trial results for EO 13148 Recyclable Adhesive qualification, the following must be submitted.
8.8 Items 1-5 above.
8.9 Image analysis results and conclusions from all trial samples listed in Table 1. Results must be reported as adhesive area in PPM, counts/m^2, and average particle size (mm^2) for each sample.
8.10 Image analysis results and conclusions from all Benchmark trial samples (only required of host-sites not yet qualified for trials).

Attachment 1

Recycling Compatible Adhesive Qualification
Full Scale Commercial Recycling Trial

9. Adhesive Loading Estimator

9.1 For the six host sites currently qualified as suitable host sites for PSA recycling trials, the previously established site-specific PSA seed levels must be employed. These PSA loadings are available upon request from the specific host-sites (all are within a 0.02% - 0.20% PSA range).
9.2 For sites not yet qualified for such trials, the PSA loading estimator (Table A1.1) must be employed to estimate appropriate loadings. The derivation of this estimator is confirmed through the accuracy as applied to the six host site PSA loading (see Figure A1.1). Regardless of the estimator findings, PSA loadings must fall within the 0.02% < PSA loading < 0.20% range for adhesive qualification in a full scale trial. For product qualification, the product loading must fall within the range of 0.1% to 1%.

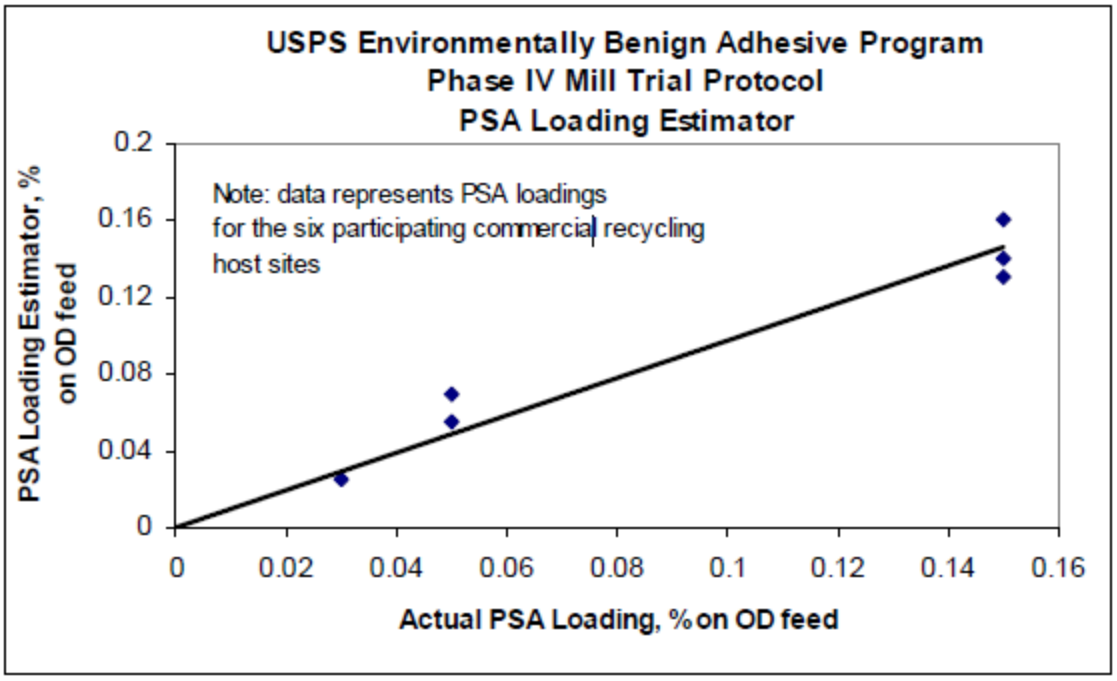
Table A1.1
PSA Loading Estimator for Commercial Recycling Host Sites

	Added PSA, % on O.D. basis
Base load PSA	0.100
Refiner in process?	
Yes	0.040
No -	0.040
Post-consumer waste in feed?	
Yes	0.015
No	0.000
Flotation in process?	
Yes	0.020
No -	0.020
DIP stickies QC method employed?	
Yes	0.030
No -	0.030
Reverse cleaners in process?	
Yes -	0.020
No	0.020
Can the process produce market pulp?	
Yes -	0.025
No	0.025
Does the process employ 0.004”-slotted screens?	
Yes	0.020
No	0.000
Does the pulper temperature exceed 130 F?	
Yes -	0.030
No	0.000
Does the process employ enzymatic deinking?	
Yes	0.015
No	0.000
Does the process employ neutral pulping?	
Yes	0.010
No	0.000
Does the process employ continuous pulping?	
Yes	0.010
No	0.000

Note: if estimated % PSA exceeds 0.20%, employ 0.20%.
if estimated % PSA is less than 0.02%, employ 0.02

Example: A site answering “yes” to all inquiries will host a PSA trial at 0.185% PSA. For individual product qualification, multiply the % PSA calculated from the procedure above by 5 to calculate the required product loading. For example, if the estimated PSA loading is 0.02%, use 0.1% as the product loading. If the estimated PSA loading is 0.2%, use 1% as the product loading.

Figure A1


USPS Environmentally Benign Adhesive Program
Phase IV Mill Trial Protocol
PSA Loading Estimator
Note: data represents PSA loadings for the six participating commercial recycling host sites
PSA Loading Estimator, % on OD feed
Actual PSA Loading, % on OD feed
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.2

Verification of Recycling Compatible Adhesive trial at a commercial recycling mill.

Name of recycling mill

Address of mill

Contact and phone number

Mill production capability (tpd)

Sample

Name and product number of adhesive laminate tested

Product loading (percent product added to the furnish)

1st adhesive spike duration

Down time between spikes

2nd adhesive spike duration

Samples collected (list all pulp samples collected)

On-site stickies analysis method (if any)

Results of on-site analysis for stickies (qualitative or quantitative)

Suitable information regarding screen/cleaner/floatation/washing stickies removal efficiencies from the trials.

Did the host-site qualify the PSA seed level as a significant loading, with respect to repulped fiber contamination levels?

Did the host site experience productivity or process performance hardships, as a result of the PSA trial?

Did the host site experience product quality hardships, as a result of the PSA trial?

Were the specific unit operation controls consistent between baseline and spike trial periods?

Signature_____

Title_____

Company_____