

## APPENDIX A - SINGLE STREAM MATERIAL LOSSES

Losses from single stream processing vary significantly among facilities depending on the types of equipment used in the single stream MRF, whether a material is positively or negatively sorted, whether a material is sorted using automated equipment or manually sorted, and how many sorters the MRF operator assigns to quality control at the end of the sorting lines. Based on comments received by ANR after the Project Team submitted the Interim Report on the bottle bill, the ANR directed that Vermont-specific data on losses be incorporated in the final report. As discussed in the interim report the Project Team is using the Rutland MRF as the baseline MRF because it has been recently converted to a single stream MRF and represents state-of-the art sorting equipment.

Key factors influencing Rutland MRF losses are:

- Glass is deliberately broken on the first corrugated disk screen to remove it from the materials being sorted. It is further separated from other materials by a secondary screen, and then is vacuumed before being discharged to a materials bunker for sale to a glass processor.
- PET is positively hand sorted resulting in much cleaner PET than if it were being sorted with automated equipment.
- Aluminum is recovered using eddy current separators. These separators work very well for whole aluminum beverage containers but do not work as well for crushed aluminum.

Losses occur for each material as follows:

- **Glass** - Glass can be lost to paper and plastic bales, and can be lost to the MRF residue line during processing at the MRF. Further losses occur when the glass is processed at the glass beneficiation facility. In this case the losses are contaminants to the glass which were reported as glass in sales from the MRF, but are actually not glass and must be removed by the glass beneficiation facility.
- **PET** - PET bottles can be lost to the paper bales and can be lost to the MRF residue line. PET losses at the PET reclaimer, like glass, consist of non-PET which was sold to the reclaimer as PET but which must be sorted out by the reclaimer. These losses are significantly less if the PET bottles are being positively sorted off the line, as opposed to either negatively sorted or sorted using automated equipment. In the case of positively sorted PET, the losses consist primarily of non-PET plastics that were mistakenly determined to be PET by the sorter, paper inadvertently pulled with the PET container, and food residue in non-beverage PET.
- **Aluminum** - As with PET and glass, aluminum can be lost to the MRF residue line, and can end up in the paper bale, or in the glass. Because of the aggressive disk screens at the front of the Rutland MRF, small pieces of aluminum can behave like glass and fall through the screen with the glass. This is especially the case for small aluminum cat food cans which are small to start with, and which may be bent during compaction in the single stream collection truck. In addition, a flattened aluminum can may behave like paper on the disk screen separating fibers from containers and end up in the paper bale. Or, the aluminum may not be removed by the eddy current separator and end up in the residue off the end of the container line.

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## CALCULATION OF LOSSES

The Project Team pursued two avenues to determine actual losses from the Rutland MRF. First, the Project Team requested data from the Casella on material audits of paper, glass, PET and aluminum. Casella provided the Project Team with material audits for glass (sold to Strategic Materials), PET (brokered through Haycore in Canada), aluminum to Anheuser Busch, and paper bale audits.<sup>1</sup>

These audited reports form the basis of the losses experienced by the buyer of material sold from the Rutland MRF and are reported in Table A-2 as “End User or Reclaimer Losses.” They are actual losses reported by the buyers.

Second, the Project Team conducted three days of sampling of process residue and of the glass output at the Rutland MRF. The goal was to learn what percent of process residue actually represented losses of bottle bill material (AL, PET and Glass) and paper. These losses represent real losses of material that were collected for recycling but end up in the landfill. Ultimately 16 samples of residue, weighing a total of 510 pounds were hand sorted to a 3/8 inch screen level, with all material that could be recycled at the Rutland MRF pulled from the residue, weighed, and compared against the total weight of the sample.

Table A-1 presents the results of the residue sampling.

**TABLE A-1.**  
**Composition of Residue at the Rutland MRF**

<b>Material</b>	<b>% of Residue</b>
Mixed Paper	15.9%
PET	0.2%
All Other Recyclable Plastic	3.0%
Aluminum	0.5%
Other Metal	2.2%
Glass	6.0%
Trash	72%

The next step was to then convert these percentages to actual tons and compare the tons against sales of each of the commodities to determine the actual loss rate to MRF residue. The following table presents a matrix of losses as percentages which can be applied to tons of materials collected to determine tons of actual material available for recycling after accounting for all losses.

The first column of Table A-2 shows the amount of potentially recyclable material that actually ends up in the MRF residue and is therefore lost to recycling. The next six columns present the results of the buyer audits showing what percent of what they received was not the material they were purchasing.

The sum of these losses at the reclaimer level are totaled first, and then losses to MRF residue added to this, to represent total material losses for each material. These loss rates are applied to the expected materials recovered under Systems 2 through 4 of this analysis to determine actual material recovery rates.

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<sup>1</sup> Casella requested that the Project Team not disclose paper buyers

**TABLE A-2. Losses in MRF Residue and at End User By Material Type**

MATERIAL	MRF Residue	End User or Reclaimer Losses							Total All Losses
		Trash	Glass	Al Food	Al UBC	PET	Paper	Total	
Mixed Paper	1.94%	1.96%	0.06%	0.00%	0.00%	0.43%	0.00%	2.46%	4.41%
Containers									
PET	0.89%	5.94%	0.00%	0.04%	0.04%	0.00%	0.98%	7.00%	7.89%
Aluminum	17.05%	1.00%	0.00%	0.00%	0.00%	0.00%	0.05%	1.05%	18.10%
Glass	3.52%	6.00%	0.00%	0.32%	0.02%	0.58%	4.08%	11.00%	14.52%