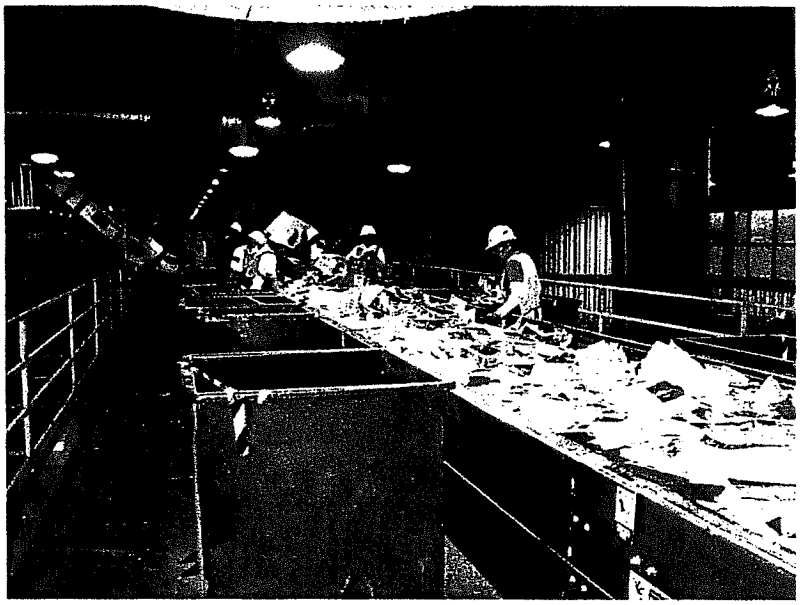
Final Report | **May 2003**



Waste Characterization Methodology for Determining Allocation of Curbside Recycling Revenues

City of Sunnyvale

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Section 1
Introduction

Brown, Vence and Associates (BVA) was retained by the City of Sunnyvale (Sunnyvale) in association with the Cities of Mountain View and Palo Alto to conduct a Study to develop a waste characterization methodology for source-separated recyclables. This methodology will be used in the process of allocating SMaRT Station ® revenues to each of the cities in accordance with the Memorandum of Understanding, and the Revenue Allocation Methodology approved by the Cities in January, 2002 (See Appendix E). The Study included:

- Meeting with the cities and haulers to collect data and discuss field sampling logistics
- Developing a comprehensive composition analysis methodology
- Preparing a training manual for future characterizations to be performed by SMaRT Station contractor
- Providing training to the staff and contractor during the field sampling
- Conducting field sampling
- Analyzing and presenting the results

The purpose of the study was to develop and implement a waste characterization methodology to determine the amounts and concentrations of each curbside material delivered to the SMaRT Station by each of the two cities.

BVA conducted the Study in three phases: initial planning, field sampling analyses, and report preparation. Initial planning occurred prior to the field sampling analyses in February and early March 2003. We held a kick-off meeting at the SMaRT Station with Sunnyvale Staff and the Contract Operator. BVA also met with Green Team/Zanker (GTZ) to discuss the overall Study approach, collect relevant data, and make contacts. A follow-up meeting was held with both cities and their haulers; Specialty Solid Waste & Recycling (Specialty) for Sunnyvale and Foothill Disposal Company (Foothill) for Mt View. During this initial planning phase a draft methodology and training manual were developed. In addition, all logistics for the field sampling phase were performed.

BVA conducted the actual field sampling analyses from March 22, 2003 through April 4, 2003, collecting a total of 40 samples from both cities. Materials were characterized during the field sampling using randomly pre-selected loads. These loads were sorted and processed by individual truck compartment using the SMaRT Station's curbside processing equipment and GTZ's normal processing staff. Details to the exact methodology are included in the following report sections.

Data collected during the field sampling analyses were sorted and summarized by city, load type, and truck compartment. Statistics were applied to the results to calculate the mean, standard deviation, and margins of error at a 90-percent confidence level for each of the curbside materials collected.

The report describes each of the initial planning, field sampling analyses, and report phases through the supporting procedures and findings. Section 2 discusses the Study's procedures, and Section 3 presents the findings of the Study, including all pertinent tables and statistics. Appendix A contains the methodology and Appendix B includes a step-by-step training manual.

Section 2
Study Procedures

Brown, Vence and Associates (BVA) followed the Methodology and Training Manual procedures described within this report in conducting the Study. We have highlighted specific procedure details developed in particular for the Study and Field Sampling Analyses conducted over the period of February through April 2003 in this section.

2.1 Phase I: Initial Planning

Sampling Plan

As discussed, a total of 40 samples, 20 samples for Sunnyvale and 20 samples for Mt View were selected. Next, a selection of the type of routes to be sampled for each city was performed. Specialty runs three types of routes for Sunnyvale. These three routes to divide the sampling across include; (1) single-family residential (SF), (2) multi-family residential (MF) and, (3) schools/City Hall. Foothill runs three types of routes for Mt View. These three routes to divide the sampling across include; (1) residential, (2) commercial and, (3) OCC. Specialty runs a total of 32 routes to cover the entire city of Sunnyvale, while Foothill runs 68 routes to cover the entire city of Mt View. To calculate the number of samples required by route type, the total number of a specific route type was divided into the total routes for each individual city. The number of routes by city, route type, percentage of routes and number of samples required by route is shown in Table 2-1.

Schedule

A schedule was developed to allow, as best possible, uninterrupted curbside processing operations at the SMaRT Station. The schedule also had to cover each day of the week (Monday through Friday) collection occurred equally. The schedule also took into account each hauler's route list and geographic representation. Routes were then selected randomly for each day from this list. As discussed, loads were held overnight from the previous day's collection activities and delivered to the SMaRT Station between 5:00 am and 8:00 am

each day (except for the initial day when all loads were scheduled an hour later to take into account training and start-up activities). In a meeting with cities haulers, it was decided that Specialty would take the earliest and latest deliveries of the day, while Foothill took the two mid-time deliveries. The actual delivery schedule is shown in Table 2-2.

Table 2-1 | Route Sampling Plan

City/Route	Number of Routes	Percentage by Routes	Number of Samples
Sunnyvale			
SF Residential	25	78%	15
MF Residential	6	19%	4
Schools/City Hall	1	3%	1
Totals	**32**	**100%**	**20**
Mt View			
Residential	41	60%	12
Commercial	20	29%	6
OCC	7	10%	2
Totals	**68**	**100%**	**20**

Table 2-2 | Study Route Delivery Schedule

Materials Collected on:	Fri 3/21	Mon 3/24	Tue 3/25	Wed 3/26	Thu 3/27	Fri 3/28	Mon 3/31	Tue 4/1	Wed 4/2	Thu 4/3
Delivered to SMaRT on:	Sat 3/22	Tue 3/25	Wed 3/26	Thu 3/27	Fri 3/28	Sat 3/29	Tue 4/1	Wed 4/2	Thu 4/3	Fri 4/4
5:00 AM		Specialty SF - 703	Specialty SF - 704	Specialty SF - 701	Specialty SF - 702	Specialty SF - 701	Specialty SF - 704	Specialty SF - 705	Specialty SF - 702	Specialty SF - 701
5:30 AM		Foothill COM - 11134		Foothill COM - 11139		Foothill COM - 11102		Foothill COM - 11139	Foothill COM - 11155	Foothill COM - 11102
6:00 AM	Specialty SF - 702		Foothill RES - 15096		Foothill RES - 15097		Foothill RES - 15097			
7:00 AM	Foothill OCC - 18	Foothill RES - 15097	Foothill RES - 15095	Foothill RES - 15098	Foothill RES - 15095	Foothill RES - 15098	Foothill OCC - 18	Foothill RES - 15098	Foothill RES - 15095	Foothill RES - 15096
8:00 AM	Foothill RES - 15096	Specialty SF - 705	Specialty 615	Specialty MF - 706**	Specialty SF - 704	Specialty SF - 705	Specialty MF - 707	Specialty SF - 701	Specialty SF - 703	Specialty MF - 706**
9:00 AM	Specialty MF - 706									

Equipment and Crew Preparation

Prior to the actual field sampling analyses, we met with the cities, their haulers and the contract operator, GTZ. The haulers, with support from their cities agreed to the schedule described above. GTZ agreed to make available all crew and equipment normally used in their day-to-day curbside processing operations. The crew for the initial Study consisted of approximately 36 personnel including approximately 17 curbside line sorters, 15 commercial line sorters, two rolling stock (forklift and front-end loader) operators, one part-time baler operator, and one floor manager. The normal truck-scale assistant was not usually on duty during our Study (the floor manager recorded scale weights). Equipment supplied by GTZ included at least two forklifts, a front-end loader, and various bins and containers to collect and store samples. Additional BVA supplied: a laptop computer to log all information from the study, flagging tape, three ½-gallon containers to collect liquids, permanent markers, duct tape, and notebooks. Personal safety equipment such as hardhats, safety vests, goggles,

earplugs etc were supplied by the contractor's crew for the crew (this is equipment that they use on a daily basis to perform their job).

2.2 Phase II: Field Sampling Analyses

Equipment Setup

Equipment setup was performed at the beginning of each and every day sampling was to occur. Setup included:

- Setting up the table and chair for the laptop computer and BVA data entry personnel near the platform scale, but out of the way of the facility operations.
- Starting up the laptop computer and readying the blank sample sheets for each day of testing (2 sheets for each city; 4 sheets total).
- Sweeping and cleaning up around the platform and truck scale area; zeroing out the scale
- Tape off areas on sorting platforms that sorters should not sort into; for container line tape one strip of caution tape across all normal bunker openings; for fiber line put caution tape over bunker chutes not in use (third and fourth bunker from in-feed, these will be used for storage).
- Check all lines to see if clear of all materials including all in-feeds, conveyor systems, sorting line containers, floor bins, bunker areas.
- Have crew clean up and sweep around all conveyor systems.
- Check tare weights on all containers and bins; apply duct tape to containers/bins and add with permanent marker the first letter of the day of sampling and the tare of the container/bin.
- Ensure that if bales are located on the balers, the last bale is marked to designate where the study loads will begin.
- Place three (3) extra bins for sort under/adjacent to the containers sorting line; these bins include: (1) aluminum cans, (2) PET, and (3) HDPE.
- Tie off residue screening material at bottom from air classification system; not much residue is gathered per run and can easily be untied and emptied into a small container at the end of each run.

Sampling Procedures

Field sampling began on Saturday March 22nd and ran through Friday April 4th. Sampling was conducted on Tuesdays through Saturdays for the two-week period; a total of 10 sampling days. Sampling began most all days (except the first) at 5:00 am and continued until all 4 samples for the day were processed. Sampling continued each day until approximately 10am to 11am. BVA found that this did not interfere much with normal curbside vehicle unloading and processing patterns.

Detailed sampling procedures are included in the Training Manual in Appendix B. A copy of this document is provided in Spanish in Appendix C. We have included a copy of our daily hand-written field notes in Appendix D.

As can be expected, some variations to the normal sampling procedures occurred throughout the Field Study period. These included:

- On March 22nd, first day of the sort, contract sorting team utilized more than the normal allotment of sorters for approximately the first 5 minutes of the first two loads (one Sunnyvale, the other Mt View).
- On March 26th, first Specialty truck's compactor unit froze; the first Foothill load was processed in its place (then the Specialty load was dumped and processed); during the same day, a container of HDPE was dumped before weighing occurred; a comparable amount was measured, weighed and added to the load.
- On March 28th, the first Foothill load was delivered using a 2-compartment truck instead of the usual 3-compartment truck; Foothill explained that the selected route is a normal Thursday route in which they use a smaller truck to access more difficult/narrower customer routes.
- On April 1st, a customer's broken toter was found in the first Foothill load in the newspaper compartment; the container was weighed as residue; a third and new forklift driver was introduced to the Study this day; he brought several containers of previously weighed materials to the scales to be weighed and recorded; these erroneous container weights were not entered into the spreadsheet (however one container needed backing out

of the spreadsheet); three forklift drivers is too many for the sort (2 is perfect).

- On April 3rd, the first Specialty truck dumped only half of its container load for processing; the remainder of the load which was stuck in the compartment was later dumped onto the tip floor and then transferred back for processing; no final tare weight for this vehicle was recorded; the final tare weight was calculated by subtracting the weight of material dumped onto the floor from the truck's final weight.

2.3 Phase III: Report Preparation

Review and Reconcile Data

All data was entered directly into an Microsoft Excel spreadsheet on the laptop computer in the field during the Study. All data was error checked after each route was sampled to check for shrinkage and possible errors. In addition, all data was checked and reconciled at the end of the Study as well.

Generate Statistics and Summary Tables

Tables were generated by city, by load type and by truck compartment type. All data was reported in weight (lbs) and percentage. A summary table was developed by aggregating material type for all loads from each city for statistical analysis. The mean, standard deviation and margin of error at a 90% confidence level was computed for each material type. To calculate the composition between the two cities, a weighting of the loads by number sampled of each type to the amount normally delivered over the two-week sampling period was conducted. Results are provided in Section 3 of the report.

Report of Procedures and Findings

This report represents the documentation of procedures prepared containing sufficient detail so that a person familiar with the design of the SMaRT Station, and a copy of the Methodology and Training Manual included in this report could replicate the Study. The report includes comments on aspects of the Study that presented special difficulties or would be difficult to replicate, and a written explanation of the findings shown in the summary tables.

Section 3
Findings

This section describes the Study's findings through presentation and discussion of resultant tables. The total weights and percentages of each material component for all 20 samples per city and by truck compartment were first accumulated. Next, tables were developed to summarize samples from "like" routes for each city. This included addressing: 1) residential and 2) schools/City Hall routes for the City of Sunnyvale and 1) residential 2) commercial and 3) OCC routes for the City of Mountain View. We also summarized data on Sunnyvale's residential routes by single-family and multi-family routes. Next an over all composition summary and statistical analysis was applied to the average percent composition by material type for each city. The analysis included calculating the mean, standard deviation and margin of error for each material. In addition to the tables presented in this section, Appendix F contains support calculations and tables.

3.1 Sunnyvale

Table 3-1 presents a summary of the average percent composition by material type and truck compartment (commingled containers and fiber compartments) from the 20 samples analyzed for the City of Sunnyvale during the Study. This table shows that for the residential routes, the largest component in the commingled containers truck compartment was mixed glass at 37.4% and in the fiber truck compartment, old newspaper at 86.5%. This table also shows that for the schools/city hall routes, the largest component in the commingled containers truck compartment was tin cans at 31.1% and in the fiber truck compartment, old corrugated cardboard at 100%.

3.2 Mountain View

Table 3-2 presents a summary of the average percent composition by material type and truck compartment (commingled containers, newspaper and mixed paper compartments) from the 20 samples analyzed for the City of Mountain View during the Study. This table shows that for the residential routes, the

largest component in the commingled containers truck compartment was mixed glass at 35.2%, the largest component in the newspaper truck compartment was old newspaper at 97.6%, and the mixed paper truck compartment, mixed paper at 99.0%. This table also shows that for the commercial routes, the largest component in the single truck compartment was mixed paper at 68.2%. For the OCC routes, OCC made up an average of 97% of the truck's load, the remainder was classified as residue.

3.3 Statistical Analyses

Table 3-3 presents a statistical analysis of the percent composition by component for each city. The analysis included development of the mean, standard deviation and margin of error at a 90% confidence level. For Sunnyvale, most all components had a margin of error of 1% or less except for ONP and mixed paper. The margin of errors for these components was 5.6% and 8.1% respectively. The higher margin of error for these two components was due to the one different type of load, the schools/City Hall load which had 0% ONP and 97.3% mixed paper (very different from Sunnyvale's residential routes).

For Mountain View, most components had a margin of error of 1% or less except for ONP, OCC and mixed paper. The margin of errors for these components was 5.2%, 8.1% and 11.9% respectively. The higher margin of error for these fiber components was due to statistically analyzing the mixture of commercial and OCC routes with those of the residential. The commercial and OCC routes had a much higher concentration of fibers.

Table 3-1 | Sunnyvale Summary by Route Type

	Residential Route Totals	Schools/ City Hall Route Totals
Characterization by Percentage		
Commingled Containers	**Ave (%)**	**Ave (%)**
Tin Cans	8.2%	31.1%
PET	6.8%	11.1%
HDPE - Mix	7.9%	12.2%
Aluminum Cans	2.3%	7.8%
Glass Bottles - Clear	10.3%	6.7%
Glass Bottles - Green	9.9%	0.0%
Glass Bottles - Brown	4.5%	0.0%
Glass Bottles - Mix	37.4%	0.0%
Liquid	0.4%	3.3%
Residue	11.1%	10.0%
Shrinkage	1.1%	17.8%
Total Container Compartment	100.0%	100.0%
Fiber	**Ave (%)**	**Ave (%)**
Old Newspaper	86.5%	0.0%
Mixed Paper	6.0%	100.3%
Old Corrugated Cardboard	6.0%	0.0%
Tin Cans	0.1%	0.0%
PET	0.1%	0.0%
HDPE - Mix	0.1%	0.0%
Aluminum Cans	0.0%	0.0%
Glass Bottles - Clear	0.0%	0.0%
Glass Bottles - Green	0.0%	0.0%
Glass Bottles - Brown	0.0%	0.0%
Glass Bottles - Mix	0.3%	0.0%
Liquid	0.0%	0.0%
Residue	0.4%	0.0%
Shrinkage	0.5%	-0.3%
Total Fiber Compartment	100.0%	100.0%

Table 3-2 | Mountain View Summary by Route Type

	Residential Route Totals	Commercial Route Totals	OCC Route Totals
Characterization by Percentage			
Commingled Containers	**Ave (%)**	**Ave (%)**	**Ave (%)**
Tin Cans	6.9%	n/a	n/a
PET	6.3%	n/a	n/a
HDPE - Natural	0.0%	n/a	n/a
HDPE - Color	0.0%	n/a	n/a
HDPE - Mix	6.4%	n/a	n/a
Aluminum Cans	1.9%	n/a	n/a
Scrap Metal	0.0%	n/a	n/a
Glass Bottles - Clear	10.7%	n/a	n/a
Glass Bottles - Green	13.6%	n/a	n/a
Glass Bottles - Brown	5.7%	n/a	n/a
Glass Bottles - Mix	35.2%	n/a	n/a
Liquid	0.3%	n/a	n/a
Residue	11.7%	n/a	n/a
Shrinkage	1.2%	n/a	n/a
Total Container Compartment	100.0%	n/a	n/a
Newspaper/Single Compartment	**Ave (%)**	**Ave (%)**	**Ave (%)**
Old Newspaper	97.6%	0.0%	0.0%
Mixed Paper	2.5%	68.2%	0.0%
Old Corrugated Cardboard	0.0%	20.4%	97.0%
Tin Cans	0.0%	0.8%	0.0%
PET	0.0%	0.3%	0.0%
HDPE - Natural	0.0%	0.0%	0.0%
HDPE - Color	0.0%	0.0%	0.0%
HDPE - Mix	0.0%	0.3%	0.0%
Aluminum Cans	0.0%	0.3%	0.0%
Scrap Metal	0.0%	0.0%	0.0%
Glass Bottles - Clear	0.0%	0.0%	0.0%
Glass Bottles - Green	0.0%	0.0%	0.0%
Glass Bottles - Brown	0.0%	0.0%	0.0%
Glass Bottles - Mix	0.0%	2.2%	0.0%
Liquid	0.0%	0.0%	0.0%
Residue	0.2%	7.5%	3.3%
Shrinkage	-0.4%	0.0%	-0.3%
Total Newspaper Compartment	100.0%	100.0%	100.0%

Table 3-2 | Mountain View Summary by Route Type (Continued)

	Residential Route Totals	Commercial Route Totals	OCC Route Totals
Mixed Paper	**Ave (%)**	**Ave (%)**	**Ave (%)**
Old Newspaper	0.0%	n/a	n/a
Mixed Paper	99.0%	n/a	n/a
Old Corrugated Cardboard	0.0%	n/a	n/a
Tin Cans	0.0%	n/a	n/a
PET	0.0%	n/a	n/a
HDPE - Natural	0.0%	n/a	n/a
HDPE - Color	0.0%	n/a	n/a
HDPE - Mix	0.0%	n/a	n/a
Aluminum Cans	0.0%	n/a	n/a
Scrap Metal	0.0%	n/a	n/a
Glass Bottles - Clear	0.0%	n/a	n/a
Glass Bottles - Green	0.0%	n/a	n/a
Glass Bottles - Brown	0.0%	n/a	n/a
Glass Bottles - Mix	0.0%	n/a	n/a
Liquid	0.0%	n/a	n/a
Residue	0.0%	n/a	n/a
Shrinkage	1.0%	n/a	n/a
Total Mixed Paper Compartment	100.0%	n/a	n/a

Table 3-3 | Study Summary With Statistics

City of Sunnyvale

Hauler:	SPECIALTY	SPECIALTY	SPECIALTY	SPECIALTY	SPECIALTY	SPECIALTY	SPECIALTY	SPECIALTY	SPECIALTY	SPECIALTY	SPECIALTY	SPECIALTY	SPECIALTY	SPECIALTY	SPECIALTY	SPECIALTY	SPECIALTY	SPECIALTY	SPECIALTY	SPECIALTY			
Date:	3/22/03	3/22/03	3/25/03	3/25/03	3/26/03	3/26/03	3/27/03	3/27/03	3/28/03	3/28/03	3/29/03	3/29/03	4/1/03	4/1/03	4/2/03	4/2/03	4/3/03	4/3/03	4/4/03	4/4/03			
Truck #:	712	703	713	715	714	703	711	701	712	714	711	715	714	702	715	711	712	713	711	703			
Route #:	702	706	703	705	704	815	701	706	702	704	701	705	704	707	705	701	702	703	701	706			
SMaRT #:	385	390	386	383	387	390	384	388	385	387	384	383	387	389	383	384	385	386	384	390	Average	Standard	Margin of
Load Type:	SF Residential	MF Residential	SF Residential	SF Residential	SF Residential	Schools/City	SF Residential	MF Residential	SF Residential	SF Residential	SF Residential	SF Residential	SF Residential	MF Residential	SF Residential	SF Residential	SF Residential	SF Residential	SF Residential	MF Residential	(Mean)	Deviation	Error
Old Newspaper	55.3%	67.8%	49.3%	45.8%	56.8%	0.0%	56.6%	67.1%	50.1%	61.3%	59.4%	59.6%	57.3%	62.8%	56.9%	50.8%	61.5%	59.3%	63.5%	59.6%	56.1%	14.4%	5.6%
Mixed Paper	5.5%	4.8%	4.4%	4.7%	3.5%	97.3%	2.9%	4.8%	2.6%	2.4%	3.5%	3.0%	7.0%	4.9%	3.7%	3.7%	3.2%	3.1%	3.2%	8.4%	8.8%	20.9%	8.1%
Old Corrugated Cardboard	5.0%	0.6%	8.9%	7.1%	3.2%	0.0%	4.0%	1.2%	4.7%	5.1%	4.7%	4.1%	7.9%	1.2%	5.2%	4.5%	4.5%	2.6%	3.8%	1.2%	4.0%	2.4%	0.9%
Tin Cans	2.9%	1.7%	2.8%	4.6%	3.2%	0.9%	2.7%	1.8%	2.6%	2.9%	3.0%	3.5%	1.7%	1.5%	2.9%	2.7%	2.5%	2.6%	2.5%	2.6%	2.6%	0.8%	0.3%
PET	2.5%	1.3%	3.2%	3.4%	2.8%	0.3%	2.4%	1.4%	2.3%	2.2%	2.5%	2.1%	1.3%	1.2%	2.8%	2.7%	2.5%	2.6%	2.5%	2.6%	2.6%	0.8%	0.3%
HDPE - Natural	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.1%	0.7%	0.3%
HDPE - Color	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
HDPE - Mix	3.0%	3.0%	3.4%	4.0%	2.4%	0.4%	2.3%	2.9%	2.4%	2.3%	2.4%	2.7%	0.9%	3.1%	2.5%	3.0%	1.8%	2.1%	2.3%	2.7%	2.5%	0.8%	0.3%
Aluminum Cans	0.9%	0.4%	0.8%	0.9%	0.7%	0.2%	0.8%	0.3%	0.9%	0.9%	0.9%	0.9%	0.5%	0.7%	0.9%	1.1%	1.0%	0.8%	0.7%	0.3%	0.7%	0.2%	0.1%
Scrap Metal	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Glass Bottles - Clear	3.9%	3.1%	4.2%	4.4%	3.3%	0.2%	2.9%	2.5%	3.8%	3.0%	3.3%	3.9%	2.3%	2.9%	3.3%	3.5%	2.6%	3.3%	2.6%	3.4%	3.1%	0.9%	0.3%
Glass Bottles - Green	3.9%	2.9%	1.5%	2.9%	3.4%	0.0%	3.7%	2.5%	4.6%	3.5%	3.9%	3.8%	1.2%	2.1%	2.7%	3.9%	2.8%	4.3%	2.9%	2.9%	3.0%	1.1%	0.4%
Glass Bottles - Brown	1.9%	1.3%	1.6%	1.9%	1.6%	0.0%	1.2%	1.4%	1.3%	1.2%	1.6%	1.3%	0.9%	1.6%	1.7%	1.6%	1.0%	1.4%	1.0%	1.5%	1.4%	0.4%	0.2%
Glass Bottles - Mix	10.7%	6.0%	15.9%	15.5%	12.6%	0.0%	16.3%	8.2%	12.1%	11.7%	11.9%	11.4%	7.9%	9.6%	13.4%	18.7%	13.7%	13.9%	11.9%	8.9%	11.4%	3.9%	1.6%
Liquid	0.1%	0.1%	0.2%	0.1%	0.2%	0.1%	0.1%	0.2%	0.1%	0.0%	0.1%	0.1%	0.2%	0.1%	0.1%	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%
Residue	3.9%	6.3%	4.5%	4.1%	3.3%	0.3%	3.6%	4.0%	2.8%	2.8%	3.0%	3.2%	1.5%	6.0%	3.6%	3.9%	3.1%	3.4%	3.2%	4.9%	3.8%	1.3%	0.5%
Shrinkage	0.6%	0.5%	-0.7%	0.6%	3.0%	0.3%	-0.4%	1.9%	-0.6%	0.7%	-0.2%	0.7%	-0.6%	2.4%	0.4%	1.4%	0.1%	0.7%	0.3%	1.2%	0.6%	1.0%	0.4%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	n/a	n/a

City of Mountain View

Hauler:	FOOTHILL	FOOTHILL	FOOTHILL	FOOTHILL	FOOTHILL	FOOTHILL	FOOTHILL	FOOTHILL	FOOTHILL	FOOTHILL	FOOTHILL	FOOTHILL	FOOTHILL	FOOTHILL	FOOTHILL	FOOTHILL	FOOTHILL	FOOTHILL	FOOTHILL	FOOTHILL			
Date:	3/22/03	3/25/03	3/26/03	3/26/03	3/27/03	3/28/03	3/28/03	3/29/03	4/1/03	4/2/03	4/3/03	4/4/03	3/25/03	3/27/03	3/29/03	4/2/03	4/3/03	4/4/03	3/22/03	4/1/03			
Truck #:	15098	15097	15096	15095	15098	15097	15095	15096	15098	15098	15095	15096	11134	11139	11102	11139	11156	11102	18	11004			
Route #:	15096	15097	15096	15095	15098	15097	15095	15098	15097	15098	15095	15096	11134	11139	11102	11139	11155	11102	18	18			
SMaRT #:	168	169	158	390	170	175	167	170	169	170	167	168	161	162	158	162	172	158	118	118	Average	Standard	Margin of
Load Type:	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Commercial	Commercial	Commercial	Commercial	Commercial	Commercial	OCC	OCC	(Mean)	Deviation	Error
Old Newspaper	31.3%	24.9%	28.5%	21.6%	28.7%	26.3%	20.7%	25.2%	19.2%	31.8%	21.1%	32.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	18.6%	13.5%	5.2%
Mixed Paper	45.8%	50.8%	45.7%	48.9%	45.2%	49.7%	51.7%	48.8%	49.9%	45.4%	53.7%	44.1%	66.1%	65.1%	69.9%	83.2%	38.5%	35.0%	0.0%	0.0%	48.0%	21.0%	8.1%
Old Corrugated Cardboard	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	18.6%	14.0%	15.4%	6.5%	50.8%	43.4%	98.8%	94.8%	17.1%	30.9%	11.9%
Tin Cans	1.8%	1.8%	1.9%	1.5%	1.9%	1.2%	1.8%	1.6%	1.9%	1.8%	1.8%	2.0%	0.1%	0.1%	1.6%	0.0%	0.1%	3.1%	0.0%	0.0%	1.3%	0.8%	0.3%
PET	1.3%	1.8%	1.4%	1.7%	1.5%	1.9%	1.9%	1.5%	1.6%	1.5%	1.6%	1.5%	1.0%	0.1%	0.3%	0.1%	0.2%	0.7%	0.0%	0.0%	1.1%	0.7%	0.3%
HDPE - Natural	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.3%	0.8%	0.3%
HDPE - Color	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
HDPE - Mix	1.4%	1.4%	0.9%	1.6%	1.5%	1.6%	2.0%	1.8%	1.8%	1.5%	1.8%	1.8%	0.2%	0.2%	0.5%	0.1%	0.1%	1.1%	0.0%	0.0%	1.1%	0.8%	0.3%
Aluminum Cans	0.8%	0.7%	0.4%	0.4%	0.5%	0.5%	0.4%	0.5%	0.5%	0.5%	0.6%	0.4%	0.2%	0.2%	0.1%	0.0%	0.1%	0.3%	0.0%	0.0%	0.4%	0.2%	0.1%
Scrap Metal	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Glass Bottles - Clear	2.7%	3.0%	2.3%	2.3%	3.0%	2.8%	2.9%	3.1%	3.2%	2.5%	2.2%	2.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.6%	1.4%	0.5%
Glass Bottles - Green	3.8%	4.0%	3.5%	3.7%	3.8%	2.6%	3.8%	4.0%	3.0%	3.2%	3.1%	3.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.1%	1.8%	0.7%
Glass Bottles - Brown	1.3%	1.2%	1.3%	1.9%	1.3%	1.5%	1.5%	1.4%	2.1%	1.3%	1.2%	1.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.9%	0.8%	0.3%
Glass Bottles - Mix	7.4%	7.4%	9.2%	12.4%	8.5%	7.7%	10.2%	8.0%	12.6%	6.1%	9.0%	7.2%	3.9%	0.5%	3.8%	1.1%	2.6%	2.6%	0.0%	0.0%	6.0%	3.8%	1.5%
Liquid	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%	0.0%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%
Residue	1.9%	2.6%	2.7%	3.3%	3.3%	4.0%	2.7%	3.5%	4.0%	2.8%	3.2%	2.8%	9.9%	0.0%	8.5%	8.1%	6.6%	13.8%	1.8%	5.4%	4.5%	3.3%	1.3%
Shrinkage	0.7%	0.2%	1.1%	0.5%	0.9%	-0.1%	0.5%	0.7%	0.2%	1.8%	0.7%	0.6%	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%	-0.4%	0.0%	0.4%	0.5%	0.2%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	n/a	n/a

Appendix A

Methodology

Methodology

Introduction

The following methodology was developed to address characterization of the source separated recyclable materials stream that is currently collected by the franchised haulers for the cities of Sunnyvale and Mountain View and delivered to the SMaRT Station (Facility) for processing.

Sunnyvale utilizes a curbside processing system at the Facility to receive, process, and separate out recyclable materials for market from source separated and commingled recyclables. These recyclables are set out at the curb by Mountain View and Sunnyvale participants. Palo Alto does not use the Facility's curbside processing system as it currently utilizes a processing system located at the Palo Alto Landfill.

Background Information

Current Collection System

Sunnyvale's and Mountain View's contract solid waste haulers, Specialty Solid Waste and Recycling (Specialty), and Foothill Disposal (Foothill), respectively, deliver materials picked-up curbside from residential and commercial (only Mountain View) sources to the Facility five days per week. A breakdown by each city follows.

Sunnyvale

Specialty's vehicles collect the following loads throughout Sunnyvale using two-compartment vehicles.

- Five (5) Single-Family (SF) residential routes each day, Monday through Friday
- One (1) Multi-Family (MF) residential route each day, Monday through Friday

- One (1) additional Multi-Family residential route on Mondays
- One (1) miscellaneous route for schools/City Hall on Tuesdays

This totals to thirty-two (32) routes per week to cover the entire city. One of the vehicle's compartments contains mixed fibers (newspaper, mixed paper, and cardboard), the other, mixed containers (tin cans, PET, HDPE, aluminum cans, and glass bottles). Both compartments contain some residue, including liquids from closed-top bottles (the fibers compartment usually contains a small amount of containers).

Mountain View

Foothill's vehicles collect the following loads throughout Mountain View using a mixture of three-compartment and one-compartment vehicles.

- Four (4) residential routes each day, Monday through Friday, over a two-week period (bi-weekly) to cover the entire city
- One (1) additional residential route every other Thursday
- Four (4) commingled commercial routes each day, Monday through Friday
- One (1) commercial old corrugated cardboard (OCC) route each day, Monday through Friday
- One additional commercial OCC route on Monday and Wednesday.

This totals to sixty-eight (68) routes over a two-week period to cover the entire city. The three-compartment vehicles collect commingled containers (tin cans, PET, HDPE, aluminum cans, and glass bottles) in one compartment, mixed paper in a second compartment, and newspapers (newspapers and mixed paper) in the third compartment. The container's compartment contains some residue, including liquids from closed-top bottles. The newspaper compartment also contains some residue as well as some miscellaneous containers. The one-compartment commercial vehicles collect a mix of OCC, mixed paper, and commingled containers; they also contain some residue. The one compartment OCC vehicles collect OCC and contain some level of residue.

A flow chart of the collection systems for each city is shown in Figures 1 and 2.

Figure 1 | City of Sunnyvale – Collection System

CITY OF SUNNYVALE

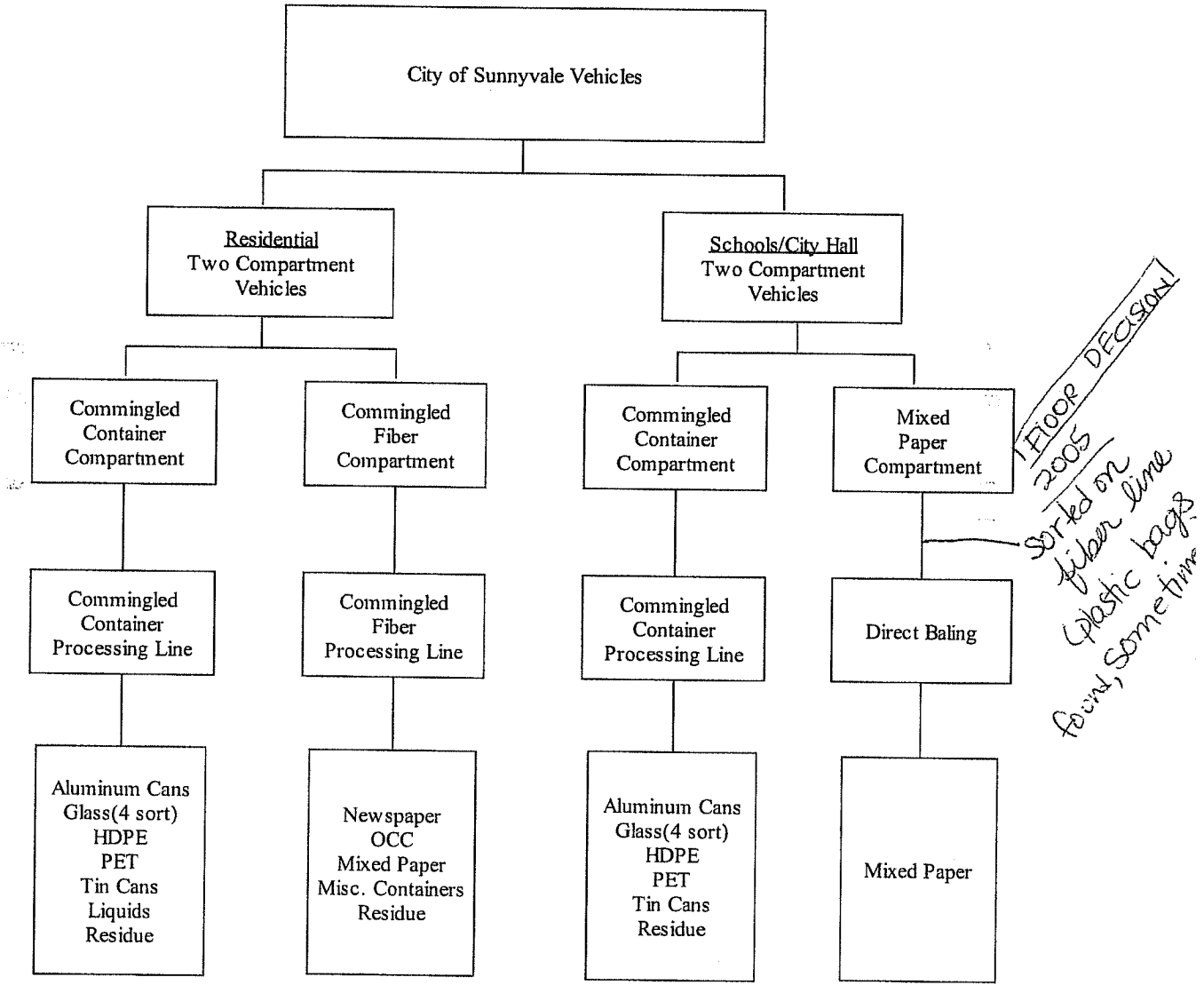
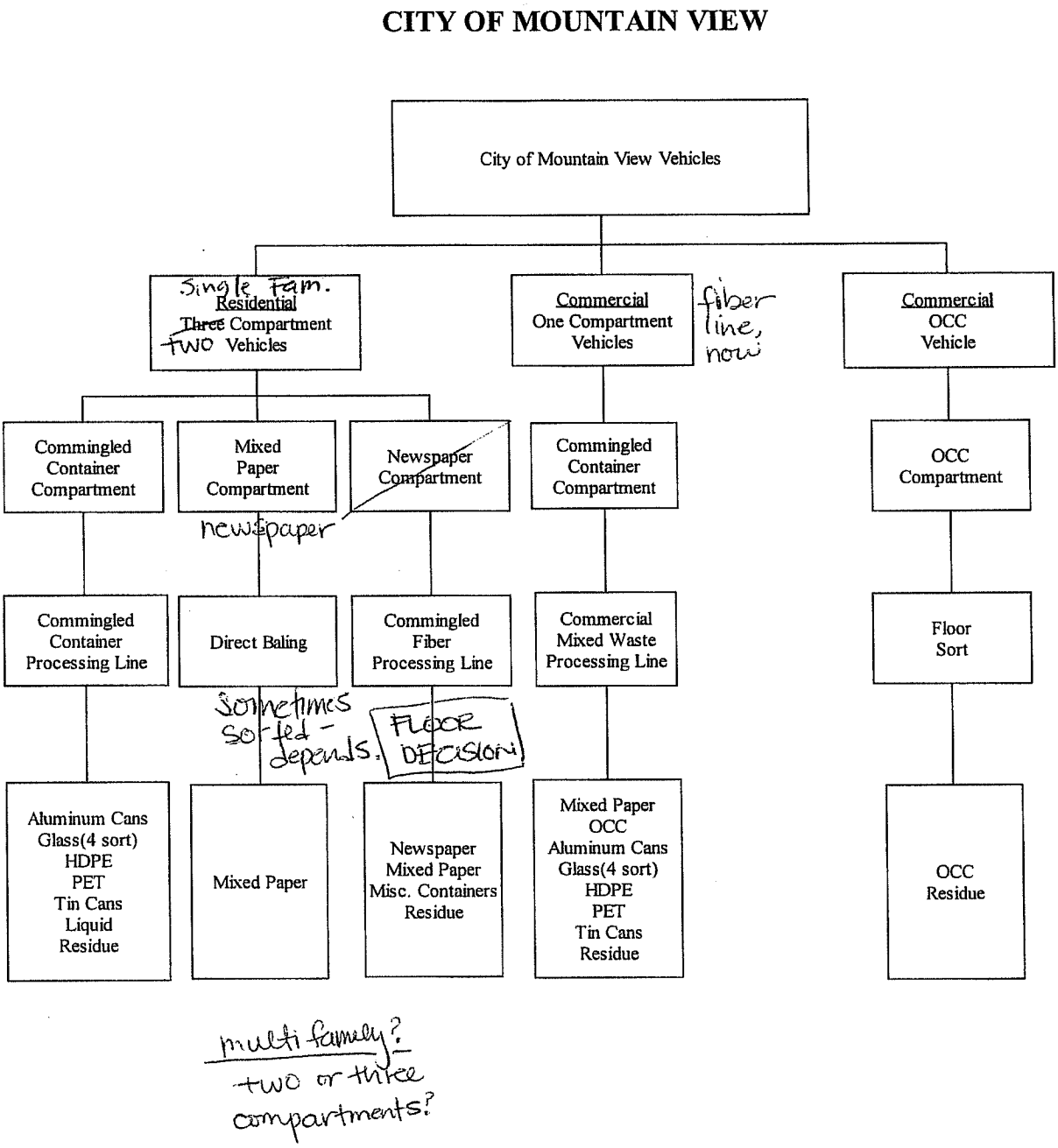


Figure 2 | City of Mountain View – Collection System



Processing System

Once the materials are delivered to the Facility, the contract operator, Green Team/Zanker (GTZ) uses three separate processing lines to sort materials; these include the curbside recyclables fiber line, the curbside recyclables container line, and the mixed commercial material processing line from the original NRT processing system. Once materials are processed, they are commingled into like material types for consolidation, delivery and sales to market.

Physical Work Area

The area adjacent to the processing lines is limited. The bulk of the area is used for receiving, weighing, and unloading of materials from the curbside collection vehicles. There is a small area adjacent to the lines that contain a platform scale and some available space between the scale and the balers for staging materials for weighing.

Equipment

Most equipment used for this study can be supplied by the Facility, including containers, bins, balers (one connected each to the fiber line and one to the commercial line), forklifts, front-end loaders, radios, the truck scale, and the platform scale. Additional items needed to be supplied outside the Facility include: a laptop computer to log all information from the study, flagging tape, three ½-gallon containers to collect liquids, permanent markers, duct tape, and notebooks. Personal safety equipment such as hardhats, safety vests, goggles, earplugs, etc are supplied by the contractor's crew (this is equipment that they use on a daily basis to perform their jobs).

Contract Operator

The GTZ contract operator's team is assumed available each and every day of the sort. The team consisted of approximately 36 personnel including approximately 17 curbside line sorter sorters, 15 commercial line sorters, two rolling stock (forklift and front-end loader) operators, one part-time baler operator,

and one floor manager. The normal truck-scale assistant was not usually on duty during our Study (the floor manager recorded scale weights).

Study Methodology

There are many steps involved in performing a study of the source separated materials composition from each of the cities. Each step is outlined below by section.

Determination of Number of Samples

The determination of the number of samples to sort is best derived through experience and available reference information. A quantitative method is not available to determine the appropriate numbers of samples to test in a materials sort of the kind required for the cities of Sunnyvale and Mountain View. The California Integrated Waste Management Board (CIWMB) provides guidelines with reference to number of samples recommended for waste characterization studies. The suggested number of samples ranges from 20-40 with a minimum weight of 200 tons varying according to residential, commercial and industrial loads. Please see www.ciwmb.ca.gov/WasteCHar/YourData.htm for further details. It should also be recognized that the stream of materials requiring sorting for this study is recyclables and not waste. However, these are the best guidelines available in the California Solid Waste industry. Combining this with BVA's past experience in material characterization sorts, we suggest that a minimum of 20 samples per city should be analyzed. For the sampling of two cities, a total of 40 samples should be taken. Sampling a total of 40 loads equates to a representation of 40% of the total loads covering the entire population of both cities (100 loads total). This is considered to be significant representation for the study.

Sample Selection

The total number of loads or routes it takes for Sunnyvale and Mountain View contract collectors to cover the entire area of the cities is 100. This is an accumulation of residential and commercial (Mt. View only) loads throughout both cities. It is important when conducting sample selection to have equal geographic as well as economic representation of each of these waste

generators. For example, a waste load from an affluent and less populated neighborhood may have a different composition than that of a less affluent and high density area. To ensure that the sampling is not skewed by over or under representation from any one area, discussion of logistics with the haulers to select the preferred routes for sampling and a few alternatives in case additional loads are needed. A random selection process should be used whenever it is possible (after geographic and sector type issues are considered).

To select samples a list of the number of samples required by route type for each city must first be developed. To determine the number of samples required by route type, the total number of routes of a certain type (for example Multi-Family Residential) is divided into the total number of routes in a particular city; this yields a percentage or share of the routes to be sampled. For example, the City of Sunnyvale runs a total of 6 Multi-Family Residential routes per week as part of a total of 32 total routes per week. This equates to approximately 19% of the routes conducted by the City. For a total sample amount of 20 for the city, 19% represents approximately 4 samples that need to be taken from Multi-Family Residential type routes. Table 1 shows the number of samples required by route type and by city for the Study.

After this list is developed, a meeting with the contract haulers from each city is required. In this meeting, the contract hauler should provide a list of when each of these route types is scheduled, associated route numbers, and a map to reference where each route is geographically collected. Using the route list, map and the number of samples by route type, potential routes for sampling should be accumulated. To finalize the routes a random number generator should be used for prioritization. For example, if there are three routes to choose from on a particular day use the random number generator to select from 1 to 3. The first number that is generated is applied to the first route, the second to the second route on the list and likewise with the third route. So if the numbers from the random number generator came up in order 3, 1 and 2, the second route number on the list would be of first priority to sample, the third route of second priority and so on. From this exercise a list showing the preferred routes for sampling

each day should be generated. The actual route list schedule for the field sampling analysis portion of the Study is shown in Table 2.

Table 1 | Number of Samples by City and Route Type

City/Route	Number of Routes	Percentage by Routes	Number of Samples
Sunnyvale			
SF Residential	25	78%	15
MF Residential	6	19%	4
Schools/City Hall	1	3%	1
Totals	**32**	**100%**	**20**
Mt View			
Residential	41	60%	12
Commercial	20	29%	6
OCC	7	10%	2
Totals	**68**	**100%**	**20**

Table 2 | Study Route List Schedule

Materials Collected on:	Fri 3/21	Mon 3/24	Tue 3/25	Wed 3/26	Thu 3/27	Fri 3/28	Mon 3/31	Tue 4/1	Wed 4/2	Thu 4/3
Delivered to SMaRT on:	Sat 3/22	Tue 3/25	Wed 3/26	Thu 3/27	Fri 3/28	Sat 3/29	Tue 4/1	Wed 4/2	Thu 4/3	Fri 4/4
5:00 AM		Specialty SF - 703	Specialty SF - 704	Specialty SF - 701	Specialty SF - 702	Specialty SF - 701	Specialty SF - 704	Specialty SF - 705	Specialty SF - 702	Specialty SF - 701
5:30 AM		Foothill COM - 11134		Foothill COM - 11139		Foothill COM - 11102		Foothill COM - 11139	Foothill COM - 11155	Foothill COM - 11102
6:00 AM	Specialty SF - 702		Foothill RES - 15096		Foothill RES - 15097		Foothill RES - 15097			
7:00 AM	Foothill OCC - 18	Foothill RES - 15097	Foothill RES - 15095	Foothill RES - 15098	Foothill RES - 15095	Foothill RES - 15098	Foothill OCC - 18	Foothill RES - 15098	Foothill RES - 15095	Foothill RES - 15096
8:00 AM	Foothill RES - 15096	Specialty SF - 705	Specialty - 615	Specialty MF - 706**	Specialty SF - 704	Specialty SF - 705	Specialty MF - 707	Specialty SF - 701	Specialty SF - 703	Specialty MF - 706**
9:00 AM	Specialty MF - 706									

Vehicle Capture Logistics

At the pre-sort meeting with the haulers, as discussed above, a methodology to capture the vehicles must be discussed. In order to keep consistent samples for the study and to minimize interference with day-to-day operations, the haulers should be required to hold the loads overnight and deliver the loads for sorting the following morning. The preferred routes to sample should be determined by the route, vehicle, and SMaRT numbers. The haulers should be informed a week in advance, or earlier if possible, regarding the schedule to hold their loads overnight, if needed. To ensure that desired loads are not dumped, the scale house operator should have a list of the vehicles that are not allowed to dump during the previous day (targeted loads for sampling). As a cross-check, vehicles should be identified prior to unloading in the receiving area. If by chance a vehicle load is missed, a make-up load would need to be scheduled.

Sampling Team

The sampling team should consist of three participants: 1) city representation, 2) the contract processor (GTZ in this instance); and 3) the Study management team (BVA in this instance). The following illustrates each party's roles and responsibilities:

City Representative(s)

The cities representative(s) should be on-site during the field characterization to monitor ongoing activities as well as train for future efforts in replicating the process. Additional responsibilities include: overall management of the project, coordination with the haulers, Specialty and Foothill, and the contract processor, GTZ, and assistance with equipment and information as needed.

Contract Processor (GTZ)

The SMaRT Station contract processor (GTZ for this initial Study) should provide the day-to-day operations crew. The crew for the initial Study consisted of approximately 36 personnel including approximately 17 curbside line sorters, 15 commercial line sorters, two rolling stock (forklift and front-end loader) operators, one part-time baler operator, and one floor manager. The normal truck-scale assistant was not usually on duty during our Study (the floor manager recorded scale weights). The Study should be conducted using the same number and type of sorters as under normal operations. It is important that the sampling process be as representative of a normal or typical daily sort, as possible. Contractor management should also be available for supervision, equipment and information, as needed.

Study Management (BVA)

The Study Management Team (BVA in this Study) should be responsible for developing the methodology, providing the training manuals and conducting a training session, managing and running the sort, collecting and aggregating the data, performing a QA/QC check on all data, developing a statistical analysis, and linking the data spreadsheet to Sunnyvale's proration spreadsheets.

During the field sampling study, the Management Team should provide three to four field managers to assist in training the workers. They should make every attempt to not only help them conduct their part of the work successfully, but to help them understand why it is important to conduct the study in a certain manner. Each of the field managers should have at least a fundamental understanding of the Spanish language.

Schedule for Sampling Team

The greatest factor in preparing the schedule is to ensure that the sort does not interfere with day-to-day operations of the facility. With this in mind, the sampling team should conduct the sorts early in the morning, preferably beginning at approximately 5 am in the morning. The sample loads should be scheduled from the prior day pick up. For example Friday's loads should be delivered, sorted and weighed on Saturday. Thus, all the sample loads should be from collection routes running Monday through Friday. Plans should be made to sort 4 samples a day over a 10-day period for a total of 40 samples (fewer sorts per day over a longer period is acceptable, as long as they are divided across the weekdays equitably.

Training for Sampling Team

The sampling team should receive appropriate training. The majority of training should be provided during the actual field sampling study. Training materials should be distributed to all personnel prior to the scheduled field study. These materials should be developed in English as well as Spanish. The English and Spanish versions of the Training Manual are included in Appendix B of this report. On the first day of the field study, management staff should review these training materials with the sort team in both English and Spanish prior to commencement of the sort. Additional processing time may be needed on the first day of the sort to acclimate personnel to the difference in procedures. City representative(s) should also participate in the on-site training to understand the required management for future materials sorts.

Maintaining Ongoing Operations

As mentioned above, the sort should be conducted during the non-operational hours of the source separated processing system to ensure that ongoing operations of the Facility are undisturbed.

Receiving Vehicles and Floor Handling

Vehicles should be received and weighed and a total vehicle/load weight recorded. Materials from the first compartment should then be dumped onto the floor or directly onto the processing system in-feed conveyor. The vehicle should then be re-weighed to record the remaining vehicle weight; a simple subtraction will yield the individual compartment weight. The second compartment (if a 2- or 3- compartment vehicle) should then be emptied onto the floor and then the vehicle re-weighed to record a total weight for that second compartment. The third compartment (if a 3-compartment vehicle) should then be emptied onto the floor and then the vehicle re-weighed to record a total weight for that third compartment. All materials must be kept segregated using placement and flagging tape as necessary prior to sort and weighing to ensure the materials are not contaminated.

By compartment, materials should be processed over the three processing lines described previously, commingled containers over the curbside containers processing line, commingled fibers over the fibers processing line and fully commingled recyclables over the older mixed commercial materials processing line. Some materials, such as newspaper from Mountain View should only need to be "cleaned-up" using a negative sort to pull out mixed paper contaminants. Other materials, such as mixed paper from Mountain View should not need to be processed over a line at all, only weighed and baled.

Fiber Line Sorting

The normal curbside processing system with the normal allotment of crew should be used for sorting the fiber type materials from each of the loads (from individual truck compartments). The crew should consist of approximately 7 sorters, including the line operator. Loads of mixed fiber materials can contain old newspaper (ONP), old corrugated cardboard (OCC), mixed paper (MP), and

residue. These loads can also contain items such as cans, glass and plastic containers.

The mixed fiber loads should be pushed onto the in-feed conveyor and conveyed up to the overhead sorting platform. OCC and MP should be pulled out of the loads and dropped into bins (placed underneath the line inside the existing concrete bunkers). Containers, cans and refuse should be placed in small containers along-side the overhead sorting conveyor belt. ONP should be the only component left on the conveyor belt and should drop off the end of the conveyor into a large bin (placed inside the bunker). This ONP bin may fill two to three times during a normal compartment run. If this is the case, the line will need to be stopped for a few minutes will the bin is weighed, emptied and replaced in the bunker. Towards the end of a run, one of the managers must make sure that all materials are hand-swept onto the belt (the front-end loader cannot reach all materials with its large bucket) and that the line is clear (all materials ran through from the load). After the entire truck compartment's load is run through the system, the materials should be taken in the containers and bins (using a forklift) to the scale for weighing. Some clean-up of materials that fall outside of the bins will be necessary to make sure as much material as possible is put into the correct bins before weighing. Some materials, such as mixed paper from the Mt View residential route's mixed paper compartment can be baled directly. OCC from the Mt View OCC routes can be floor sorted for residue and then baled directly as well.

Commingled Container Line Sorting

The normal curbside processing system with the normal allotment of crew should be used for sorting the commingled container type materials from each of the loads (from individual truck compartments). The crew should consist of 6 sorters on the container line, 2 glass sorters and 2 pre-sort personnel, including the line operator. Loads of mixed containers can contain HDPE and PET plastic containers, aluminum and tin cans, glass bottles, liquids contained inside bottles and residue.

The commingled container loads should be pushed onto the in-feed conveyor and conveyed up to the overhead sorting platform. At the top of the platform, ferrous metals are pulled automatically with a ferrous magnet, a trommel screen is used to remove smaller residue and the light and heavier materials are separated with an air classifier (cyclone). The ferrous materials are automatically deposited in a bunker which needs to be emptied into wheeled-carts for transport and weighing at the end of the sort. The heavier material stream contains mostly glass bottles which are sorted by color, with mixed glass conveyed off the end of the belt. Each of these materials should be collected below the overhead sorting line in bins for weighing. In addition, the heavy materials line collects containers filled with liquids which need to be separated and carried to the scale for weighing (at the scale these containers are opened and the liquid is emptied into ½-gallon pitchers for weighing, the containers, which are mostly PET, are also weighed separately).

The lighter material stream contains plastic containers and aluminum cans. The plastic containers are sorted into two (2) fractions; HDPE colored/mixed, and PET. Each of these materials should be placed in small containers along-side the overhead sorting conveyor belt for collection and dumping into larger bins placed below the sorting platform. There should be three (3) additional bins placed under the platform for PET, HDPE, and aluminum cans. These larger bins are transported to the scales by a forklift for weighing at the end of the load's sort. Residue should be collected at several points throughout the processing line, including at the presort station, at the cyclone, at the end of the lighter fraction sort line and under the trommel.

Commercial Line Sorting

Loads from Mountain View's commercial curbside collection program should be unloaded on the Facility's main tipping floor, away from the curbside processing system. This material should be fed to the Facility's commercial processing line on a batch basis when no other waste is being processed. This should occur for the most part at the beginning of the sort day, when all equipment and bins are clean. All recovered materials such as OCC, MP, ONP, containers and scrap metals should be collected in bins and containers and weighed. The residue should not be weighed as it is too difficult to effectively capture in this system.

Residue amounts are instead calculated by subtracting the total weights of the recovered materials from the total truck load weights. The crew should consist of approximately 15 sorters including a manager.

Weighing of Samples

Approximately 20 to 40, 32-gallon and 50-gallon containers as well as 4-cubic yard 6-cubic yard bins are needed for collection of the sorted materials, and are provided by the contract processor, GTZ. At the beginning of each day, the containers and bins should be weighed on the platform scale and their tare weight tagged on the side of the container/bin using duct tape and a permanent marking pen. The markings should also contain the first-letter of the day of the week to ensure they are tared. The less bulky materials such as certain containers should be collected in the containers, the more bulky materials in bins. As mentioned previously, some materials such as mixed paper from the Mt View residential route's mixed paper compartment can be baled directly. OCC from the Mt View OCC routes can be floor sorted for residue and then baled directly as well.

Collection and Storage of Data

The data collected during the sort should be entered in MS Excel spreadsheets. Two separate types of spreadsheets were developed; one for Sunnyvale's loads, and one for Mountain View's loads to match their individual route and truck/compartment types. In addition, each sample/load should have its own sheet within the overall spreadsheet. The information should be stored on the laptop, as well as saved to a backup disc or CD at the end of each day. The on-site laptop should be protected by a plastic cover to ensure that material spillage does not affect the computer. A sample of the data collection spreadsheets are shown in Table 3 and Table 4.

Sample Shrinkage Checks

The information entered into the MS Excel spreadsheets is automatically totaled, so that comparisons between individual recyclable/residue components to the

initial total compartment weights can be made. Any shrinkage figures that appear to be out of the norm (above or below the average) for no reason should be checked during the sort to understand if and where a potential problem may exist. Some problems can be fixed using this tool. This in-field check is very important, as it is BVA's experience that errors can and do appear in the field. It is best if these errors can be found and corrected in the field.

Table 3 | Sunnyvale Sample Data Collection Form

Hauler:	SPECIALTY								
Date:									
Truck #:									
Load Type:									
Total Truck Wt.									
Wt. After 1st Unload		Compartment Type Unloaded:		Original Net Wt.	0	Total Sorted Wt.		Shrinkage%:	#DIV/0!
Wt. After 2nd Unload		Compartment Type Unloaded:		Original Net Wt.	0	Total Sorted Wt.		Shrinkage%:	#DIV/0!

Commingled Containers	Container 1		Container 2		Container 3		Container 4		Container 5		Container 6		Container 7	
	Tare	Total	Tare	Total	Tare	Total	Tare	Total	Tare	Total	Tare	Total	Tare	Total
Tin Cans														
PET														
HDPE - Natural														
HDPE - Color														
HDPE - Mix														
Aluminum Cans														
Scrap Metal														
Glass Bottles - Clear														
Glass Bottles - Green														
Glass Bottles - Brown														
Glass Bottles - Mix														
Liquid														
Residue														

Fiber	Container 1		Container 2		Container 3		Container 4		Container 5		Container 6		Container 7	
	Tare	Total	Tare	Total	Tare	Total	Tare	Total	Tare	Total	Tare	Total	Tare	Total
Old Newspaper														
Mixed Paper														
Old Corrugated Cardboard														
Residue														
Tin Cans														
PET														
HDPE - Natural														
HDPE - Color														
HDPE - Mix														
Aluminum Cans														
Scrap Metal														
Glass Bottles - Clear														
Glass Bottles - Green														
Glass Bottles - Brown														
Glass Bottles - Mix														
Liquid														

Table 4 | Mountain View Sample Data Collection Form

Hauler:	FOOTHILL							
Date:								
Truck #:								
Load Type:								
Total Truck Wt.								
Wt. After 1st Unload		Compartment Type Unloaded:		Original Net Wt.	0	Total Sorted Wt.		Shrinkage%: #DIV/0!
Wt. After 2nd Unload		Compartment Type Unloaded:		Original Net Wt.	0	Total Sorted Wt.		Shrinkage%: #DIV/0!
Wt. After 3rd Unload		Compartment Type Unloaded:		Original Net Wt.	0	Total Sorted Wt.		Shrinkage%: #DIV/0!

Commingled Containers	Container 1		Container 2		Container 3		Container 4		Container 5		Container 6		Container 7	
	Tare	Total	Tare	Total	Tare	Total	Tare	Total	Tare	Total	Tare	Total	Tare	Total
Tin Cans														
PET														
HDPE - Natural														
HDPE - Color														
HDPE - Mix														
Aluminum Cans														
Scrap Metal														
Glass Bottles - Clear														
Glass Bottles - Green														
Glass Bottles - Brown														
Glass Bottles - Mix														
Liquid														
Residue														

Newspaper	Container 1		Container 2		Container 3		Container 4		Container 5		Container 6		Container 7	
	Tare	Total	Tare	Total	Tare	Total	Tare	Total	Tare	Total	Tare	Total	Tare	Total
Old Newspaper														
Mixed Paper														
Old Corrugated Cardboard														
Residue														
Tin Cans														
PET														
HDPE - Natural														
HDPE - Color														
HDPE - Mix														
Aluminum Cans														
Scrap Metal														
Glass Bottles - Clear														
Glass Bottles - Green														
Glass Bottles - Brown														
Glass Bottles - Mix														
Liquid														

Mixed Paper	Container 1		Container 2		Container 3		Container 4		Container 5		Container 6		Container 7	
	Tare	Total	Tare	Total	Tare	Total	Tare	Total	Tare	Total	Tare	Total	Tare	Total
Old Newspaper														
Mixed Paper														
Old Corrugated Cardboard														
Residue														
Tin Cans														
PET														
HDPE - Natural														
HDPE - Color														
HDPE - Mix														
Aluminum Cans														
Scrap Metal														
Glass Bottles - Clear														
Glass Bottles - Green														
Glass Bottles - Brown														
Glass Bottles - Mix														
Liquid														

Single Compartment	Container 1		Container 2		Container 3		Container 4		Container 5		Container 6		Container 7	
	Tare	Total	Tare	Total	Tare	Total	Tare	Total	Tare	Total	Tare	Total	Tare	Total
Old Newspaper														
Mixed Paper														
Old Corrugated Cardboard														
Residue														
Tin Cans														
PET														

Cleaning and Purging Lines

After the materials for each sample have been processed over the line, the sampling team must make sure that the lines, containers and bins are cleared so that the next load is not contaminated. Areas around the line should be picked up and swept as necessary to maintain "cleanliness" in the area.

Management of City Staff and Contract Operator

The Contract Operator should supply the Management Team with a field manager to coordinate all operations, such truck receiving and weighing, sorting operations, forklift and front-end loader coordination, weighing operations, etc.

Summation and Statistical Analysis of Data

The data output from the sample sheets should be summarized showing material composition by CIty, route type (i.e., commercial, residential, etc.) and truck compartment type (incoming material stream). Statistical calculations should be made including the mean, standard deviation and the margin of error at a 90% confidence level.

City Spreadsheet Linkage

All relevant information gained during the field sampling and aggregated as described above, should be linked directly to Sunnyvale's spreadsheet for distribution of the representative share of revenues and costs between Mountain View and Sunnyvale.

Appendix B

Smart Station Source Separated Materials Characterization Study Training Manual English

Smart Station Source Separated Materials Characterization Study Training Manual

I. Introduction

The purpose of the study is to characterize the source separated materials delivered to the SMaRT Station to more effectively and consistently determine the allocation of revenues between the cities of Mountain View, Palo Alto and Sunnyvale.

II. Pre-Field Sort Preparations

Determination of Number of Samples

1. Use California Solid Waste Industry Guidelines to determine the number of samples as applicable (CIWMB recommends 15 to 50 samples depending on study and population type)
2. Based on the number and type of routes and total tonnage in 2003, 20 samples per city for a total of 40 samples were taken

Contract Hauler Coordination

A meeting with the contract haulers early in the process is necessary to ensure an effective and efficient study; outline the responsibilities of the contract hauler.

1. A list of routes with load type, pick-up day, route numbers, truck numbers, and SMaRT numbers should be collected
2. A map of all the routes showing geographical pickup areas by day is also needed
3. Management team and contract haulers will work to develop a chart of routes and days that need to be targeted for the study
4. Contract haulers and management team must work with vehicle drivers and scale house operators to ensure that the collection vehicle is the

correct route, the delivery time is accurate, and that vehicles use proper weighing procedures

Sample Selection

1. Crucial to have a representative and directly proportional sampling of the normal truck routes in both the cities
2. Review each hauler's route lists and maps showing number of normal routes including the type (e.g. residential, commercial, OCC) and geographical coverage
3. Calculate the number of sample loads by generator type through understanding the percentage of each route types. For example, if a city has 100 total routes and 45 are residential, 45% of the sample load should be residential loads. Using the base case of 20 loads, 45% would equal 9 residential routes; some rounding of these calculations will be necessary as a "whole" number for sampling is needed (e.g. for Sunnyvale's MF loads, approximately 19% of the 20 total samples was calculated to be 3.75 samples required, since this is not possible, the 3.75 was rounded to the "whole" number of 4)
4. Randomly select the daily loads that are of the number and type required (see above) and that give geographic representation; the random selection is conducted as follows:

   Route maps are collected from each hauler; the haulers cover a different geographical area each day. If two residential routes are required from an area that has 6 running that same day, two must be selected randomly. To do this, take the daily list of routes and route numbers, note a 1 to 6 next to each of the six route numbers for that day. Use the random number generator in MS Excel. The function is called RAND. If there are 6 possible route selections multiply the random number generator number by 6 (i.e. =RAND*6). Make sure you format the cell referenced to zero decimal places. The random number generator will pick one of the routes 1 to 6 for you. For the second choice, simply recalculate in MS Excel by hitting F9; it will yield the second random choice.

Sample Logistics

Management team, sorting crew, and contractor must have an initial meeting to determine the best plan of action to most effectively minimize the impact to daily operations. Suggested sampling logistics include:

1. Two weeks (10 business days) to conduct sampling of 40 loads; average of 4 loads per day
2. Estimated one hour per load for sorting, weighing and recording
3. Coordination with contract haulers to hold loads overnight and deliver them the next morning, if needed
4. Study samples should be scheduled for delivery before normal day-to-day operations begin

Assemble Team

1. Team should consist of the same number of sorters that perform day-to-day operations, preferably the team that performs this function on a daily basis
2. Team should be scheduled and assembled through discussions with managing representative for the contract processor; contract manager needs to assign one responsible manager from their crew for all direct coordination on a daily basis
3. Three managers are required in the following positions: 1) manage weighing and data entry at the scales, 2) manage operations on the floor, and 3) manage operations above on the sorting platforms

Sampling Team Training

1. Training materials should be distributed in both English and Spanish prior to training
2. One-half to one hour of time should be allocated to a training session on the first day of the sort

3. Sampling team will meet prior to the arrival of the first truck and receive training in both Spanish and English covering the following topics:
    a. Overview and purpose of the study
    b. Differences in study sort activities from normal daily sorting routine
    c. Review safety aspects involved in differing sorting activities

Equipment

The following equipment will be required during the sort:

- Sort lines
- Baler
- Containers
- Bin
- Gloves
- Safety vests
- Hard hats
- Flagging tape, duct tape, marking pens, clip boards, note paper, pens, pencils, scissors, stapler, etc.
- Other safety equipment, as needed
- Laptop computer with Excel spreadsheets

III. Field Sort

Pre-sort checklists for both the mixed containers and fiber processing lines are attached as tables 1 and 2, respectively.

General Preparations

At the beginning of each day, there are several tasks that must be accomplished prior to the receipt of the first load. These tasks are measures to ensure the accuracy of the study.

1. Set up table, plug in laptop computer, get note sheets ready on clip boards, etc. for the day
2. Zero out scale; clean around scale areas
3. Tape off areas on sorting platforms that sorters should not sort into; for container line tape one strip of caution tape across all normal bunker openings; for fiber line put caution tape over bunker chutes not in use (third and fourth bunker from in-feed, these will be used for storage)
4. Check all lines to see if clear including all in-feeds, conveyor systems, sorting line containers, floor bins, bunker areas
5. Have crew clean up and sweep around all conveyor systems
6. Check tare weights on all containers and bins; apply duct tape to containers/bins and add with permanent marker the first letter of the day and the tare of the container/bin
7. Ensure that if bales are located on the balers, the last bale is marked to designate where the study loads will begin
8. Place three (3) extra bins for sort under/adjacent to the containers sorting line; these bins include: (1) aluminum cans, (2) PET, and (3) HDPE.
9. Tie off residue screening material at bottom from air classification system; not much residue is gathered per run and can easily be untied and emptied into a small container at the end of each run

Vehicle Receiving and Weighing

1. Receiving and weighing of all vehicles is done in the same manner as performed on a daily basis
2. Entire vehicle will be weighed fully loaded, and weight recorded
3. Continue until all compartments are weighed, emptied and recorded
4. Final tare weight of vehicle will be taken and recorded
5. All weights are taken on the large in-floor truck scale (accuracy +/- 20lbs)

Collection and Storage of Data

1. Data collected in two Excel spreadsheets: one for each city 1) Sunnyvale and; 2) Mountain View
2. Each sample load has its own spreadsheet
3. Information to be stored in laptop and backup discs at the end of each sort day
4. Computer should be covered with plastic for protection from material spillage

Sample Shrinkage Checks

1. Spreadsheets will automatically total the shrinkage percentage once the sorted components have been weighed and recorded
2. Shrinkage figures that are roughly out of the norm and can't be explained will be checked at the end of each truck compartment run, with errors corrected as applicable
3. This "in-field" check allows for instant identification and possible correction of errors

Sorting Procedures

Materials will be sorted using three separate lines as in normal daily operations. The sorting procedures should replicate normal operations as close as possible including use of the same stationary and mobile equipment, use of the same number and types of personnel, etc.

Cleaning and Purging of the Lines

It is essential for the integrity of the study that the lines, bins, containers and working areas be cleaned and purged before commencement of each sort load. Managers should conduct a visual inspection prior to the start of each sampling load.

IV. Specialty (Sunnyvale) Vehicles

Specialty uses two compartment trucks for all source-separated collection routes including single-family residential, multi-family residential and city/schools. The truck compartments contain newspaper and containers.

Newspaper Compartment – Sorted Over Fiber Line

1. Fiber loads target to include old newspaper (ONP), old corrugated cardboard (OCC) and mixed paper. Other materials such as mixed containers and residue, which can be sorted into separate small containers next to the sort line, are often found in these loads.
2. Load are pushed onto the in-feed conveyor belt by a front-end loader and conveyed to the overhead sorting platform. Towards the end of a run, someone should be assigned to sweep the leftover materials onto the conveyor to ensure the entire load is processed (materials inaccessible by front-end loader).
3. OCC and mixed paper are first sorted off the line and deposited in bunker chutes, which contain one to two large bins for collection. Some materials fall on the floor and will need to be swept up and placed back into the appropriate bins at the end of the run.
4. ONP falls off the end of the conveyor into a large bin. Most likely the sort line will need to be stopped one to two times during the run when the large newspaper bin fills up. At this time, the bin should be weighed, recorded, dumped, and located back under the bunker chute to continue the sorting process.
5. As discussed, containers may also inadvertently be placed by residents into the fiber load and should be sorted off the line into containers located next to the sorters. This happens most frequently with the multi-family routes. Sorting crew members will need to separate the containers found in the fiber loads into the following classifications (this can be done on the floor area adjacent to the scale):
    - HDPE
    - PET
    - Mixed glass
    - Aluminum Cans
    - Tin
    - Residue

6. At the completion of the fiber line sort, sort crew members will need to sweep up materials that have fallen on the floor and place them into the appropriate bins.
7. All OCC, mixed paper bins and the separated containers must be weighed and recorded. Once all the materials are weighed, the shrinkage numbers should be examined to see if it appears the weights are reasonable.

Commingled Container Compartment – Sorted Over Containers Line

1. Commingled container loads can include mixed HDPE and PET plastic containers, aluminum and tin cans, glass bottles (clear, green, brown, and mixed), liquids (contained in bottles) and residue
2. Loads are pushed onto the in-feed conveyor belt by the front-end loader and conveyed to the overhead sorting platform. Towards the end of a run, someone should be assigned to sweep the leftover materials onto the conveyor to ensure the entire load is processed (materials inaccessible by front-end loader).
3. Commingled containers are conveyed through a trommel screen where small residue materials drop out into a small residue bin.
4. Materials pass under a magnet and collected ferrous metals are deposited into a cage-type bunker.
5. Materials pass through an air classifier (cyclone), where materials are divided by weight into a "heavies" component (mostly glass and liquid containing PET bottles) and a "lights" component (mostly plastic and aluminum containers).

Heavies

6. Sorters separate the glass by color (green, brown or amber, and clear) in to bins located below. The remaining glass (mixed color) will be conveyed off the end of the sort belt into a bin located below the platform
7. Additionally, PET bottles containing liquids are sorted into a separate container. Upon completion of the sort, the sort crew will need to empty

the liquid from the containers into separate pitchers. Both the empty PET containers and the liquid will need to be weighed and recorded.

Lights

8. The remaining materials are conveyed over the platform sort line and mixed HDPE, PET, and aluminum cans are sorted off the line and placed in containers next to the sorters.
9. Residue falls off the end of the line into a large bin.
10. During the run, as they fill, the small mixed HDPE, PET and aluminum can containers, located next to the sort belt will be dumped over the platform into large bins below. This is an area where safety is critical; sorters must be careful in dumping these containers and no personnel should be allowed under the sorting platform during a run. In addition, if possible, one extra person should be made available for dumping duties so as not to take away from normal sorting procedures.
11. Sorting crews will need to pick up inadvertently dropped materials around the bins and place them into the appropriate bins for weighing
12. The forklift driver will then pick up each of the container bins and have the bins weighed.
13. Additionally, sort crew will need to remove ferrous materials from caged bunker and place them into rolling carts to be transferred to the scales and weighed.
14. All containers and bins are to be weighed and recorded. Once all the materials are weighed, the shrinkage numbers should be examined to see if it appears the weights are reasonable (i.e. within study norms and are explainable).

V. Foothill (Mountain View) Vehicles

Foothill uses three compartment trucks for residential solid waste collection; these compartments contain: 1) mixed paper 2) ONP and; 3) commingled containers. Foothill does not distinguish between single-family or multi-family loads. Additionally, Foothill uses one compartment vehicles for collection of OCC and commercial routes. Each of these loads is handled differently.

Residential Vehicle Mixed Paper Compartment – No Sorting, Just Baled

Unlike Sunnyvale, the Mountain View collection program separates mixed paper from the ONP. Due to the curbside source separation, the handling of the compartment load is as follows:

1. Mixed paper compartment is dumped on the sorting floor.
2. Mixed paper is pushed into an empty bunker by the front-end loader where it is then baled, and the bales are weighed and recorded.

Residential Vehicle ONP Compartment - Sorted Over Fiber Line

1. ONP loads mostly ONP, some mixed paper and a small amount of mixed containers and residue.
2. Load are pushed onto the in-feed conveyor belt by a front-end loader and conveyed to the overhead sorting platform. Towards the end of a run, someone should be assigned to sweep the leftover materials onto the conveyor to ensure the entire load is processed (materials inaccessible by front-end loader).
3. Mixed paper is sorted off the line and deposited in a bunker chute, which contains one to two large bins for collection. Some materials fall on the floor and will need to be swept up and put back into the appropriate bins at the end of the run.
4. ONP falls off the end of the conveyor into a large bin. Most likely the sort line will need to be stopped one to two times during the run when the large newspaper bin fills up. At this time, the bin should be weighed,

recorded, dumped, and located back under the bunker chute to continue the sorting process.

5. As discussed, containers may also inadvertently be placed by residents into the ONP load and should be sorted off the line into containers located next to the sorters. Sorting crew members will need to separate the containers found in the fiber loads into the following classifications (this can be done after the run on the floor area adjacent to the scale):
   - HDPE
   - PET
   - Mixed glass
   - Aluminum Cans
   - Tin
   - Residue
6. At the completion of the ONP sort, sort crew members will need to sweep up materials inadvertently lying on the floor and place into the appropriate bins.
7. All ONP and mixed paper bins and the separated containers must be weighed and recorded. Once all the materials are weighed, the shrinkage numbers should be examined to see if it appears the weights are reasonable (i.e. within study norms and explainable).

Residential Vehicle Commingled Container Compartment - Sorted Over Containers Line

1. Commingled container loads can include mixed HDPE and PET plastic containers, aluminum and tin cans, glass bottles (clear, green, brown, and mixed), liquids (contained in bottles) and residue
2. Loads are pushed onto the in-feed conveyor belt by the front-end loader and conveyed to the overhead sorting platform. Towards the end of a run, someone should be assigned to sweep the leftover materials onto the conveyor to ensure the entire load is processed (materials inaccessible by front-end loader).
3. Commingled containers are conveyed through a trommel screen where small residue materials drop out into a small residue bin.
4. Materials pass under a magnet and collected ferrous metals are deposited into a cage-type bunker.

5. Materials pass through an air classifier (cyclone), where materials are divided by weight into a "heavies" component (mostly glass and liquid containing PET bottles) and a "lights" component (mostly plastic and aluminum containers).

Heavies

6. Sorters separate the glass by color (green, brown or amber, and clear) in to bins located below. The remaining glass (mixed color) will be conveyed off the end of the sort belt into a bin located below the platform
7. Additionally, PET bottles containing liquids are sorted into a separate container. Upon completion of the sort, the sort crew will need to empty the liquid from the containers into separate pitchers. Both the empty PET containers and the liquid will need to be weighed and recorded.

Lights

8. The remaining materials are conveyed over the platform sort line and mixed HDPE, PET, and aluminum cans are sorted off the line and placed in containers next to the sorters.
9. Residue falls off the end of the line into a large bin.
10. During the run, as they fill, the small mixed HDPE, PET and aluminum can containers, located next to the sort belt will be dumped over the platform into large bins below. This is an area where safety is critical; sorters must be careful in dumping these containers and no personnel should be allowed under the sorting platform during a run. In addition, if possible, one extra person should be made available for dumping duties so as not to take away from normal sorting procedures.
11. Sorting crews will need to pick up inadvertently dropped materials around the bins and place them into the appropriate bins for weighing
12. The forklift driver will then pick up each of the container bins and have the bins weighed.
13. Additionally, sort crew will need to remove ferrous materials from caged bunker and place them into rolling carts to be transferred to the scales and weighed.

14. All containers and bins are to be weighed and recorded. Once all the materials are weighed, the shrinkage numbers should be examined to see if it appears the weights are reasonable (i.e. within study norms and are explainable)

OCC Vehicle/Compartment

The single compartment OCC loads contain mostly OCC with some residue.

1. OCC compartment is dumped onto the floor.
2. Sorting crew separates out residues such as film plastics, etc. which are placed into a container and taken to the scales for weighing.
3. OCC is then pushed into an empty bunker by the front-end loader where it is baled. Bales are weighed and recorded.

Commercial Vehicle/Compartment

The single compartment commercial loads contain mostly mixed paper, cardboard and mixed containers, with some residue, and are sorted on the commercial line.

1. When commercial loads are scheduled, ensure there is a cleared area on the main tipping floor for the truck to dump.
2. Check the MRF commercial sort line to ensure that all containers and the conveyor are cleared from prior sorts.
3. Have the vehicle weigh on the in-floor truck scale fully loaded.
4. Accompany the truck to the main tipping floor and have them dump on to or as close to the in-feed conveyor (walking floor) if cleared and ready for sorting. If the in-feed is not readily available, have the vehicle dump its load in a clear area and mark the load with caution tape. Take care to ensure that it is not mixed with other loads on the tipping floor.
5. Inform the truck driver that they must re-weigh the vehicle after emptying the load.
6. The commercial load will be pushed onto the in-feed walking floor and conveyed through the commercial processing equipment (screens, sort line, etc.). OCC and mixed paper are picked off and deposited into chutes/bunkers for baling. Containers are also pulled off the line,

deposited into small containers and hand transferred to the scales for weighing at the end of the run. Materials that are not removed from the sort line are considered residue. This residue is not weighed. The amount of residue is calculated by subtracting the total weight of the recovered materials from that of the net truck compartment weight.

7. Once the sort is completed, sorters should separate containers in to the following categories:
   - HDPE
   - PET
   - Mixed glass
   - Aluminum Cans
   - Tin

   The container/bin filled with these materials are then weighed and recorded.

8. The OCC and mixed paper bunkers are run separately through the commercial baler. The bales are then weighed and recorded.
9. Shrinkage numbers should be analyzed at this time to see if the load seems reasonable
10. Residue from the commercial loads are not weighed. It is only calculated as accurate collection of residues is difficult with this processing line.

VI. Post-Field Sort Analysis

Aggregation of Data and Linkage to SMaRT Spreadsheet

1. Each individual data sheet (40 in total) will be aggregated and summarized in a final spreadsheet showing total weights and percentages by material type and truck compartment including residue and shrinkage.
2. Data will be aggregated by the six route types (3 per city) by truck compartment type.
3. Summarized spreadsheets will be provided for linkage to SMaRT Station materials reconciliation spreadsheet for representative distribution of revenues between the three cities.

Statistical Analysis of Data

The analysis will include calculations of the mean, standard deviation, and margin of error using a 90% confidence limit for each material type.

Table 1 | Recyclables Characterization Pre-Sort Checklist
Mixed Container Line

	Yes/No
Sorting deck clean	
Infeed area clean	
Bunkers taped off	
Ferrous (tin can) bunker clean	
Belts clean	
Containers/Bins emptied (see list below)	
Platform scale - Set Zero	
Container tare weights (see list below)	

	Size	Product	Tare weight (lbs)
Heavies Line - Floor	**4-yard**	**6**	
Pre-sort from belt	4-yard	Residue	
Under trommel	4-yard	3-Mix Glass	
Heavies sorting belt	4-yard	Flint glass	
Heavies sorting belt	4-yard	Brown glass	
Heavies sorting belt	4-yard	Green glass	
Heavies sorting belt - end	4-yard	3-Mix Glass	
Heavies Line - Sorting Deck	**32-gallon**	**3**	
Under trommel (on deck)	32-gallon	3-Mix Glass	
Next to sorters	32-gallon	recyclable containers with liquid	
Next to sorters	32-gallon	Residue	
Lights Line - Floor	**4-yard**	**4**	
Lights Line - Floor	**32-gallon**	**1**	
Cyclone	32-gallon	Residue	
Lights Line (floor behind sorters)	4-yard	PET	
Lights Line (floor behind sorters)	4-yard	HDPE	
Lights Line (floor behind sorters)	4-yard	Aluminum	
End of container line	4-yard	Residue	
Lights Line - Sorting Deck	**32-gallon**	**8**	
Sorting station	32-gallon	HDPE	No Tares Needed
Sorting station	32-gallon	HDPE	
Sorting station	32-gallon	PET	
Sorting station	32-gallon	PET	
Sorting station	32-gallon	Aluminum	
Sorting station	32-gallon	Aluminum	
Sorting station	32-gallon	Empty	
Sorting station	32-gallon	Empty	

Table 2 | Recyclables Characterization Pre-Sort Checklist
Fiber Line

	Yes/No
Sorting deck clean	
Infeed area clean	
Fiber bunkers clean	
Chutes not in use -- taped off	
Belts clean	
Containers/Bins emptied (see list below)	
Platform scale - Set Zero	
Container tare weights (see list below)	

	Size		Tare weight
Floor - Sunnyvale Fiber and Mountain View Newspaper Compartments	**6-yard yard**	**8 1**	
Positive sort bunker	6-yard (2)	OCC	
Positive sort bunker	6-yard (2)	Mixed Paper	
Negative sort bunker	8-yard (1)	Newspaper	
Sorting Deck - Sunnyvale Fiber and Mountain View Newspaper Compartments	**32-gallon**	**8**	
Sorting station	32-gallon	Mixed Containers	No Tares Needed
Sorting station	32-gallon	Mixed Containers	
Sorting station	32-gallon	Mixed Containers	
Sorting station	32-gallon	Residue	
Sorting station	32-gallon	Residue	
Sorting station	32-gallon	Residue	
Sorting station	32-gallon	Empty	
Sorting station	32-gallon	Empty	

Table 3 | Recyclables Characterization Pre-Sort Checklist
MRF Line

	Yes/No
Sorting deck clean	
Infeed area clean	
Bunkers clean	
Belts clean	
Containers/Bins emptied (see list below)	
Platform scale - Set Zero	
Container tare weights (see list below)	

Bunkers - Two Required for Mixed Paper and OCC Materials -Feed Directly to Baler

Positive sort bunker	Live Floor Bunker	OCC
Positive sort bunker	Live Floor Bunker	Mixed Paper

Sorting Deck - Mt View Commercial Loads

	32-gallon	11
Sorting station	Two 32-gallon	Tin
Sorting station	Two 32-gallon	PET
Sorting station	Two 32-gallon	HDPE
Sorting station	One 32-gallon	Aluminum
Sorting station	Four 32-gallon	Mixed Glass

No Tares Needed