



SFO Zero Solid Waste Management Plan

Task 1 – Benchmarking

Background

The San Francisco International Airport’s (SFO) Five Year Strategic Plan identifies a series of solid waste management initiatives within a central goal of achieving status as a “Zero Waste” Airport by 2021. SFO’s Administration and Policy Division has been tasked with the development of a Zero Waste Management Plan, which will serve as a resource to guide future decision-making processes associated with projects, policies, and practices that may directly or peripherally impact the management of waste materials across the Airport. The development of the Plan includes the following tasks, which are summarized below. This report summarizes the efforts and findings from **Task 1**.

TASK	COMPLETION DATE
• Task 1 – Benchmarking of Solid Waste Generation Rates and Trends at SFO	1 September 2016
• Task 2 – Evaluate Current Waste Generators and Diversion Practices at SFO	1 December 2016
• Task 3 – Summarize Influential Factors in Waste Diversion at SFO	1 January 2017
• Task 4 – Develop Priority Measures to Enhance Solid Waste Diversion Rates at SFO	1 April 2017
• Task 5 – Evaluate Long-term Strategies for a Zero Waste Management at SFO	1 May 2017
• Task 6 – Develop Draft Zero Waste Management Plan	1 June 2017
• Task 7 – Solicit Stakeholder Input for Draft Zero Waste Management Plan	1 July 2017
• Task 8 – Finalize Zero Waste Management Plan	1 August 2017

Introduction

This Task 1 Report was prepared to summarize the available records for solid waste collection, transport, and disposal, as well as waste characterization studies, which have been conducted for San Francisco International Airport (“SFO” or “Airport”). The data compiled from these records have been evaluated in order to develop estimates for the quantities of various types of materials that are currently discarded at the Airport. The analysis is also intended to support SFO’s strategic goal for becoming the first Zero Waste airport in the United States.

For the purposes of this document, “general solid waste material” is defined to encompass all recyclable, compostable, and non-renewable (“refuse”) materials that are discarded at SFO and handled under the SFO Airport Commission’s contract with its waste hauler, South San Francisco Scavenger Company (SSFSC). Complete waste hauling records from SSFSC were not available for years prior to FY 2010/11, and the analysis was restricted to the period spanning from FY 2010/11 through FY 2015/16. *The analysis does not include Construction and Demolition (C&D) debris, deplaned waste from international flights, or materials falling under the classification of universal or hazardous waste, which are all handled separately at the Airport.* Additionally, a variety of tenants at SFO (e.g. – United Airlines, Gate Gourmet) maintain their own hauling contracts. Solid waste material hauled under these contracts does not fall under control of the SFO Airport Commission, and is not assessed in this report. However, future efforts will seek to further understand the composition of these waste streams.

The discussion within this document covers the following elements:

- A. General Solid Waste Production at SFO
- B. Diversion of Compostable & Recyclable Materials
- C. Waste Material Hauling Costs
- D. Solid Waste Characterization Studies at SFO
- E. Solid Waste Handling at Other Airports
- F. Data Gaps & Next Steps

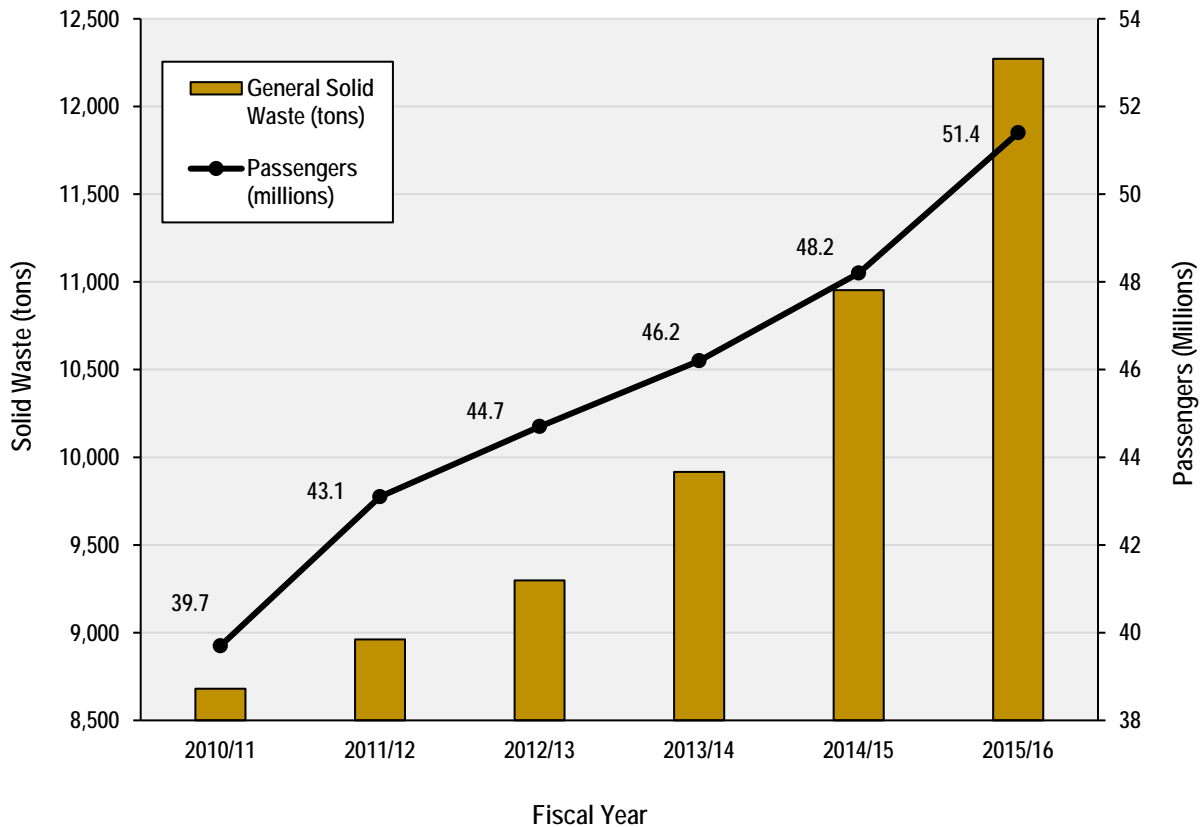
The findings of this report will be carried forward and integrated into SFO’s final Zero Solid Waste Management Plan.

A. General Solid Waste Production at SFO

During the Fiscal Year (FY) of 2015/16, over 12,200 short tons (a short ton is equivalent to 2,000 lbs) of general solid waste material was hauled under SFO’s contract with SSFSC (see Table 1). For this Section of the report, compostable, recyclable, and refuse materials are considered in aggregate, as general solid waste, in order to evaluate the total mass of waste materials that is hauled from SFO, by SSFSC, in a given year. General solid waste is broken down and assessed as sub-categories of materials in subsequent sections. The quantity of general solid waste material that SSFSC hauled in FY 2015/16 represents a 12% increase over the previous fiscal year, when nearly 11,000 tons were hauled, and it is a 41% increase over the respective quantities reported from FY 2010/11. Once again, it is noted that the accuracy of these figures are contingent on the precision and validity of SSFSC’s quarterly hauling reports, from which they were derived.

Figure 1 summarizes the levels of passenger traffic and production of general solid waste material at SFO. Passenger traffic data is reported by SFO’s division of Business and Finance, and data regarding general solid waste quantities have been compiled from quarterly reports submitted by SSFSC, as noted above.

Figure 1. Annual Solid Waste Generation & Passenger Traffic Level at SFO



Over the past six fiscal years, a steady increase in the production of general solid waste is evident at SFO. This growth is congruent with annual increases in passenger travel at the Airport, over this same time period. The positive

correlation between passenger travel and waste generation is significant as SFO's annual passenger traffic (which now exceeds 51 million), is project to increase at a rate of 2% a year, through 2021. While FY 2015/16 passenger traffic was 29% higher than levels in FY 2010/11, the amount of general solid waste hauled under the SSFSC contract in FY 2015/16 was over 41% higher than respective quantities from FY 2010/11. Thus, general solid waste production is increasing at a rate that exceeds growth in passenger travel. However, it is noted that passenger spending at the Airport has also increased over this time. Table 1 provides a summary of key waste handling statistics at SFO, including the current diversion rates and passenger travel statistics.

Table 1 – Historic Solid Waste Generation & Passenger Activity at SFO

	Fiscal Year					
	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
General Solid Waste						
Tons / Fiscal Year	8,680	8,961	9,298	9,917	10,953	12,272
Tons / Day	23.8	24.6	25.5	27.2	30.0	33.6
% Increase in General Solid Waste Production over previous FY	-	3.2%	3.7%	6.7%	10.4%	12.0%
Material Diversion Rate (%) ^a	52%	50%	53%	49%	52%	57%
Total Passengers (millions)	39.7	43.1	44.7	46.2	48.2	51.4
% Increase in Passenger Travel over previous FY	-	8.6%	3.7%	3.4%	4.4%	6.6%
General Solid Waste (lbs/passenger)	0.44	0.42	0.42	0.43	0.45	0.48
Enplaned Passengers (millions)	19.8	21.4	22.3	23.0	24.0	25.6
Food, Beverage, & Retail Sales per Enplaned Passenger (\$/passenger)	10.34	11.02	11.18	11.76	12.22	12.26
% Increase in Passenger Spending over previous FY	-	6.6%	1.5%	5.2%	3.9%	0.3%
General Solid Waste (lbs/ enplaned passenger)	0.88	0.84	0.83	0.86	0.91	0.96

^a Diversion Rate reflects percentage of solid waste that was either composted or recycled

Incremental increases in the amount of general solid waste production, on a per-passenger basis, may result in substantial contributions towards the total quantity of materials hauled over the course of a year at SFO. For example, a 1/10th of pound increase in general solid waste production for each passenger that passes through the Airport over the course of a year (e.g. – an increase from 0.48 lbs/passenger to 0.58 lbs/passenger), equates to a 2,500-ton increase in yearly annual waste hauling, based on current levels of total annual passenger traffic (51.4 million). If this additional material is either landfilled or composted, SFO's annual hauling costs would increase by over \$380,000, given the current unit hauling cost of \$149/ton for refuse and compostable materials. Thus, revenue from increased passenger spending at the airport may be partially offset by the increased production and handling of waste material.

B. Diversion of Compostable & Recyclable Materials

In FY 2015/16, approximately 57% of SFO’s general solid waste materials (6,960 tons) were source-separated on-site and placed into containers that were reserved for specific material types. Over 70% of source-separated material (4,917 tons) was reported as compostable, which was ultimately directed towards processing at a compost facility in Gilroy, CA (owned by Zanker Recycling). The remainder of the source-separated materials (e.g. – cardboard) were hauled at a reduced rate and sold as recyclables by SSFSC. In FY 2015/16, SFO saved over \$150,000 in hauling costs, through the source separation of recyclable materials.

SFO’s diversion rate is considered to be one of the highest within the airport community. During FY 2015/16, over 5,300 tons of refuse materials were collected and hauled offsite by SSFSC. These comingled materials were either landfilled or potentially processed at a SSFSC-owned material recovery facility (MRF), operated as the [Blue Line Transfer Station](#). However, previous waste characterization studies and summary data from SSFSC’s annual published recycling rates suggest that loads of mixed materials from SFO are commonly landfilled when the MRF is over-burdened with incoming material from other collection routes or public services offered at Blue Line.

The current waste-hauling contract with SSFSC, which runs through FY 2020/21, does not require SFO’s mixed refuse material to be further processed at the MRF operated by SSFSC. SFO now relies entirely on the sorting of materials at the Airport to achieve the maximum diversion of materials to composting or recycling. For the purposes of this evaluation, it was assumed that SSFSC does not conduct any additional sorting or recycling for materials that are deposited in bins, containers, and compactors that are marked for “landfill” (i.e. – intended to hold non-renewable refuse materials).

SSFSC’s quarterly reports detail the tonnage of source-separated recyclable materials that were collected from SFO and sold by SSFSC, as well as the estimated tonnage of compostable waste that were processed at the Z Best facilities in Gilroy, CA. The quarterly data has been compiled for the past six years of records, which serve as the most comprehensive source of information available for SFO’s historic waste generation rates. Figure 2 summarizes the quarterly generation rate of recyclable, compostable, and refuse materials at SFO, with each quarter’s corresponding passenger volume plotted on a secondary vertical axis.

Figure 2 – Historical Passenger Enplanement and Waste Material Generation Rates at SFO

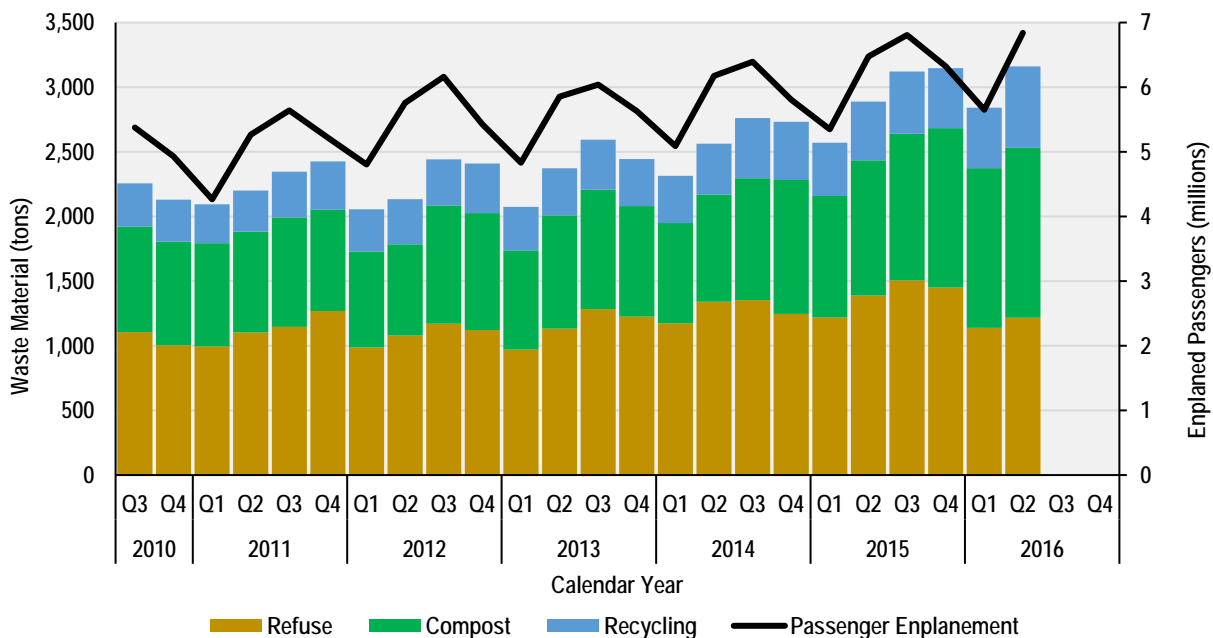
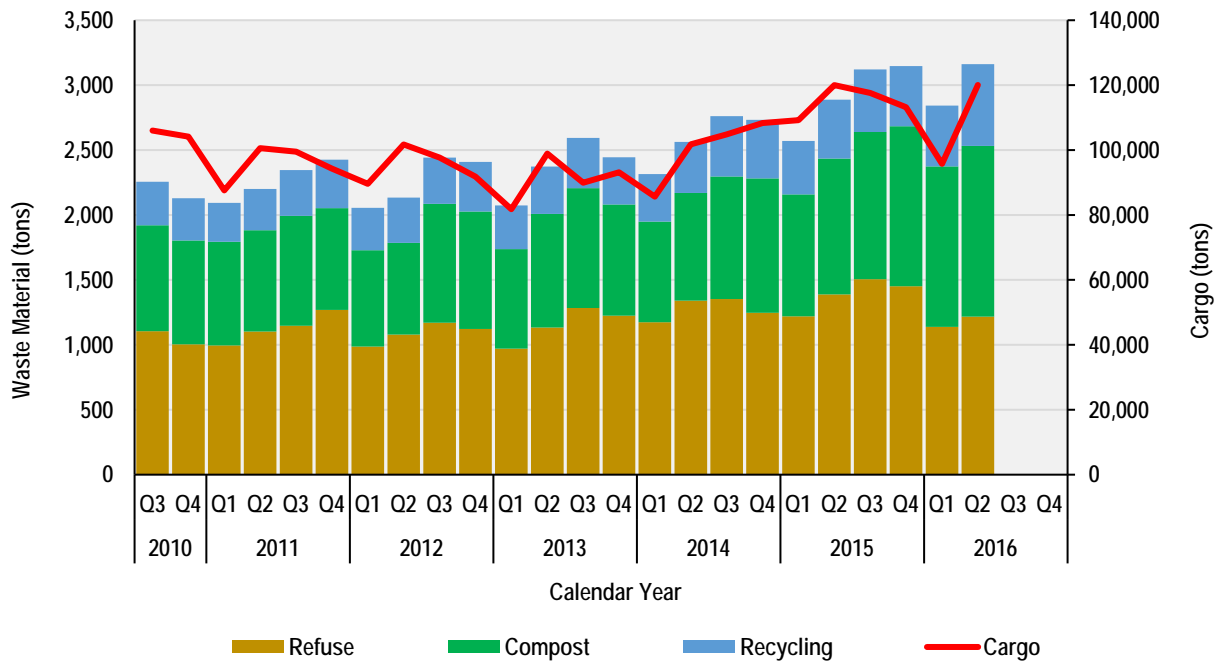


Figure 2 depicts similar seasonal trends for quarterly passenger enplanement and waste material hauling, with both data sets exhibiting a general increase over time. Quantitatively, the production of general solid waste tracks well with passenger enplanement ($R^2=0.70$). When general solid waste is evaluated as separate material streams, refuse is the most highly correlated with passenger volume ($R^2=0.64$), followed by recyclables ($R^2=0.60$), and compost ($R^2=0.47$).

In addition to passenger traffic, a significant quantity of cargo also passes through SFO each quarter. Figure 3 displays SFO's quarterly cargo handling (source: SFO Business & Finance Division), overlaid upon the same solid waste data from Figure 2. While this comparison also indicates a qualitative correlation between cargo and solid waste generation, the seasonal cargo trends are less pronounced. At a cursory level of evaluation, recyclable materials are the most highly correlated with quarterly cargo volume ($R^2=0.47$), followed by compost ($R^2=0.41$), and refuse ($R^2=0.38$), suggesting that cargo traffic's influence on these three waste streams is reduced, from that of passenger activity, and weighted more towards recyclable material types.

Figure 3 – Cargo Volume and Waste Material Generation Rates at SFO



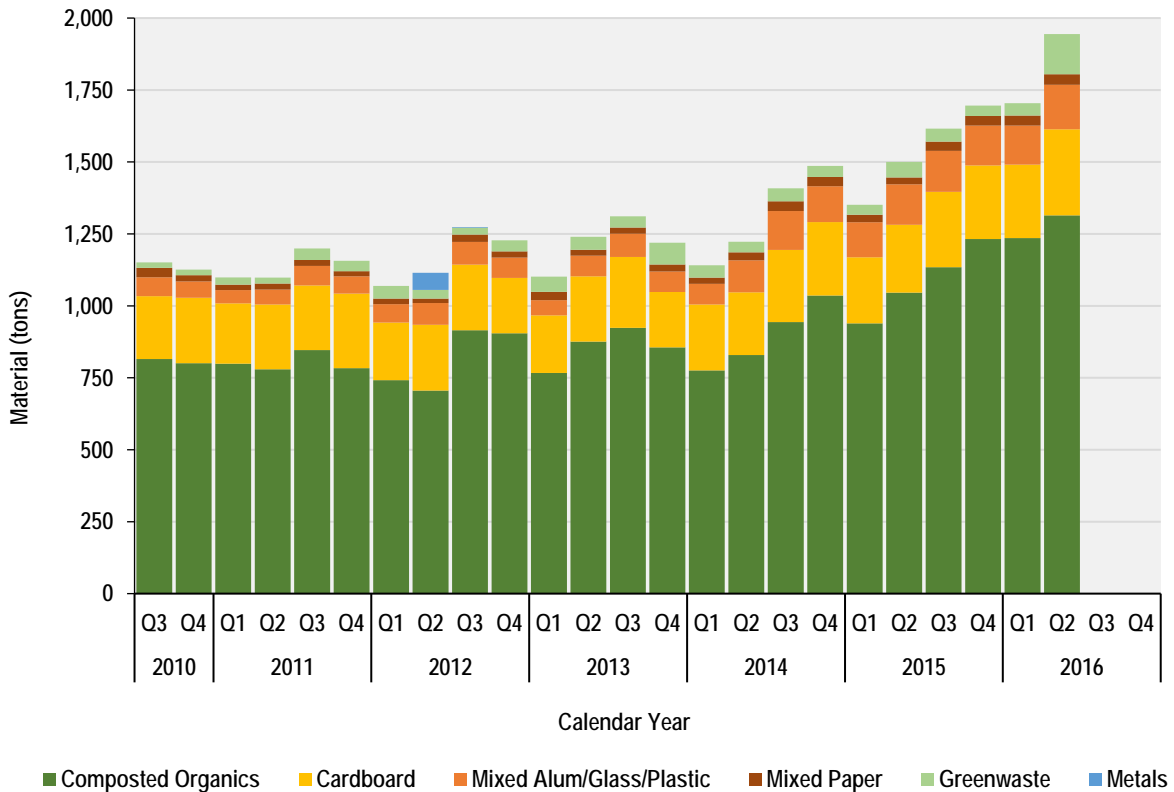
Overall, the quarterly SSFSC waste hauling reports provide limited insight towards the Airport's solid waste handling practices or key waste generators, since the records summarize the tonnage of materials collected from containers, bins, and compactors that serve an array of Airport departments and tenants. However, these reports remain the best available data to describe the state of SFO's waste management practices. Thus, it is challenging to delineate where solid waste materials originated from, within the Airport's operations, and it is also difficult to further define the primary classes of constituents within the refuse and compost waste streams.

Recyclables may be further classified into categories of Cardboard, Wood/Green waste, Mixed Paper, Scrap Metals, and "Mixed Aluminum, Glass, and Plastic" (AGP), since the Airport promotes the on-site source separation of these materials. Figure 4 summarizes data from SSFSC's records for the compostable and source-separated recyclable material streams. Green waste, wood, and lumber materials are not composted, but are instead chipped and shipped for use as biofuel. The remaining organic materials, including food soiled paper and discarded food waste, are combined into a single compostable waste stream at SFO, which have generally comprised the bulk of SFO's "diverted" solid waste materials. The compactors holding these materials have historically been accepted for

processing at the composting facility, after waste characterization studies have indicated that they contain 85- 90% or more compostable organics. However, the average rate of contamination for such compactors is unclear, and the frequency with which they are diverted towards landfilling is unknown, as it is not collected or reported by SSFSC.

SSFSC has indicated that they typically conduct an intermediate sorting phase for loads of compostable material (including the removal of plastic bags), before shipping this material to the composting facility. Since the hauling records only report the “pre-sorted” weights of compactors containing compost, it is probable that the reported values for compost represent an over-estimate.

Figure 4 – Quarterly Estimate of Source-separated Recycling & Compost at SFO



Over the past three fiscal years, the SSFSC-reported quantity of compostable materials has steadily increased. This trend may result from a host of factors, which include an increasing number of restaurants and concessionaires, higher passenger levels, and the dedication of additional compactors to the collection of compostable materials. Enhanced source separation may only partially account for the reported increases in quantities of composted materials.

Figure 4 also indicates that cardboard is the most commonly source-separated recyclable material at SFO (by mass). The recycling rate of cardboard has remained remarkably consistent over the past six years, while reported diversion rates for mixed paper and mixed-AGP have increased by factors of 1.5 and 2.5, respectively, as compared to corresponding rates from FY 2010/11. The increasing diversion of these material types is promising, although previous waste characterization studies indicate that significant quantities of paper, plastic, glass, and metals remain in the loads of comingled refuse materials that are sent each year to the landfill from SFO.

Table 2 summarizes the estimated reductions in lifecycle greenhouse gas (GHG) emissions and energy consumption (British Thermal Units [BTU]) from SFO-recycled and composted materials. These estimates were generated using the US Environmental Protection Agency’s (EPA) lifecycle analysis model (WARM, version 14) for waste reduction strategies.

Table 2 – Lifecycle Greenhouse Gas Emissions & Energy Savings from Material Diversion

Fiscal Year	Estimated GHG Emissions from Landfilled Material (Tonnes, CO _{2e})	GHG Emissions Avoided via SFO Material Diversion (Tonnes, CO _{2e})	Equivalent Savings in Fuel Combustion (Gallons of Gasoline)	Reductions in Energy Consumption via SFO Material Diversion (million BTU)	Equivalent Savings in Annual Household Energy Use (# of Households)
2010/2011	1,443	5,014	564,244	16,956	147
2011/2012	1,537	5,101	573,957	18,024	157
2012/2013	1,508	5,389	606,387	21,588	188
2013/2014	1,723	5,372	604,503	19,121	166
2014/2015	1,787	6,489	730,200	23,183	202
2015/2016	1,822	7,329	824,688	25,730	224

The reductions in GHG emissions and energy consumption reflect the relative difference between landfilling and composting/recycling for SFO’s diverted materials. The EPA WARM model attempts to capture the GHG emissions and energy inputs for the lifecycle for 54 common materials found in the US solid waste stream. This model also differentiates between the use of virgin and recycled materials, in addition to estimating the downstream environmental impacts associated with either landfilling, recycling, digesting, or composting processes. However, SFO’s records only cover eight generic categories of materials (e.g. – cardboard, mixed organics, refuse), which limits the utility of the model, as it is capable of incorporating more detailed inputs.

As shown in Table 2, the source-separation of recyclable and compostable materials at SFO has consistently generated indirect environmental benefits over the past several years. It is also emphasized that the estimated GHG emissions for landfilled waste (refuse) from SFO has continued to grow. This data has traditionally been accounted for in SFO’s annual Climate Action Plan, and going forward, analysis from the US EPA WARM model presents one standardized method for tracking the environmental impacts of SFO’s Zero Waste goal.

C. Waste Material Hauling Costs

The diversion of renewable solid waste materials from landfill disposal towards recycling or composting facilities generates a variety of environmental benefits, such as mitigating the release of greenhouse gases from decomposing organics, and reducing energy consumption associated with virgin material extraction. For SFO, recycling carries an added financial incentive, given the reduced unit hauling costs and positive credits provided under the current SSFSC contract, for some classes of recyclable materials. As noted above, SFO saved over \$150,000 in the past fiscal year as result of their source separation practices.

The unit waste handling charges under SSFSC’s current contract with SFO are summarized in Table 3.

Table 3 – SSFSC Waste Material Handling Rates for SFO

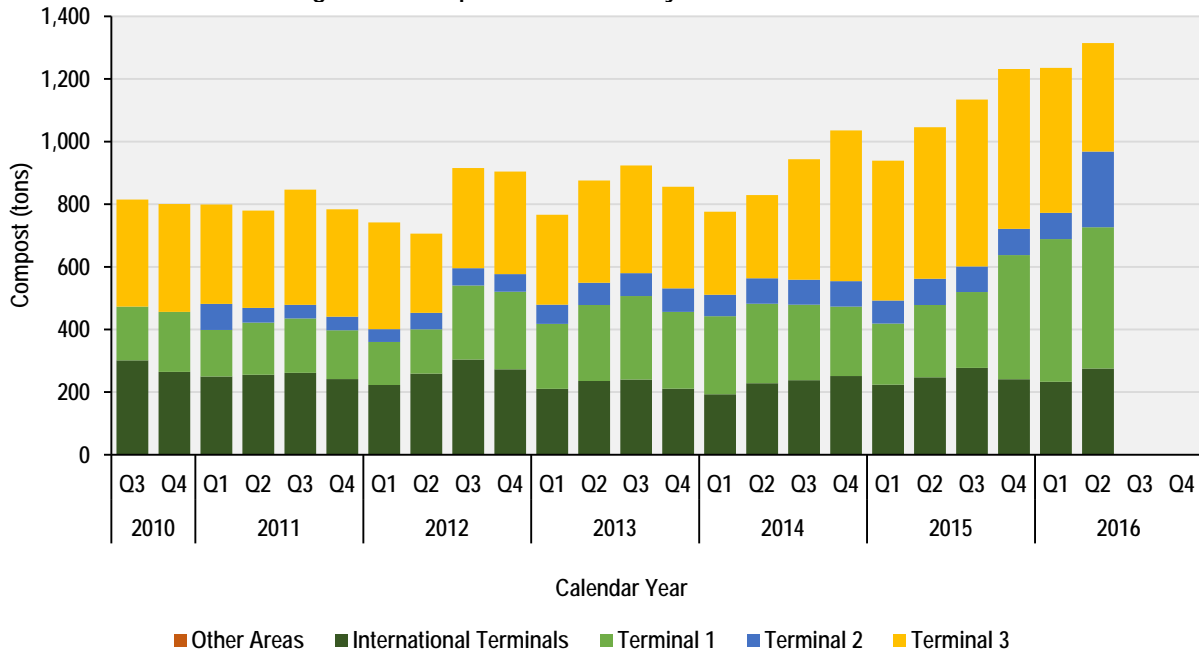
Material Type	Fiscal Year (\$/ton)				
	2016/17	2017/18	2018/19	2019/20	2020/21
Refuse	\$ 149.00	\$ 153.00	\$ 158.00	\$ 163.00	\$ 170.00
Compost	\$ 149.00	\$ 153.00	\$ 158.00	\$ 163.00	\$ 170.00
Cardboard	\$ 70.00	\$ 70.00	\$ 70.00	\$ 70.00	\$ 70.00
Wood/Green-waste	\$ 113.00	\$ 116.00	\$ 119.00	\$ 123.00	\$ 128.00
Mixed AGP	\$ 50.00	\$ 50.00	\$ 50.00	\$ 50.00	\$ 50.00
Mixed Paper	\$ 50.00	\$ 50.00	\$ 50.00	\$ 50.00	\$ 50.00
Scrap Metal	\$ -	\$ -	\$ -	\$ -	\$ -
Plastics	\$ (500.00)	\$ (500.00)	\$ (500.00)	\$ (500.00)	\$ (500.00)
Aluminum	\$ (2,000.00)	\$ (2,000.00)	\$ (2,000.00)	\$ (2,000.00)	\$ (2,000.00)

Overall, the estimated annual cost to handle SFO’s recycling, compost, and refuse is \$1.66 million for FY 2016/17, based on rates of the current SSFSC contract and the quarterly reports submitted by SSFSC. While the SSFSC contract provides reduced handling costs for source-separated cardboard, mixed paper and mixed AGP, there are only modest savings in the cost of hauling for wood and green waste. Further source separation of the mixed AGP stream into dedicated receptacles for glass, aluminum and plastics could also result in positive credits for plastics and aluminum. The source-separation of glass is expected to be cost neutral. Currently, these material streams (aluminum, glass, and plastic) are co-mingled into a single stream at SFO and then further sorted at SSFSC facilities, resulting in incurred costs for both SSFSC and SFO.

Although glass represents a relatively small fraction of the Airport’s waste, it is repeatedly noted as a contaminant of the refuse and composting streams. Glass is a relatively high density material, and as a contaminant of other waste streams, it may unnecessarily increase the aggregate cost of waste hauling. Additionally, the breakage of glass containers during MRF sorting operations is also regarded as a significant source of equipment downtime and unnecessary maintenance. At SFO, the feasibility and cost effectiveness of further sorting the mixed-AGP stream should be evaluated to increase the economic return on the Airport’s recycling efforts. The impact of SSFSC’s hauling schedule should also be evaluated, with respect to further source-separation of these materials, as it could require more frequent service to the Airport for the hauling of separate material types. This added activity may increase the garbage truck travel on the Airfield Operations Area, where traffic congestion and ramp space is a consistent issue.

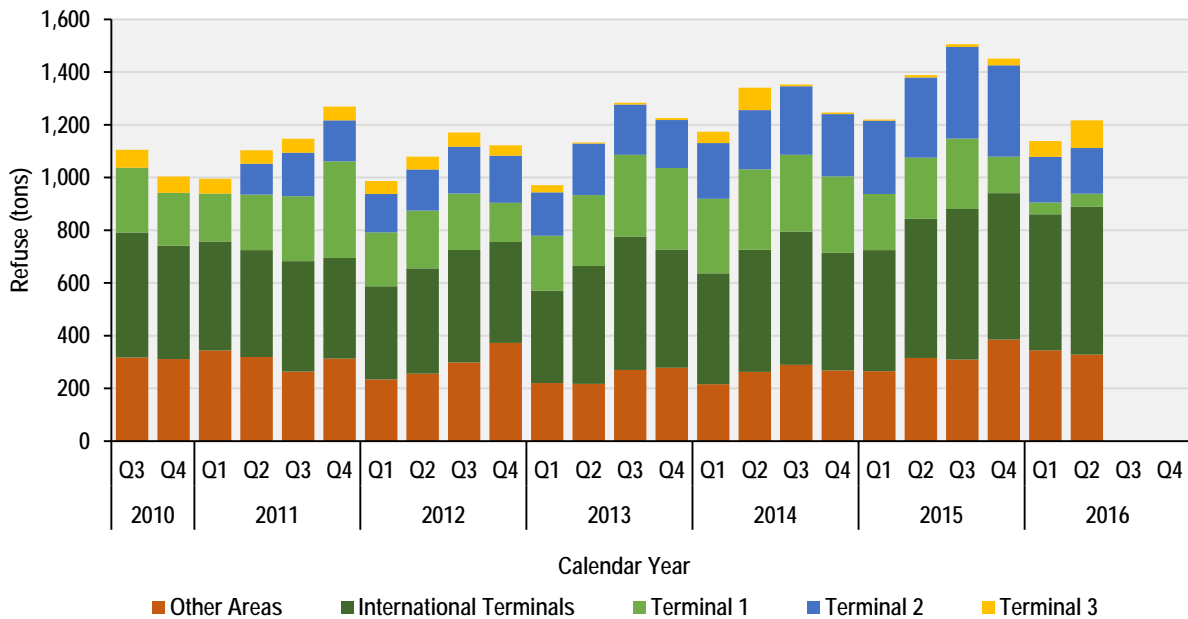
Figures 5 and 6, below, are intended to describe the general areas around the Airport that generate the highest quarterly quantities of compostable materials and refuse, based on SSFSC hauling records. While this depiction does not necessarily indicate where these materials originated from at the Airport, it approximates the total quantities collected from boxes, bins, and compactors situated around SFO’s terminal spaces, and at other non-terminal areas of the campus (“Other Areas”). It may also provide insight for which areas are serviced most frequently by SSFSC. The recycling data is not shown in this context, as the records are not sufficient to determine from which locations the loads of these materials originated.

Figure 4 - Compost Generation by SFO Terminal Area



In general, the preponderance of compostable materials have originated from compactors at Terminals 1 & 3, and the International Terminals (A & G). The seasonal trends in compostable waste generation have been diluted over the last several quarters, suggesting a shift in either the number of compactors dedicated to composting or perhaps a sustained increasing in the diversion of these materials.

Figure 5 - Refuse Generation by SFO Terminal Area



In contrast to the hauling trends for compostable waste, displayed in Figure 4, the collection of mixed refuse (landfilled waste) is dispersed more evenly across the Airport. However, discrepancies are evident for Terminal 3, which appears to contribute higher quantities of compostable waste. The non-terminal areas of the Airport make up

roughly one-quarter of regular refuse collection loads, but do not measurably contribute to the compostable material totals.

D. Solid Waste Characterization Studies

Annual solid waste characterization studies have been conducted at SFO since 2011. Prior to FY 2015/16, SFO's contract with SSFSC provided funds for the hauler to procure the services of a waste characterization consultant, to conduct studies once a year. Each of these studies were completed by ESA, an environmental consulting firm, who sampled compactors and various waste bins each year, over the course of a single week, between July and September. On average, 15-16 compactors were sampled, in addition to six rolloff boxes and a mixture of waste materials that were collected from numerous smaller bins and totes around the Airport. Three "samples" of material were collected from each container and the relative percentages (by mass) of refuse, organics, and recyclables were then estimated based on the apparent volume of each respective piece of material and its assumed material density. The volume or mass of these samples were not indicated in annual reports. Table 4 summarizes the containers sampled for the most recent waste characterization, and largely reflects those sampled over previous years.

Table 4 – Containers Sampled for 2015 ESA Waste Characterization Study

ID Number	Location	Area	Container Type	Destination
Gate 24	Gate 24		Compactor	Landfill
C-5 (was H-5)	Gate 21	Terminal 1	Compactor	Compost
30 - Gate 40	Gate 40		Rolloff Box (30 CY)	Landfill
30 - Gate 59	Gate 59		Rolloff Box (30 CY)	Landfill
D-2	Terminal 2	Terminal 2	Compactor	Compost
D-3	Terminal 2		Compactor	Landfill
20 - CT3	Courtyard 3		Rolloff Box (20 CY)	Landfill
E-1	Gate 69		Compactor	Landfill
F-1	Gate 81	Terminal 3	Compactor	Compost
G-76	Gate 76		Compactor	Compost
C-4 (was H-4)	Gate 78		Compactor	Landfill
IT-1	Courtyard 4		Compactor	Compost
IT-2	Courtyard 4		Compactor	Landfill
IT-3	Courtyard 1		Compactor	Landfill
IT-4	Courtyard 1	International Terminal Buildings	Compactor	Compost
A-2	Gate A-2		Compactor	Compost
G-1	Gate 93		Compactor	Landfill
G-2	Gates 94-96		Compactor	Landfill
G-3	Gate 91		Compactor	Landfill
14 - RAC	Rental Car Facility		Rolloff Box (14 CY)	Landfill
30 - Maintenance	North Field near USCG	Other SFO Facilities	Rolloff Box (30 CY)	Landfill
20 - Airtrain	AirTrain Maintenance		Rolloff Box (20 CY)	Landfill
FEL	Multiple locations		Front-End-Loader	Landfill

Although waste characterization summary statistics are available for several years, for many of the same compactors, these results have yielded limited data for reliable quantitative use. The visual characterization of such a diverse mix of material lacks the precision of approaches that directly catalog the weight of each piece of material within samples from a representative compactor or bin. Additionally, the use of a cross-sectional sampling approach only captures the contents of each bin or compactor once during the year, limiting the generalizability of the results. Although the repetition and consistency of Airport operations would suggest consistency in the composition of waste materials generation at SFO, the impact of strong seasonal trends in passenger traffic should not be discounted, as traveler populations may change (e.g. – international versus domestic) and higher passenger volumes may indirectly reduce the efficiency of material source-separation.

Overall, the data from ESA's investigations suggest that considerable contamination exists across bins and compactors, even though a relatively small percentage of SFO's waste (less than 5%) appears to be unsuitable for recycling or composting. While the contamination of compactors and bins at SFO is not surprising, the low percentage of non-renewable materials in the aggregate general waste stream is somewhat contradictory to characterization studies from broader populations, such as the statewide residential and commercial characterizations conducted for CalRecycle. These studies suggest that 20 – 30% of materials in the general solid waste stream remain unsuitable for recycling or composting. SFO's solid waste material stream is unlikely to differ significantly from national or statewide averages, and ESA's low estimate for non-renewable materials may be due to the limitations of visual waste characterization method.

E. Solid Waste Handling at Other Airports

Few airports in the US have provided publicly-available quantitative data on their own waste handling practices and general solid waste production rates. Atlanta International Airport (ATL), the busiest air traffic hub in the World, may provide the most appropriate case that is available for this comparison, based on results published in a 2015 solid waste characterization study that was commissioned by the City of Atlanta's Department of Aviation. The report is available at this site: <http://www.forester.net/pdfs/Atlanta-Airport-Waste-Characterization-Study.pdf>.

Table 5 contains operational statistics for both SFO and ATL, in order to provide context for the scale of operations at the two airports.

Table 5 – Comparison of SFO and Atlanta International Airport Solid Waste Characteristics

	SFO (FY 15/16)	ATL (2015)
Passenger Volume	51,400,000	101,491,000
Landings & Takeoffs	429,815	882,497
Cargo (metric tons)	449,045	625,000
Total Waste Material (tons)	11,727	18,527
Reported Waste Diversion Rate (tons)	6,960	926
Reported Diversion Rate (%)	57	5

On average, the ATL airport has twice the passenger volume of SFO, with over twice the number of landing and takeoffs and nearly 1.4-fold more cargo tonnage. ATL reports that their respective airport operations produce 60 percent more general solid waste than SFO, while they have historically diverted just 5% (or less) of this material to recycling and composting. However, the diversion rate at ATL is expected to increase significantly once they have finished the construction of their own MRF, which is currently under development.

For SFO, it should be acknowledged that only half of the general solid waste materials produced by Airport operations is handled under the SFO Commission-controlled waste hauling contract. The remainder of general solid

waste produced from Airport operations is processed under separate tenant-administered hauling contracts (based on Airport surveys conducted in 2008 and 2013). If all general solid waste material from SFO operations were to be directed through the Airport’s SSFSC hauling contract, annual quantities would effectively double to 24,000 tons per year, while per-passenger rates would approach 1.0 pound of general solid waste per passenger. This exemplifies the difficulties with contrasting general solid waste data across airports due to a variety of differences that include the ratio of domestic to international flights, local recycling and composting ordinances, and solid waste handling contracting arrangements.

For purposes of comparison, an estimate of SFO’s potential solid waste material profile has been extrapolated using the relative percentages of material types reported from ATL’s 2015 solid waste characterization study. Table 6, below, presents a summary of this data, and shows that SFO recovers and diverts higher quantities of wood/greenwaste and cardboard than would be expected to be found in the entire waste stream, if the estimated quantity of such materials were based on the ATL material profile. Meanwhile, the efficiency with which SFO diverts mixed-paper and mixed-AGP would appear to be rather low, if these materials were present at levels suggested by the ATL waste profile. Most importantly, this highlights the limitations of the past ESA characterization studies, which are not sufficient to determine the percentage of materials types that comprise the aggregate SFO waste stream.

Table 6 – Extrapolation of Atlanta Solid Waste Characterization to SFO’s

Material Type	ATL Solid Waste Profile (estimated from 2015 Characterization Study) (tons)	% of Total ATL Solid Waste	Profile of SFO Solid Waste (extrapolated from ATL Waste Characterization Study)	SSFSC Reported Disposal Quantities, FY 15/16 (tons)
Refuse	5,190	28.0%	3,436	5,312
Compost	8,132	43.9%	5,387	4,916
Cardboard	1,198	6.5%	798	1,072
Wood	17	0.1%	12	264
Mixed AGP	1,946	10.5%	1,289	571
Mixed Paper	2,025	10.9%	1,338	137
Scrap Metal	18	0.1%	12	0

SFO also differs from many other organizations with respect to reporting procedures for the handling of construction and demolition (C&D) debris. All C&D debris from construction activities at SFO is reported separately and is not included in the Airport’s general solid waste stream profile, or its corresponding diversion rate. In contrast, the City of San Francisco (the “City”) includes C&D debris recycling in their published material diversion rate of 80%. Exclusion of C&D debris from the City’s general solid waste stream would reduce their diversion rate to below 60%. Thus, the Airport’s diversion rate is roughly equivalent to that of the City’s modified diversion rate. Other Airports also include the generation and recycling data for C&D debris in their overall solid waste generation data.

F. Data Gaps & Next Steps

The infrastructure development that is programmed under SFO’s current capital plan suggests that the production of general solid waste material will continue to escalate through 2020, in the absence of significant materials management interventions. Consistent annual increases in the Airport’s solid waste generation, as well as its growing number of waste generators, could pose a challenge for the development of effective strategies for attaining Zero Waste status.

SFO’s system for tracking solid waste material generation at the Airport is entirely reliant on the quarterly waste hauling reports submitted by SSFSC, which are difficult to validate. Benchmarking the Airport’s solid waste

generation rates on this data and actively monitoring for improvement or regression within such an accounting system is neither efficient, nor particularly accurate, in the context of a Zero Waste initiative. It is unlikely that the resolution of data from SSFSC's hauling records may be improved beyond their current state. While monthly or weekly hauling data may be obtainable, the accuracy or validity of these records is not necessarily improved, and no added insight is gained, regarding the sources of these materials.

Therefore, additional effort should be focused on introducing tracking and reporting mechanisms at SFO-maintained waste containers to develop waste generation and characterization data that would be independent of SSFSC's hauling records. Purchasing records for common materials at SFO (e.g. – office paper, paper towels, trash bags, etc.) should also be obtained by zero waste staff to provide baseline data on source reduction. Both environmental and economic rewards could be generated by improving solid waste material management procedures at SFO. A more rigorous system for the tracking solid waste generation and characterizing the waste streams would be beneficial for both optimizing custodial staffing and waste handling infrastructure, as well as effecting behavior change among SFO passengers, tenants, and Commission staff. This will be a focus of future tasks.