Task 7: Reduce the Production and Disposal of Solid and Hazardous Waste

Final Report – Solid and Hazardous Waste Reduction Opportunities and Recommendations

Prepared for: **Broward County Aviation Department**

Fort Lauderdale, Florida

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Prepared for

Broward County Aviation Department
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Final Report

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ACRONYMS

ADPD – Airport Development Plan Definition

ANAC – Airport Noise Abatement Committee

ANOMS – Airport Noise and Operation Monitoring System

APU – Auxiliary Power Unit

ARS – Airport Recycling Specialists, Inc.

ASCE – Annual Comprehensive Site Evaluation

AST – Above Ground Storage Tank

ATCT – Air Traffic Control Tower

BCAD – Broward County Aviation Department

BCC – Broward County Board of County Commissioners

BOD – Biological Oxygen Demand

CAP – Clean Airport Partnership, Inc.

CO – Carbon Monoxide

CO_2 – Carbon Dioxide

COD – Chemical Oxygen Demand

CWA – Clean Water Act

CUP – Consumptive Use Permit

CY - Cubic Yard

dB(A) – "A" weighted Decibel

DEA – Draft Environmental Assessment

DEIS – Draft Environmental Impact Statement

DOA – US Department of Agriculture

DOT – US Department of Transportation

EPA – US Environmental Protection Agency

EDMS – Emissions and Dispersion Modeling System

FAA – US Federal Aviation Administration

FAR – Federal Aviation Regulations

FBO – Fixed Base Operator

FDEP – Florida Department of Environmental Protection

FDOH – Florida Department of Health

FDOT – Florida Department of Transportation

FLL – Ft. Lauderdale-Hollywood International Airport

FLLS – Ft. Lauderdale South

FLLS2 – Ft. Lauderdale South – facility 2

GCTL – Groundwater Cleanup Target Levels

GSE – Ground Support Equipment

GSLD – General Service Large Demand

HID – High Intensity Discharge

IM – Impact Metric

INM – Integrated Noise Model

LTO – Landing and Take Off

KWH – Kilowatt Hour

Ldn – Day/Night Average Sound Level

MRF – Materials Recycling Facility

MS4 – Municipal Separate Storm Sewer System

MSGP – Multi-Sector Group Permit

MSW – Municipal Solid Waste

NADC – Natural Attenuation Default Criteria

NADP – Noise Abatement Departure Profile

NEPA – National Environmental Policy Act

NO_x – Nitrogen Oxides

NPDES – National Pollution Discharge Elimination System

OES – Broward County Office of Environmental Services

PAC – Pre-Approved Advance Cleanup

PCPP – Petroleum Cleanup Participation Program

RCC – Rental Car Center

RMT – Remote Monitoring Terminals

SFWMD – South Florida Water Management District

SO_x – Sulfur Oxides

SPCC – Spill Prevention Control and Countermeasure

SWPPP – Storm Water Pollution Prevention Plan

TMDL – Total Maximum Daily Load

TOU – Time of Use

TSA – Transportation Security Administration

TSS – Total Suspended Solids

UST – Underground Storage Tank

VFD – Variable Frequency Drive

VOC – Volatile Organic Compounds

1. Executive Summary

As air traffic at FLL continues to increase, so will the production of solid and hazardous waste. Waste minimization is key to promoting a more sustainable society, reducing the amounts of waste generated, and reducing the consumption of landfill space. The EPA supports increasing the amount of recycling and reducing waste generation because the programs are simple and fair. They also contribute to environmental and economic sustainability. The purpose of this report is to explore different strategies of reducing the amount of waste that is generated at FLL.

Two major improvements to FLL's current waste management program are discussed in detail in this report. They include methods of expanding the existing successful recycling program at FLL by increasing recycling participation and recycling efficiency, as well as the implementation of a food donation program that would not only reduce the amount of waste being generated, but can benefit the local community in a tremendous way. A cost benefit analysis is also presented for each of these recommendations. The overall effect on the impact metric that was calculated in the Baseline Report is also evaluated.

2. Project Overview

2.1 Introduction

Waste produced at FLL is costly to treat and dispose of and has an environmental impact due to the use of natural resources as well as the consumption of landfill space. Minimizing waste generation through process and design changes and/or aggressive recycling programs can reduce raw material expense, disposal costs, and environmental impact. Solid and hazardous waste streams are an indication of inefficiency and require fee-based transportation and disposal costs.

2.2 Purpose

This report identifies opportunities for reducing the quantities of waste generated at FLL thereby increasing the sustainability of the airport itself. Our previous work quantified waste generated at FLL on a per passenger basis. As FLL continues to grow, waste generation is projected to increase in a

direct relationship with increased air traffic. By identifying additional opportunities for waste reduction and recycling, the rate of this increase can be diminished.

The project team conducted discrete sampling at FLL and analyzed the existing waste stream in order to develop strategies for reducing the quantities of waste that must be managed. Working with the private company that currently oversees municipal solid waste from FLL's terminal areas and the rental car center, we looked for opportunities to expand their service area to include additional facilities at the north and west side of FLL, as the majority of the FBOs occupy these portions of the airport. We also identified opportunities for reducing the quantities of waste generated and concomitant benefits. This work included:

- Analyzing data on waste composition & quantity
- Conducting discrete sampling at two different locations throughout the airport over a period of seven days each. Samples analyzed were waste products collected for disposal in onsite dumpsters. Analytical results were reviewed to identify components of the waste stream for reduction
- Identifying technologies for waste reduction
- Reviewing existing recycling practices
- Identifying new opportunities for recycling
- Estimating the cost of recommended waste management strategies

2.3 Report Organization

The two sections that follow examine the composition and quantity of non-hazardous and hazardous waste at FLL; the methodology and techniques used to quantify the waste stream; and the strategies for reducing waste quantities. The benefits of implementing these proposed programs are also calculated.

3. Solid Waste Composition and Quantity at FLL

3.1 Introduction

As one of the fastest growing airports in the country, approximately 11.3 million passengers enplaned at FLL during the fiscal year ending September 30, 2005[1]. These passengers generate waste as do the employees who work at the airport and other businesses associated with the airport operations. Our baseline report defined the quantity of waste generated per passenger at FLL in terms of an "impact metric".

MSW in this report includes, but is not limited to, putrescible wastes such as from food preparation, paper, cardboard, metal, glass, and plastics. Currently, the MSW at FLL's terminals, the RCC, and from domestic flights is collected and taken to ARS' onsite facility for sorting and recycling. Even though ARS has historically achieved an average recycling rate of about 30 percent, the quantity of waste disposed of offsite has increased as the airport has grown.

3.2 Waste Generation

Airport, non-airport, and construction activities generate solid waste. As air traffic has increased at FLL over the years, so has the quantity of waste generated. FLL's waste generation has been well documented because very good data exist for the terminal area and RCC, as shown in Figure A-1 in Appendix A.

Updated research from the Baseline Report summarized the amount of waste generated from the different sections at the airport. Since the terminal waste is sent to ARS who achieves a 30 percent recycle rate, the following information in Table 1 can be calculated. It is important to note that ARS manages approximately 40 percent of the total waste stream at FLL.

[1] Annual Statistical Report - Fiscal Years Ended Sep 30, 1996 to 2005 by BCAD

Table 1: Current Annual MSW Generated at FLL

Location	Annual MSW (lbs)	Waste Handler	Recycle Rate (%)
Terminal Area (Passenger Area + Domestic Aircraft Waste) and RCC [1]	7,360,002	ARS	30
Terminal Restaurants [2]	3,600,000	WM[a]	--
Airfield (Domestic Flights)	Included in Terminal Waste	ARS	--
Airfield (International Flights [3])	233,600	Stericycle Inc.	--
FBOs on West Side	1,921,560	WM, AS	--
FBOs on North Side	5,457,760	WM, AS	--
Total lbs MSW/yr	18,572,922		
Lbs MSW/psgr [4]	1.78		
Net lbs MSW/psgr (after ARS' current recycling rate of 30% of Terminal Area waste)	1.57		

[1] Three-year weighted average of ARS data
[2] Data provided by Nova Consulting, Inc. from 2004 communications with WM
[3] Special waste that is incinerated

[a] Waste Management, Inc.
[b] All Service Refuse Company

[4] Three-year weighted average of passenger data from BCAD Annual Statistical Report = 10,440,778 passengers

ARS has operated a MRF at FLL since 1989. A MRF is a facility that processes MSW and separates out the recyclables which are hauled to various locations to be processed into new products. ARS, through two compactor chutes, is able to receive MSW in their facility twenty-four hours a day, seven days a week from the terminal areas and the airlines, as shown in Figure 1.

Figure 1: View of compactor dump chutes at ARS

ARS has a dumpster located at the RCC for which they provide hauling services. The bags of MSW are opened on a conveyer belt system where several personnel separate out the recyclables and place them in allocated containers. ARS has cardboard, plastic, and aluminum baling machines. A perforating machine is used to punch holes in the plastic bottles and aluminum cans to allow the liquids to drain out prior to baling. These three recyclables are baled on site and then picked up by the various recycling companies. A view of baled aluminum and plastic is shown in Figures 2 and 3. The paper products are stored in containers until a large enough quantity is collected to be hauled to the recycling company. ARS has received pallets and scrap metal at times which are recycled when feasible. The remaining unrecyclable material is sent to a waste-to-energy facility in southern Broward County.

Figure 2: Stacks of baled aluminum at ARS

Figure 3: Stacks of baled plastic bottles at ARS

ARS is currently using a pay-as-you-throw (PAYT) system at the RCC which is based on the amount of solid waste that is actually thrown away. The other parts of the airport (the terminal restaurants, the airfield, and the FBOs) are served by various waste haulers, as mentioned in Table 1, and therefore it is more difficult to quantify the amount of waste that is generated. This may be due in part to the fact that their waste handlers typically charge a fixed fee depending on the size of the container that is provided to the customer. When a customer knows that their waste handling fee remains fixed regardless of how much waste they generate, there is no incentive to minimize waste generation either through source reduction or recycling.

This creates a direct economic incentive to reduce the amount of waste generated.[2] If this concept is introduced to the FBOs, they may have strong economic reasons to participate, as the majority of them currently have waste collection contracts with WM or AS based on dumpster size, not the amount of waste that is actually collected.

3.3 Data Collection and Analyses

The CAP team conducted a solid waste study at two of the larger FBO tenants at FLL – one on the north side and one on the west side. FedEx Express

[2] http://www.epa.gov/epaoswer/non-hw/payt/intro.htm

(FedEx), the tenant in the north side, currently has two 7-cubic yard (cy) dumpsters that are emptied twice a week. SheltAir Aviation (SheltAir), the tenant on the west side, has five 7-cy dumpsters that are emptied on an as-needed basis, usually two to three times a week. Neither facility currently participates in a recycling program. Both facilities are being charged by the number of pick-ups performed, not by the amount of waste actually being picked up. In both cases, the waste is collected by WM and then taken to a waste-to-energy facility located in Broward County where it is all incinerated.

ARS, at the request of Westhorp & Associates, Inc. (WA) placed one 15-cy dumpster at each of these facilities for a period of seven days. The dumpsters were collected daily and taken back to the MRF located at FLL. The material was sorted and recyclables identified and separated. The data can be found in Tables A-1 and A-2 in Appendix A. The results indicate that significant opportunities exist for recycling – potentially up to 56 percent and 60 percent by weight respectively at FedEx and SheltAir.

3.4 Analysis of Promising Strategies and Technologies

The EPA has ranked the most environmentally sound strategies for MSW: Source reduction (including reuse) is the most preferred method, followed by recycling, and lastly, disposal in combustion facilities and landfills.[3] Reuse and recycling opportunities exist at FLL for special wastes such as wooden pallets, which can be reused numerous times, and clean plastic wrap that can be recycled. During the team's solid waste study, these two items comprised a large part of FedEx's waste stream that was simply being disposed of.

Based on research and on the solid waste study, the CAP team suggests that the following strategies be considered for implementation to reduce the amount of solid waste being generated at FLL:

- Introducing source separation of recyclables throughout FLL. The purchase of additional bins will be required for the implementation of this method. Recycle bins range from $25 to $500 depending on the type and size of bins. Additionally, a "blue bag system" for these recyclables can be a valuable time-saving method. This

[3] http://www.epa.gov/msw/facts.htm

method uses a different colored bag for the recycle bins so that when the bags get to the MRF for sorting, it will be apparent to the workers which bags contain the recyclable products so time will not have to be wasted sorting through other garbage. These blue bags cost the same as regular trash bags, but the purchase of the extra bins will be required.

- Providing public education and awareness through the placement of signage in the terminals and rental car center indicating that all waste collected at these places are being separated for recycling may encourage passengers to dispose of their waste at FLL rather than travel home with it.
- Donating unused cooked food from the terminal restaurants to food banks, soup kitchens, and/or shelters can eliminate perfectly good food from the waste stream while feeding the hungry. This item is discussed in further detail in Section 2.4.2.
- Introducing a centralized waste management system where the airport authority manages the waste for all the tenants and airlines. This can increase recycling participation from the FBOs, many of whom practice minimal recycling as observed during our solid waste study.
- Purchasing products in bulk to reduce packaging material, printing double-sided on paper, using durable utensils, cups, mugs etc. instead of disposable items, and using rechargeable batteries are all methods to minimize the amount of waste that is generated from an office or a facility. These practices can be implemented at the BCAD offices and suggested as best management practices to the FBOs.
- Donating old magazines instead of disposing of them can be done by the airlines. Magazines can be donated to libraries, care shelters, or hospitals. This would reduce the amount of waste that currently must be disposed of at a licensed facility.
- Introducing electric hand dryers in the restrooms in the terminal building would reduce the large amount of waste paper that is currently sent to landfills or incinerators.

Source separation, increasing public education and awareness, and the implementation of a food recovery program are discussed in further detail below.

3.4.1 Implementation of Source Separation and Increasing Public Awareness

FLL's recycle rate can be improved by implementing a source separation of recyclables throughout the airport. The purchase of additional bins will be required for the implementation of this method. Recycle bins range from $25 to $500 depending on the type and size of bins. Assuming an average cost of $250 per bin, 50 new bins would cost $12,500. We assume the life of these bins is approximately 10 years; therefore, the annual cost for these bins is $1,250. In addition, a different colored bag can be used in the new recycle bins. This will help increase the sorting efficiency for the recycling contractor.

There are approximately 400 garbage bins that are managed by Sunshine Cleaning Systems, Inc. (Sunshine) from the RCC, the parking garages, and the terminal building (both inside and outside)[4]. The annual quantity of waste which goes to the MRF from Sunshine is approximately 4,745,000 pounds. Based on the 40 percent increase in recycling that Seattle-Tacoma International Airport saw after the implementation of a similar program[5], the CAP team estimates that FLL will be able to conservatively increase their current recycling by 20 percent by weight. This would amount to approximately 949,000 pounds of waste annually. At a regular waste disposal rate of $170 per ton of waste (or $0.085 per pound of waste), this would save BCAD $81,000 annually.

Studies have shown that the key to long-term success for any program which is implemented is planning and education.[6] This can be achieved by increasing public awareness through the postage of signs within the terminal area and

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[4] Conversation with Mr. Bruce Walker of Sunshine on 5/1/07.

[5] EPA Recycle on the Go Success Story.

http://www.epa.gov/epaoswer/osw/conserve/onthego/documents/seatac.pdf

[6] "Decision Maker's Guide to Solid Waste Management", Volume II, (EPA 530-R-95-023), 1995.

the RCC and/or the placement of decals on trash bins indicating that all the waste is being sent to the onsite MRF. Greater visibility and increased awareness of the recycling that is being done would promote FLL's sensitivity to recycling as well as encourage travelers to use the garbage cans for their waste disposal.

The CAP team recommends that BCAD hire a fulltime recycling coordinator to manage and implement this program. We assume that this position would cost BCAD about $40,000 per year plus benefits, making the annual cost $60,000.

3.4.2 Food Recovery Program

Twenty percent of all food produced in the United States goes to waste. As discussed in Section 2.4, the most environmentally sound strategy for handling MSW as determined by the EPA is source reduction. A food waste reduction hierarchy of feeding people first, then animals, then recycling, then composting exists. To encourage food donations, the US Congress passed a law – the Bill Emerson Good Samaritan Food Donation Act – that protects businesses, organizations, and individuals that donate food in good faith from legal liability that might arise from their donations.[7] Along these lines, as long as the food at the restaurants has been handled in a sanitary manner and maintained wholesome and unadulterated as defined by FAC Chapter 64E-11.003 and 64E-11.004, the FDOH does not object to food being donated.[8]

Several food banks expressed interest in receiving this food, the largest being the Daily Bread Food Bank (DBFB) which is a chapter of America's Second Harvest. America's Second Harvest is the nation's largest domestic hunger relief organization that collects surplus food and grocery products and delivers it to day-care centers, homeless shelters, residential homes for the physically and mentally challenged, assisted living facilities for the elderly, youth programs, soup kitchens, and emergency food pantries. Approximately 98 percent of every dollar that is donated is spent on programs; less than two

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[7] DOA and EPA, "Waste Not Want Not: Feeding the Hungry and Reducing Solid Waste Through Food Recovery." http://www.p2pays.org/ref/26/25249.pdf

[8] E-mail from Mr. Ric Mathis of FDOH on 9/12/06.

percent is spent on administrative costs. The DBFB distributes approximately 1.5 million pounds of food each month through a network of over 800 agencies. Forty-three percent of those receiving food through the DBFB are children, and 13 percent are elderly.[9]

The DBFB has warehouses in Dade, Broward, and Palm Beach Counties. They have made arrangements with CA One, the company that manages the food concessionaires at FLL, to launch the food donation project with weekly collections in DBFB's refrigerated truck for distribution within Broward County. The DBFB will provide a donation receipt at each collection event, which may then be used by the participating donors for tax filing purposes.

There are several food concessionaires at FLL that have the potential to be food donors. They include Cheeburger Cheeburger, Dunkin' Donuts, Pizzeria Uno, Spinaci's Italian, TJ Cinnamons, Chili's Too Bar and Grill, Grand Forno Bakery, La Cucina by Sbarro, Miami Subs Grill, Nathan's Famous, Kenny Rogers Roasters, Vito's Deli, and Corky's BBQ & Ribs. These types of prepared food are ideal for donation to the elderly and homeless as no preparation is required.

Seattle-Tacoma International Airport's food donation program has a success rate of 26,000 pounds of food donated annually to food banks in the area[5], which is approximately 0.3% of their total waste stream. For lack of actual data from the recently implemented food donation program at FLL, if we assume that 0.3% of FLL's total waste stream of 18,572,922 lbs is being donated to the DBFB, this works out to 55,720 lbs of food donated annually. This amounts to a cost savings of $5,000 per year, using an average disposal cost of $170 per ton (or $0.085 per pound of waste). The benefit in this case is not only a financial one, but a philanthropic one as well.

[9] http://dailybread.org/

3.5 Cost vs. Benefit Analysis

The two recommended strategies discussed earlier were also analyzed from a budgetary standpoint which is summarized in Table 2 below.

Table 2: Annual Cost vs. Benefit Analysis

Strategy	Operating Cost	Pounds of Waste	Cost / (Savings) for Disposal	Cost / (Savings) per Pound [a]
Source Separation + Recycling Coordinator [b]	$1,250[c] + $60,000	949,000	($79,750)	($0.084)
Food Recovery	$0	55,720	($5,000)	($0.085)
TOTAL ANNUAL COST/(SAVINGS)	$61,250	1,004,720	($84,750)	($0.023)

[a] Cost per pound of disposal is $0.085

[b] Assume fulltime position pays $40,000 annually plus 50% for benefits

[c] Assume the purchase of 50 bins at $250 each, the life of each bin is about 10 years, and 10 bins are replaced annually

3.6 Impact on FLL Environmental Footprint

Based on additional data provided to us by Nova Consulting Inc. (Nova),[10] one of the FLL DEIS consultants, and on our solid waste study conducted in this task, the CAP team has revised the solid waste impact metric that was presented in the Baseline Report. The amount of MSW generated at FLL is 1.78 pounds per passenger. Based on the current recycling rate by ARS as outlined in Table 1, the net amount of MSW generated at FLL is 1.57 pounds per passenger. However, if FLL implements the two recommended waste management strategies discussed earlier, the following numbers can be calculated:

- By introducing new recycle bins and proper signage on the existing bins within the RCC, the parking garages, and the terminal building, 949,000 pounds of garbage can be diverted from FLL's

[10] E-mail from Ms. Maya Compton of Nova Consulting Inc. on 9/12/06.

waste stream, decreasing the annual amount of waste for disposal from these areas to 4,203,002 pounds.

- With the terminal restaurants' participation in the food donation program at a recovery rate of 0.3% of FLL's total waste stream, this would amount to 55,720 pounds of food per year being diverted. This decreases the annual amount of waste for disposal from the terminal restaurants to 3,544,280 pounds.

Using these numbers, the following information in Table 3 below can be calculated, thereby decreasing the net amount of waste generated at FLL per passenger to 1.47 pounds. This amounts to a net 6 percent decrease in the impact metric.

Table 3: Future Annual MSW Generation at FLL

Location	Lbs of MSW Disposed	Lbs of MSW Recycled	Net lbs MSW Disposed Of
Terminal Area (Passenger Area + Domestic Aircraft Waste) and RCC	5,152,002	949,000	4,203,002
Terminal Restaurants	3,600,000	55,720	3,544,280
Airfield (International Flights)	233,600	--	233,600
FBOs on West Side	1,921,560	--	1,921,560
FBOs on North Side	5,457,760	--	5,457,760
Total	**16,364,922**	**1,004,720**	**15,360,202**
		New net lbs MSW/psgr[1]	1.47

[1] Three-year weighted average of passenger data from BCAD Annual Statistical Report

4. Hazardous Waste Composition and Quantity at FLL

4.1 Introduction

Hazardous wastes are defined as wastes that pose a substantial present or potential hazard to humans or other living organisms due to many different reasons.[11] Hazardous wastes as defined here include antifreeze, diesel and jet fuel, solvents, and batteries. Figure A-2 shows the breakdown by component of hazardous and non-hazardous wastes at FLL. The FBOs in the north and west side of FLL are the largest contributors to this waste stream due to the nature of their businesses and the activities conducted there. As air traffic at FLL increases, so will the operations at the FBOs, directly contributing to an increase in the amount of hazardous waste that is generated.

The EPA does not regulate used oil that is being recycled or certain types of used oil filters as hazardous waste. Instead, used oil handlers follow a set of federal management standards that are designed to encourage the recycling of used oil.[12] It is important to note that recycling just two gallons of used oil can generate enough electricity to run the average household for almost 24 hours. It takes 42 gallons of crude oil, but only one gallon of used oil, to produce 2.5 quarts of new, high-lubricating oil.[13]

4.2 Waste Generation

Based on the data collected during the Baseline Report and on the data provided by Nova, the amount of hazardous and non-hazardous waste generated in relation to MSW comprises approximately two percent by weight of the total waste that is generated at FLL.

Currently, it appears that all the generators of hazardous waste at FLL all have contracts with various hazardous waste pickup companies such as EQ Florida, PMI Corp., Ricky's Oil Service, Inc. for oily wastes, solvents, tires, and

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[11] Tchobanoglous G., Theisen H., and Vigil S., *Integrated Solid Waste Management,, Mc-Graw-Hill Inc.,* 1993, p. 100

[12] http://es.epa.gov/techinfo/facts/oilfltrz.html

[13] http://www.epa.gov/epaoswer/non-hw/muncpl/oil.htm

light bulbs. Many of these hauling companies reuse or recycle the hazardous wastes at their facilities in one of four ways. Used oil can be reconditioned onsite, inserted into a petroleum refinery, re-refined, or processed and burned for energy recovery. Of these four options, re-refining is the preferred choice of the EPA by closing the recycling loop by reusing the oil to make the same product that it was when it started out. Processing and burning the used oil for energy recovery is not as a preferable as re-refining as it only enables the oil to be reused once.[14]

A large quantity of the oily waste that is generated at these facilities is comprised of used oil and oily water which, as mentioned earlier, is not considered to be a hazardous waste according to the EPA. The state of Florida has a Used Oil Recycling Program under the FDEP which is recognized as one of the most successful in the United States. It consists of a registration and record keeping program for used oil handlers, a permitting program for used oil processors, and technical assistance to the public and regulated community.[15]

Based on 2003 data from Florida's Used Oil Recycling Program, of the oil and oily wastes that are not recycled, 1.1% was landfilled, 88.5% was treated as industrial wastewater, and 10.4% is incinerated. Of the used oil that was recycled, 71.4% was marketed as an on-specification used oil fuel, 8.8% was burned as an off-specification used oil fuel, and 19.8% was marketed for other industrial uses.[15]

4.3 Hazardous Waste Reduction Strategies and Technologies Evaluated

Since participation in the proper disposition of hazardous wastes is currently widely practiced at FLL, the CAP team focused on researching strategies to minimize the generation of hazardous waste, as a sustainable society focuses on minimizing waste. The EPA states that programs that target overall waste reduction are vital to achieving sustainability, but focus should also be placed

[14] http://www.epa.gov/epaoswer/hazwaste/usedoil/usedoil.htm

[15] Florida's Used Oil Recycling Program, 20th Annual Report. January 2005

on reducing the impacts of wastes that are creating the most pressing environmental threats. The EPA's Waste Minimization Program has a goal of reducing chemicals that have the properties of persistence, bioaccumulation, and toxicity. These "priority chemicals" should be reduced or eliminated wherever possible to lower the potential long term effects of their release via waste generation. If they cannot be eliminated, they should be contained within a use-reuse cycle wherever possible.[16]

There are several ways that the amount of hazardous waste generated at FLL can be reduced. Based on research, the CAP team suggests that the following strategies be considered for implementation[17]:

- Practicing pig cleaning – a method that cleans pipelines by hydraulically or pneumatically propelling a plastic projectile cleaner through the pipes – instead of chemicals.
- Use countercurrent methods of cleaning where possible. This would involve using used solvent for initial cleaning and clean solvent for the final cleaning.
- Substituting inputs with less toxic materials such as substituting solvent-based parts cleaner with an aqueous-based one.
- Using equipment with high transfer efficiency, such as electrostatic precipitators when painting, can reduce paint waste.
- Ensuring that secondary containment is used for oils and solvent containers so that spills can be contained or perhaps even reused.
- Establishing good housekeeping practices by repairing equipment leaks; practicing preventative maintenance; keeping waste streams separated that would increase their potential for reuse, recycling, or treatment; keeping containers covered to prevent evaporation and spills; and inspection of materials upon delivery and the returning of rejected materials.
- Recovering and reusing cooling water, used solvents, plastic scraps.

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[16] http://www.epa.gov/epaoswer/hazwaste/minimize/about.htm

[17] http://www.deq.state.mi.us/documents/deq-ead-p2-p2atyrfa.pdf

- By exploring an informal exchange for liquid, solid, and hazardous waste with other companies, tenants can realize how one company's waste could be another's raw material.
- Keeping hazardous wastes with non-hazardous wastes separate during disposal is more economical for the waste generator.

4.4 Recommendation to BCAD

One of the best ways to promote waste minimization at FLL is to promote tenant awareness through public education. Other airports have produced pollution prevention documentation that was made available to their tenants.[18] Leading by example is a great way to encourage participation in waste reduction strategies.

The BCAD maintenance facilities are currently doing an excellent job of managing their hazardous wastes for disposal. However, they can improve on their waste minimization habits by following a waste minimization plan. The FDEP has a guide for the preparation of a waste minimization plan which can be prepared by the recycling coordinator as part of their job[19]. By distributing this plan to the other airport tenants during a facility audit or lease renewal, the benefits of the plan's implementation will be seen throughout FLL.

[18] http://miami-airport.com/html/pollution_prevention_informati.html

[19] http://www.dep.state.fl.us/waste/quick%5Ftopics/publications/shw/hwregulation/binder1%5Fwaste%5Fmin%5Fguide.pdf

5. Conclusion

FLL can become a leader in south Florida for operating a sustainable airport, even as air traffic increases. By implementing the recommended strategies outlined in Sections 2.4 and 3.3, FLL can decrease the amount of waste generated on a per passenger basis. The two recommended strategies discussed in the solid waste discussion will contribute significantly towards decreasing the amount of waste being disposed of, and have been proven successful in other airports. The increase in recycle rate and associated cost savings will offset the expense associated with hiring a recycling coordinator.

Though the final handling of the disposed hazardous wastes cannot be controlled by the tenants, by following the simple suggested strategies, they can minimize the amount of hazardous waste generated at FLL.

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Appendix A – Solid Waste Data

Table A-1: MSW Data from FedEx Study

Table A-2: MSW Data from SheltAir Study

Figure A-1: MSW vs. Passengers at FLL

Figure A-2: Hazardous and Non-Hazardous Waste Components at FLL

Table A-1: FedEx Data

		Weight (pounds)							
	Date Sorted	8/4/2006	8/6/2006	8/8/2006	8/10/2006	Total	Daily Average	Yearly Average	% Recycled
	Total Waste Collected	**712**	**1118**	**1120**	**842**	**3792**	**948**	295,776	
RECYCLED	Steel	62	244	38	15	359	90	28,002	9%
	Aluminum Cans	6	8	12	9	35	9	2,730	1%
	OCC *	57	64	86	74	281	70	21,918	7%
	Newspaper	7	15	23	19	64	16	4,992	2%
	Office Paper	66	96	87	89	338	85	26,364	9%
	Magazines	5	5	10	5	25	6	1,950	1%
	Plastic Film	35	7	22	16	80	20	6,240	2%
	Plastic Bottles (includes liquid)	127	240	246	209	822	206	64,116	22%
	Glass	5	5	18	16	44	11	3,432	1%
	Other (wood, copper wire)	0	46	0	0	46	12	3,588	1%
	Waste to landfill	342	342	578	390	1652	413	--	--
	Total Recycled	**370**	**730**	**542**	**452**	**2094**	524	163,332	
	Percentage Recycled	**52%**	**68%**	**48%**	**54%**	**56%**	56%		55%

* Old Corrugated Cardboard

Table A-2: Sheltair Data

		Weight (pounds)							
	Date Sorted	8/19/2006	8/21/2006	8/23/2006	8/26/2006	Total	Daily Average	Yearly Average	% Recycled
	Total Waste Collected	**564**	**1140**	**580**	**720**	**3004**	**751**	234,312	
RECYCLED	Steel	0	10	7	3	**20**	5	1,560	1%
	Aluminum Cans	5	8	6	7	**26**	7	2,028	1%
	OCC	22	109	35	78	**244**	61	19,032	8%
	Newspaper	38	146	37	77	**298**	75	23,244	10%
	Office Paper	113	210	178	129	**630**	158	49,140	21%
	Magazines	140	74	61	38	**313**	78	24,414	10%
	Plastic Film	0	0	0	0	**0**	0	0	0%
	Plastic Bottles (includes liquid)	35	78	34	52	**199**	50	15,522	7%
	Glass	0	43	8	9	**60**	15	4,680	2%
	Other	0	0	0	0	**0**	0	0	0%
	Waste to landfill	211	462	214	327	**1214**	304	--	--
	Total Recycled	**353**	**678**	**366**	**393**	**1790**	448	139,620	
	Percentage Recycled	**63%**	**59%**	**63%**	**55%**	**60%**	60%		60%

Figure A-1
Annual Solid Waste Disposal and Enplaned Passengers at FLL 2002-2005

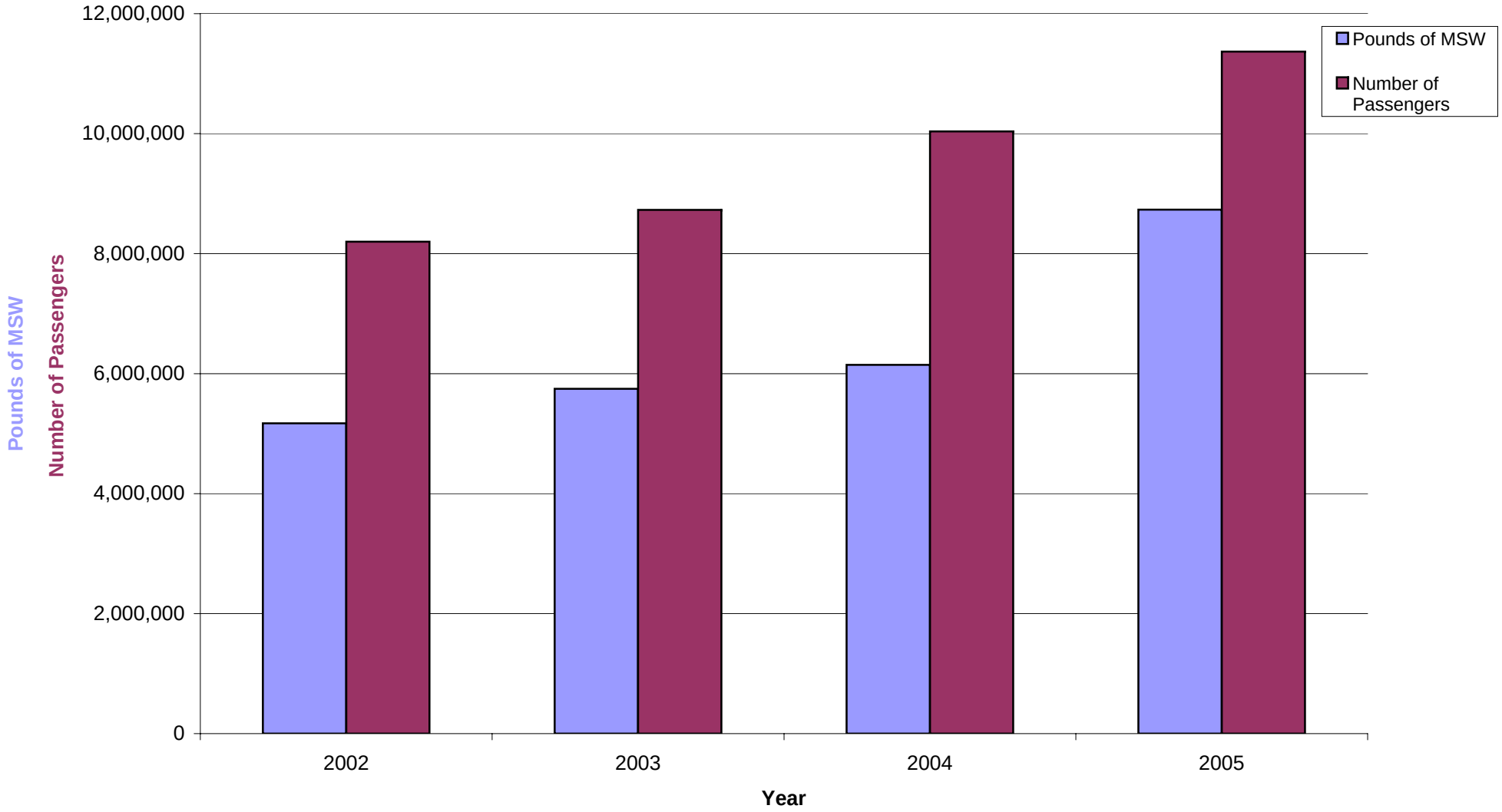

Figure A-2
Hazardous and Non-Hazardous Waste Components at FLL