

A Guide to Recycling at Sports Venues

**Prepared by
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I. INTRODUCTION

Events held at sports venues¹ generate significant quantities of recyclable materials from a variety of different facility operations. Many of these materials can be collected and stored on-site for pick up relatively easily and inexpensively. Other materials can be more difficult to recycle and may require additional effort, space and cost to manage.



Recycling bin in sports arena.

In addition to conserving natural resources, minimizing greenhouse gas emissions and reducing impacts on the environment, recycling can have economic benefits. Depending on local waste disposal and recycling market conditions, recycling can lead to a reduction in solid waste management costs as revenue is generated from commodities such as cardboard, paper and aluminum. Other materials such as plastic, glass and food waste can be more challenging to manage, especially where space is limited and recycling or composting facilities for these items are not locally available.

Other opportunities exist within sports venues to reduce waste generation, such as the use of returnable shipping containers or reuse of incoming product or supply packaging. Most waste reduction practices result in significant cost savings, both in material and shipping costs as well as avoided waste management expenditures.

Nearly all sports venues built in the U.S. today are incorporating various design elements aimed at maximizing environmental performance in terms of energy, water and resource conservation. Environmental certification programs, such as Leadership in Energy and Environmental Design (LEED), incorporate solid waste management and recycling to promote environmental materials reuse and recycling.² Many sports venues are

¹ The term "sports venue" is used in this document to refer to stadiums, ballparks, arenas, sports centers, fields, race tracks and other permanent sports facilities.

² See <http://www.usgbc.org/leed> for additional information on the LEED rating system.

establishing programs or expanding current recycling efforts as more data and information becomes available on successful programs.

In addition, factors such as laws or ordinances requiring waste reduction and recycling are driving the implementation of recycling programs. For example, laws in California, North Carolina and Washington specifically target recycling at venues and events.³ Local ordinances requiring recycling at venues and large events are also being considered as municipalities target waste generation beyond households and businesses to meet recycling goals set forth by state laws.

Finally, many fans expect recycling containers to be available, and are willing to put extra effort into placing recyclables in their proper place. Successful programs involve creative and consistent outreach and education so that fans are aware of the availability of recycling containers as well as what items should or should not be placed in them.



Recycling bin with clear signage indicating acceptable materials.

A successful recycling program creates a positive public perception of both the facility as well as the entity hosting events.

It is important to recognize that recycling involves three steps:

1. Collecting recyclable materials
2. Using recovered materials in the manufacture of new products
3. Purchasing recycled products

In order for recycling to be sustainable, in addition to collecting materials companies must exist to utilize recyclable materials in the manufacture of new products. These

³ See California AB 2176, Washington HB 2056, and North Carolina HB 267.

companies can exist only if consumers purchase products made from recycled feedstock. As large purchasers and consumers of products such as paper, plastic and construction materials, sports venues are in a unique position to support markets for recycled content products. Only when a recycled product is purchased is the “recycling loop” completed.



Beer cup made from post-consumer recycled materials.

Recycling in sports venues requires development of a tailored program that takes into account facility infrastructure, types of events, fans, and waste streams.⁴ The purpose of this guidebook is to share information on the planning, development and implementation of stadium recycling programs. The information is based on demonstration projects and published information on baseball, football, basketball, hockey and other sports. Examples are provided of innovative and successful programs so that sports venues interested in establishing or expanding recycling can benefit from practices and lessons learned by others.

II. DEVELOPING A RECYCLING PROGRAM

The following ten steps should be followed in the design, development and implementation of a stadium recycling program.

- 1) Identify Decision Makers and Stakeholders
- 2) Obtain Buy-In and Support
- 3) Designate a Recycling Coordinator
- 4) Conduct Site Assessment and Evaluation
- 5) Conduct Facility Waste Audit and Recycling Options Assessment
- 6) Educate and Train Staff
- 7) Fan Education
- 8) Promote Positive Results
- 9) Purchase and Use of Recycled Products
- 10) Measure Success

⁴ Final Report, EPA Venue Recycling Project, NAPCOR (2008)

1. Identify Decision Makers and Stakeholders

All sports venues are unique in terms of ownership, management, tenants, operations and maintenance. In most cases, the facility may be owned and operated by either a public or private entity that is entirely separate from the occupying teams or event sponsors. In addition, many sports venues are utilized for a number of purposes other than sporting events, such as concerts, special shows and performances.

Establishing a stadium recycling program requires strong support from the upper management of all entities involved, including the facility owners, occupant team franchises, special event sponsors, caterers, suppliers, vendors, janitorial and other service providers. In addition, operations managers, floor supervisors, union stewards and kitchen supervisors from all operational areas and shifts must be included in preliminary discussions when recycling plans are developed and finalized, as these individuals will be responsible for carrying out recycling operations.

Many leagues such as the National Football League, National Hockey League, Major League Soccer, Major League Baseball and the National Basketball Association are involved in green initiatives,⁵ and may be of assistance to individual team owners or operators. Furthermore, several vending, janitorial and service contractors have corporate environmental policies or greening initiatives available for regional and local sales managers to leverage when working with individual facilities.

2. Obtain Buy-In and Support

It is critical that establishing a recycling program is deemed a priority by all tenants and contractors, and that a clear message supporting recycling is sent by the owner or operator of the facility. In some cases, it is worthwhile to establish a written policy or statement of principles which can be shared with incoming event organizers, suppliers, tenants or contractors so they are aware of environmental policies or practices at the venue.

Elements to Consider in Developing an Environmental Policy
<ul style="list-style-type: none">• Environmental Performance• Sustainability• Regulatory Compliance• Green Construction• Water Conservation• Energy Conservation or Alternatives• Waste Reduction, Reuse and Recycling• Transportation• Environmentally Preferable Purchasing• Greenhouse Gas Reduction• Communications and Marketing

Figure 1. Environmental policy components.

⁵ See <http://www.greensports.org> and <http://greensportsalliance.org/> for green sports initiatives involving the Natural Resources Defense Council and Green Sports Alliance.

In most cases, there will be costs associated with establishing a recycling program which must be accounted for, including:

- Signage, stickers or labels
- Public service announcements
- Dock space or storage area for equipment, sorting or staging of recyclables
- A cardboard baler, dedicated compactor, can crusher or paper shredder and electrical service
- Recycling bins/liners for collection on concourses, vending areas or suites
- Servicing and cleaning of containers, storage areas and equipment

Vendors and Concessionaires

In many cases, existing in-house vendors or contractors already have knowledge and capabilities for recycling and are able to offer recycling containers and/or equipment as part of the services they provide to the facility. Though contractors may not normally be included in discussions with stadium management regarding facility planning and operations, they do have an understanding of facility operations and may be able to leverage experience and resources available through their corporate offices.

Operations and Maintenance

At facilities where janitorial or maintenance services are managed by a contractor, a contract amendment or change may be required to include recycling. In addition, labor unions should be consulted to ensure that recycling duties are included in existing agreements. It is important that union stewards and floor supervisors are committed and supportive of the program to ensure continued success.

Waste Haulers

Several waste companies have recognized that attitudes about waste have changed, and that customers are increasingly looking for recycling services, containers, equipment, supplies and signage. In some cases, traditional waste management companies have become more flexible and have specific programs which offer recycling services, equipment and supplies, especially to large clients. It may be advantageous to consult with a waste hauler during the planning process to assess the expertise and potential resources available.



Waste hauler-provided compactor with team logos to promote recycling effort.

3. Designate a Recycling Coordinator

Many facilities have recognized the importance of integrating recycling and sustainability issues into their daily operations. Designating a facility recycling coordinator is important in the development, implementation and maintenance of any recycling plan. This individual acts as a single point of contact for all recycling related projects, programs and daily operations. Dedicating an individual to focus on recycling allows for better oversight of the program, enhances decision making processes, and improves communication between stadium management, tenants, staff and patrons.

Recycling coordinator responsibilities include:

- Convene meetings of key stakeholders to present and discuss recycling plans
- Develop a recycling policy
- Conduct or oversee facility assessment
- Discuss options for bins, equipment and signage
- Source, bid and purchase bins and equipment
- Seek grants or outside funding sources for recycling equipment/containers
- Coordinate and train staff
- Provide information and coordinate with incoming event managers
- Conduct patron outreach and education
- Seek opportunities for waste reduction, reuse or recycling of more materials
- Measure, document, report and communicate program results

Though the function can be incorporated into existing staff responsibilities after the program is up and running, it is recommended that recycling program responsibilities remain within the job description or performance agreement of the recycling coordinator.

4. Conduct Site Assessment and Evaluation

An important step in developing a recycling program is establishing a clear understanding of the layout, operation, staff and job functions operating within the facility. The purpose of conducting a preliminary facility assessment is to:

1. Understand the stadium layout and key operational areas
2. Meet maintenance staff and document current waste management procedures
3. Identify and examine any ongoing waste reduction or recycling activities
4. Document any model practices
5. Identify potential opportunities for improvement

Identification of existing infrastructure is essential when creating or improving a recycling program. With knowledge of the materials generated and the flow of materials through the facility, it is then possible to begin identifying areas where improvements can be made. Figure 2 contains a checklist for conducting a preliminary assessment.

STADIUM RECYCLING ASSESSMENT CHECKLIST	
Facility Description	
<ul style="list-style-type: none">▪ What functional areas are within the facility and where are they located?▪ Can you provide a floor plan of the facility?	
Personnel	
<ul style="list-style-type: none">▪ Who oversees waste management/recycling? Is it part of their job description?▪ Is there a green team? Who serves on it and what department do they represent?▪ Are there any other individuals that have a lead role in any part of recycling?	
Waste Generation and Flow	
<ul style="list-style-type: none">▪ Where are waste receptacles located and what types are used?▪ Who collects waste and what is the process of handling waste (from emptying receptacles to hauler pick-up)?▪ Who monitors the collection process for waste?▪ Is there a staging area? Compactor? Baler? Shredder?▪ Who is the waste hauler and how is their contract set up?▪ Is waste pick-up done on a regular or as-needed basis?▪ Where does the waste go after removal? Is this a transfer station or final destination?▪ What waste prevention measures are in place (i.e., using returnable shipping containers, replacing individual paper towels with roll paper or hand dryers, etc.)?	
Recycling Materials and Flow	
<ul style="list-style-type: none">▪ What materials are collected for recycling?▪ Are toner cartridges, ink jet cartridges, batteries, diskettes, CDs, video/audio tapes, computers, phone books, fluorescent tubes, or food waste recycled?▪ How are materials collected (e.g., separate streams, co-mingled, etc.)?▪ What type(s) of receptacles are used? Where are they located? How much did they cost?▪ Who collects recycling materials and who monitors the process?▪ What storage/receptacles are available for staging? Is there a compactor for recyclables?▪ Who is the recycling hauler and is pick-up done on a regular or as-needed basis?▪ Where do recyclables go after being picked up? Is there any further sorting?	

Metrics
<ul style="list-style-type: none"> ▪ Does the facility track the weight of waste being removed? If so, how do you arrive at these numbers (e.g., on-site scale, weekly/monthly reports from hauler)? ▪ How far back is data on the weight of waste being removed from the facility available? ▪ Does the facility track the weight of recycled material being removed? If so, how do you arrive at these numbers (e.g., on-site scale, weekly/monthly reports from hauler)? ▪ How far back can you track the weight of recyclables removed? ▪ What is the stadium's annual waste removal cost and how is it broken out?
Improvements
<ul style="list-style-type: none"> ▪ Have you already identified any opportunities for improvements in recycling? ▪ Are there any particular areas of the recycling program that you would like the assessment team to focus on?

Figure 2. Stadium recycling assessment checklist.

Most new sports venues have dedicated space for recycling equipment such as a baler or compactor as well as storage areas for cardboard bales and staging areas for full containers or gondolas prior to pick up. However, space is the primary limiting factor in many facilities which were not designed for integration of recycling. Normally, additional space is required adjacent to a loading dock or storage area on the ground floor of the facility. In addition, an electrical connection for baling or compacting equipment is necessary. In existing buildings, adding recycling may require additional capital costs not only for equipment, but for the space and utilities to operate these activities.



Cardboard baler in utility room adjacent to loading dock.



Loading dock area with multiple, separate compactors for waste and recyclables.

Establishing Baseline Measurement

Another critical component of the preliminary assessment is to establish a baseline for existing waste management and recycling activities. This is important to conduct prior to the development, implementation or upgrade of a recycling program so that improvements can be measured and reported. Documenting current waste generation and hauling and disposal costs must be done in coordination with the waste hauler, as they normally collect data on the hauling and tonnages of wastes managed. A worksheet for documentation of waste management and recycling costs is included in Appendix A.

It is important that key personnel involved in the operation and management of individual areas within the stadium be consulted so that accurate and detailed information can be documented. Many of these individuals have detailed knowledge and working experience in stadium operations and can be excellent resources for ideas and revised procedures to effectively incorporate recycling at the stadium.

5. Conduct Facility Waste Audit and Recycling Options Assessment

A “walk through” is conducted in order to gain an understanding of the flow of materials through the facility as well as current solid waste and recycling handling. All areas within the stadium that generate waste (see Figure 3) are visited during the assessment. As mentioned above, it helps greatly to conduct the assessment with operations managers or supervisors responsible for the areas visited.

Major Areas of Waste Generation	
	<ul style="list-style-type: none"> • Souvenir stands or stores • Food and beverage concessions • Food and beverage stocking / distribution closets • Restaurants and bars • Concourses • Seating areas • Kitchen or food preparation areas • Administrative offices (including contractor spaces) • Service areas, workshops • Warehouses, shipping/receiving or equipment storage areas • Locker rooms • Press boxes and briefing rooms • Skyboxes or luxury suites • Parking and outside common areas • Restrooms

Figure 3. Typical waste generating areas of a stadium.

The most common recyclable materials generated by volume within sports venues are plastic beverage containers, aluminum cans and cardboard. The most significant waste stream by weight is food waste. However, each operational area generates different materials, many of which can be recovered, recycled or reused. Figure 4 identifies the wide range of wastes generated along with strategies/options to consider when targeting materials and assessing recycling options.

Figure 4. Recyclable Materials Generated and Collection Strategies

Figure 4. Recyclable Materials Generated and Collection Strategies	
Concourses	Kitchen / Food Preparation
Generation: <ul style="list-style-type: none"> - Beverage containers, cups Strategy: <ul style="list-style-type: none"> - Post event picks - Bins - Incentive programs 	Generation: <ul style="list-style-type: none"> - Food wastes - Steel cans - Plastic containers - Shrink wrap - Oil/grease Strategy: <ul style="list-style-type: none"> - Bins - Collect, consolidate, transport to staging area
Shipping and Receiving	Restaurant / Bars
Generation: <ul style="list-style-type: none"> - Pallets - Shrink wrap - Plastic containers - Paper and plastic packaging - Metal banding Strategy: <ul style="list-style-type: none"> - Reuse - Storage, collection, pick-up 	Generation: <ul style="list-style-type: none"> - Food wastes - Beverage containers (plastic, glass aluminum) - Cardboard - Paper - Oil/grease Strategy: <ul style="list-style-type: none"> - Bins - Collect, consolidate, transport to staging area
Janitorial, Maintenance and Grounds Keeping	Souvenir Vending
Generation: <ul style="list-style-type: none"> - Field turf / sod - Landscaping material - Oil, antifreeze - Tires - Scrap metal - Batteries - Plastic containers, bags - Shop towels - Pallets - Shrink wrap Strategy: <ul style="list-style-type: none"> - Composting - Reuse - Collect, consolidate, transport to staging area 	Generation: <ul style="list-style-type: none"> - Cardboard - Plastic and paper packaging - Paperboard - Pallets - Hangers Strategy: <ul style="list-style-type: none"> - Bins - Reuse - Collect, consolidate, transport to staging area
Concessions	Parking / Tailgate
Generation: <ul style="list-style-type: none"> - Cardboard and paperboard - Shrink wrap - Food wastes - Plastic containers - Oil/grease - Lost personal items (phones, eyeglasses, etc) Strategy: <ul style="list-style-type: none"> - Collect, consolidate, transport to staging area 	Generation: <ul style="list-style-type: none"> - Beverage containers (plastic, glass and aluminum) - Paper/cardboard Strategy: <ul style="list-style-type: none"> - Bins - Collection sweeps by crews - Volunteers
Sky boxes	Administrative Offices
Generation: <ul style="list-style-type: none"> - Beverage containers (plastic, glass, aluminum) - Paper - Carpet - Fluorescent lamps - Food wastes Strategy: <ul style="list-style-type: none"> - Bins - Cleaning crews collect, consolidate 	Generation: <ul style="list-style-type: none"> - Paper - Beverage containers - Food waste - Toner cartridges - Batteries - Fluorescent lamps - Cardboard - Electronic - Carpet Strategy: <ul style="list-style-type: none"> - Bins (desk side and central bins) - Collect, consolidate, transport to staging area



Cardboard bales staged for pickup in loading dock.



Bartender setting out a bin filled with glass bottles at end of shift.



Outdated programs and promotional printed materials staged for pick-up.

Detailed Waste Sort / Characterization

Conducting a detailed waste sort can be an important step in characterizing the overall waste generation and identifying potential recycling opportunities. Using existing data available from stadium waste sorts can also provide useful insights into the expected waste streams. A waste sort involves the physical collection, sorting, and weighing of a representative sample of waste generated at a facility, which will identify and quantify the components of the waste stream. A waste sort can focus on the facility or target certain functional areas or departments. Guidance on how to conduct a waste sort can be found at: <http://www.epa.gov/smm/wastewise/approach.htm>

Selection of Recycling Bins

The selection of recycling bins is important from the perspective of maximizing participation, convenience and maintaining aesthetics. The following considerations should be taken into account in selecting bins for public spaces in the venue. Bins in administrative offices, kitchens or other employee work areas require different considerations than bins for patrons who are not at the venue on a daily basis. A 'Recycling Bin Selection Guide' can be found in Appendix B.



Recycling bins co-located with trash cans on concourse.

6. Educate and Train Staff

Staff involvement is perhaps the most important aspect of establishing and maintaining a successful stadium recycling program. In order for staff to be part of the effort, they must be informed, trained and updated on recycling procedures. In addition, both operations and administrative staff must be motivated to support and participate in the program.

Operations and Maintenance

Successful recycling within the stadium requires extensive participation and cooperation by janitorial, maintenance and operations staff. Staff needs to know special procedures for collecting recyclables apart from waste before, during and after an event. In many cases, it is worthwhile to consult or elicit the participation of crews in developing a strategy that addresses the collection, staging and storage of recyclables.

In addition, loading dock staff must be aware that recyclables must be handled, stored and placed in different containers for pick up. This may involve a change in established procedures or the need for additional time required to do the same job. It is important that all operational shifts are aware of recycling procedures. As many crews are bi-lingual, it is important that training, signage and instructions are developed in additional languages. Finally, ongoing training and reminders (such as posters in equipment closets or break areas) should be provided to ensure that recycling procedures are implemented and maintained.



Multi-lingual recycling signage placed on compactor door.



Multi-lingual sign adjacent to waste compactor prohibiting recyclables.

Administrative

Full time staff in sports venues can range from a few individuals to a several hundred, depending on whether or not team or franchise offices are housed on site. A significant amount of recyclables can be generated by administrative staff, such as paper and beverage containers. Administrative staff need to know where and how to recycle these items in the office. If containers or signage are confusing or unclear, staff will not know where or how to recycle resulting in high contamination and lower recycling rate.

Office recycling efforts can be reinforced with announcements or articles in newsletters, reminders or progress reports on opening webpage, and posters in common areas such as break rooms or copy rooms. Many offices have established policies to reduce waste by requiring double sided copying, which can significantly reduce paper costs.



Paper recycling bin adjacent to copy machine.

7. Fan Education

Fans need to be educated on why they should recycle, what they can recycled and where. The program should be advertised through sponsors, vendors, signage, public service announcements and team mascots. Skybox patrons can be reached via newsletters, annual luncheons, signage on bins, advertisements on the in-house, closed circuit television system.

Asking fans to recycle represents a behavior change, as recycling may not be second nature to many when away from home. Successful behavioral change strategies require an understanding of fan behavior and situational factors that can potentially limit behavior. Some teams utilize players and in-house video capabilities to produce short creative video clips played before, during or after the event to encourage proper use of the recycling bins and which materials are acceptable or not acceptable.



Dual use bin with recycling on one side and trash on the other.

Once recycling bins and signage is in place, additional advertisement such as signage at concession stands, printed messages on recyclable cups increases fan exposure to the message. In addition, promotion of the program through use of a recycling mascot, or give-a-ways such as t-shirts, ball caps or towels can help. Some teams create incentives

by offering tickets in exchange for a specified number of recyclable cups collected, which can be collected and redeemed for prizes. Whatever approach is used, sharing the credit is important to maintain support and enthusiasm for the recycling program.



Concourse signage promoting recycling.

Philadelphia Phillies “Red Goes Green Team”

The Phillies implemented several initiatives to urge fans to get involved:

- **Green Caps:** Symbolizing their commitment, the entire Phillies team wore green baseball caps during a game against the San Diego Padres.
- **Red Goes Green Cards:** 100 fans received a 1-year credit to secure clean renewable energy for home consumption.
- **Red Goes Green Team:** Captained by the Phillies Ballgirls, volunteers from local colleges and community organizations collected recyclables from the seating bowl throughout each game. They wore green aprons and announcements were made pre-game for fans to look for the green team and take part in recycling efforts.
- **Red Goes Green Tips:** Fans are invited to go to www.phillies.com/redgoesgreen for tips on how to improve the environment. ‘Red Goes Green’ tips are posted on the scoreboard during each game at Citizens Bank Park.

8. Promote Positive Results

With today’s emphasis on “going green,” a stadium with an effective recycling strategy establishes positive public relations with the community while conserving natural resources and reducing generation of green house gases. Having documentation of recyclables diverted from landfills can aid in a promotional campaign. Various tools are available to calculate environmental, economic and resource conservation impacts of recycling. One tool is EPA’s WARM model,⁶ which calculates the greenhouse gas impacts of recycling specific materials, the results of which can be provided in the equivalent number of cars taken off the highway for one year. Other conversions can be developed to document and share the success of the program, such as the amount of space saved in a landfill in terms of the stadium volume or number of trees saved by recycling cardboard and paper. If cost savings from waste hauling and disposal or revenue

⁶ See <http://www.epa.gov/warm> for access to EPA’s Waste Reduction Model (WARM).

generated from recyclables is achieved, this is a valuable tool for stadium or franchise management. Environmental results can be promoted each April on Earth Day or in November on America Recycles Day.

Boston Red Sox Earth Day 2008 Celebration

To celebrate Earth Day, all players and on-field staff were dressed in special uniforms adorned with the club's greening logo. The team received an Environmental Merit award from EPA in recognition of their efforts to run a greener organization. The Administrator of the EPA and the Director of the Natural Resources Defense Council threw out a joint ceremonial first pitch. Boston has been taking significant steps to making their operations more eco-friendly at Fenway Park, including a recycling program for plastic bottles. Over 100 recycle bins branded with the Poland Spring Green Team and Waste Management logos have been placed throughout the ballpark.

9. Purchase and Use of Recycled Products

Sports venues consume large amounts of materials to sustain daily operations and maintain facilities. It is important to consider the types of materials being consumed at the facility and how these materials will affect the overall recycling strategy. Purchasing consumer products and construction materials that both contain recycled content and are readily recyclable benefits the recycling program. In addition, reducing the packaging of incoming materials such as promotional items can avoid collection and disposal costs.

Consumer Products

Items such as toilet paper, paper towels, napkins, paper cups and drink and food trays are now available with significant quantities of post-consumer recycled content. The purchase and use of recycled paper products plays a significant role in sustaining recycling efforts.

Aluminum cans, glass and cardboard are the most commonly collected and recycled materials in many metropolitan areas. These products are often made from recycled materials collected in municipal recycling programs. The use of these materials creates and maintains a sustainable market for recyclables, thus perpetuating their continued collection.

The single largest recycling challenge in sports venues is collection and recovery of plastic beverage cups. Beverage cups made of polyethylene terephthalate (PETE, #1) or high density polyethylene (HDPE, #2) are more desirable than cups made of polystyrene (PS, #6) or polypropylene (PP, #5) cups due their greater value in the recycling markets. It is important to check all materials being utilized in incoming food and beverage service materials to see if they are acceptable for collection and recycling within the local recycling infrastructure. Figure 5 provides a list of environmentally preferred materials.

Figure 5. Environmental Preferable Purchasing	
Preferred Material	Materials to Avoid
Polyethylene terephthalate (PETE #1)	Polystyrene (#6)
High density polyethylene (HDPE #2)	Polypropylene (#5)
Biodegradable Silverware	Other Plastic (#7)
Recycled Paper	Plastic Silverware
Aluminum Cans	No Recycled Content Paper
Molded pulp paper food trays	

Several environmentally friendly food service products are now available through vendors and contractors. These products, such as biodegradable forks/knives/spoons, molded pulp paper food trays, or small plastic water cups may be offered at restaurants, concessions and other food/beverage service areas. In many cases, these items are neither recyclable nor compostable, as few commercial composting facilities are locally available which accept these items. For example, biodegradable water cups are not acceptable in most plastic cup recycling programs, and may only become contaminants in recycling containers. It is important to check with recycling and composting service providers to ensure that these materials will not become contamination in recycling containers. Contamination will significantly raise processing costs as loads may require manual separation to remove contaminants, or rejection and subsequent land filling of the entire load.

Construction Materials

A wide variety of construction products made from recycled materials can be utilized in offices, seating and concession areas. EPA and many states maintain lists of recycled content construction products, many of which are locally available.⁷

Figure 6. Construction Materials with Recycled Content
Structural Steel – superstructure
Aluminum – siding, facade, containers, concession tables
Plastic Lumber – seating, decking, railings, ramps
Ceiling Tiles – offices, skyboxes
Carpet Squares – offices, skyboxes
Paving materials – concourses, parking lots, pedestrian walkways
Concrete w/ Fly Ash – superstructure

10. Measure Success

Establishing Metrics

The success of waste reduction and recycling is determined by comparing recycling rates and waste volumes before the implementation of a recycling program to those after the program has been in place for a set period of time. It is important that this information be documented consistently over the course of the year or season and reported so that trends can be analyzed and evaluated for purposes of making improvements.

⁷ See <http://www.epa.gov/cpg> for a list of recycled content products available in the U.S.

Obtaining a complete understanding of existing collection and disposal costs requires access to data from the waste hauler, concessionaires and vendors. A baseline for waste figures can be arrived at using the 'Public Venue Waste Management and Recycling Cost Worksheet' in Appendix A.

Waste Hauler Data

Some waste haulers are unwilling to provide data as they consider this information proprietary. It is essential in determining the success of a program to know the amount of material that is being diverted from the waste stream and into the recycling stream. Acquiring the tonnages of both waste and recycled materials from the designated waste hauler is a critical step in this process. Waste and recycling tonnages should be tracked monthly (even in the off season) and evaluated annually to track program implementation. Prior to program implementation, it is important to quantify the amount of both waste collected and recyclables collected. This data serves as a baseline for comparison to future weights and volumes. Waste contractors may charge for hauling in several different ways (see Figure 7).

Figure 7. Waste Contractor Hauling Fee Structures

Flat Fee – Rate remains constant over contract period despite variability in amount of waste generated.

Weight or Volume – Rate is based on the amount (tonnage or yardage) of waste removed.

Fee per pull – A fee is paid each time waste is picked up from the facility.

Vendor and Concessionaire Data

Normally, food and vending operations are controlled by contractors whom have detailed knowledge of all materials handled. Data can be obtained from the concessionaires and vendors which is useful in determining flow of materials (such as cups, beverage containers, cardboard, pallets, etc.) through the facility. Some questions which can be posed to vendors and concessionaires are included in Figure 8.

Figure 8. Questions for Concessionaires / Vendors

1. How many events do you prepare for each year (include small group sale parties)?
2. Do you have an estimate of the total amount distributed for the season or an average per event (both food servings and serving containers)?
3. What type of utensils, plates, etc. do you provide for patrons (i.e., polystyrene forks, knives, spoons, polyethylene plates, polyethylene cups, etc.)?
4. What efforts have been made to use recycled materials or recycle materials from the waste stream? Who is the recycler?
5. For the pre- and post- preparation of events, estimate the amount of paper (waxed and unwaxed), other packaging (i.e., foil, napkins) and food waste disposed of in the trash (either estimate per event or whole season). For instance, on average how many containers are filled per event, or trash bags generated from clean up?
6. What do you do with the plastic packaging and cardboard generated from unpacking food items for preparation and customer use?
7. How many beverage containers do you distribute per event (includes beer, soda, coffee cups)?

This information can be used to estimate the quantity of recyclables to be generated and subsequently targeted for collection. In addition, many food service contractors conduct detailed inventories of both sold and unsold beverage and food/beverage items following each event. This is an ideal time for separation and recovery of recyclable containers and food items which can either be composted or donated to a local food pantry.

Programmatic Cost Data

Finally, program costs such as advertising, signage, bins, staff time, bags, equipment, and maintenance/cleaning should be documented. This information can be consolidated and presented to stadium management each year to demonstrate program costs and success.

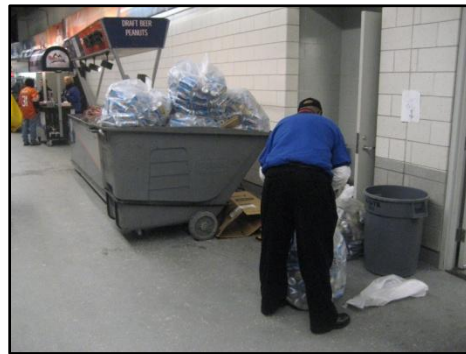
III. CASE STUDIES

CONCOURSES

Facility: Soldier Field
Type: Football, Special Events

Location: Chicago, IL
Capacity: 61,500

Soldier Field utilizes clear recycling bins on concourses for plastic cups which reduce contamination because patrons can see items inside. Bins are strategically placed near garbage cans and near bathroom entrances, but away from concession/condiment dispenser areas, which are a source of contaminants, such as condiment packets.



Aluminum cans are collected in bags at the point of sale by vendors, immediately after the cans are emptied into plastic cups. The cans are taken to 'vending closets,' staged in gondolas, and taken to the loading dock where they are loaded into a separate compactor for aluminum only. Cardboard is taken via gondola to a storage room where it is baled.

Contact: Michael Orton, 312-235-7153, mortman@soldierfield.net

Facility: Verizon Wireless Arena
Type: Hockey, Special Events

Location: Manchester, NH
Capacity: 11,140

Verizon Wireless Arena focuses on the collection of cardboard and PET plastic bottles. Special recycling bins in the shape of plastic bottles to help patrons between the recycling

and garbage bins. During events, patrons are instructed through public service announcements to place plastic bottles into the bins. The arena captures nearly 90% of the plastic bottles generated within the stadium. Cardboard is deposited into a compactor by custodial staff and represents about 15% of the total disposable waste generated during events and normal operations.

Contact: John Ayres, 603-644-5000 ext. 6005, jayres@verizonwirelessarena.com

SEATING AREAS

Facility: U.S. Cellular Field

Type: Baseball

Location: Chicago, IL

Capacity: 47,098

The White Sox “Hit for the Cycle” Recycle program utilizes fans to assist in collecting as many plastic cups as possible. In addition to the collection of cups during a bowl sweep by a crew of stadium workers, fans are challenged to collect plastic cups from the seating area. Cups are brought to a designated area where they are exchanged for tickets which can be redeemed for prizes.



The program uses public announcements to advertise to fans over the big screen, and players encourage patrons to “Pitch In” while explaining the program. U.S. Cellular Field estimates an over 50% recovery rate of plastic cups and bottles.

Contact: Mike Pfeiffer, 312-674-5515, mpfeiffer@chisox.com

Facility: Coors Field

Type: Baseball

Location: Denver, CO

Capacity: 50,445

Coors field uses a crew of twelve pickers to walk the rows of the stadium collecting plastic bottles and large trash items using a two bag technique. Pickers walk the rows placing plastic bottles into clear plastic bags while putting the larger non-recyclable items such as trays, cups, paper/plastic litter material into a black plastic bag. As the bags are filled, pickers tie off the bags and leave them for collection crew to handle. As the

pickers finish the initial “pick” and bags are removed, a secondary crew follows pickers with leaf blowers pushing litter down rows to aisles where it is bagged for disposal.

Contact: Justin Bishop, 303-312-2004, bishop-justin@aramark.com

SKYBOX

Facility: Candlestick Park
Type: Football

Location: San Francisco, CA
Capacity: 70,207

Candlestick Park developed and instituted a comprehensive recycling program incorporating the use of janitorial contracting services as the primary entity for implementing the program. Each suite is equipped with two ‘Slim-Jim’ cans, one for recyclables (colored blue) and the other for garbage. After each game, custodial crews remove all food waste left from catering and empty it into a 32 gallon organics bin. The next day, crews re-enter the suites to remove the garbage and recyclables from containers. Recyclables are taken to an area for separation by commodity. Trash is taken to a sorting area where organic material and recyclables are removed. Since 2003, Candlestick Park has increased its solid waste diversion rate to about 48%.

Contact: Michael Gay, 415-467-1995, Michael.gay@sfgov.org

Facility: Heinz Field
Type: Football

Location: Pittsburgh, PA
Capacity: 65,050

The facility developed an intensive recycling plan involving placement of recycling containers at entrances, cardboard collection, and recycling behind vendor counters. In addition, each suite is equipped with a blue recycling bin located next to a trash can. Suite owners and participants are instructed to place all plastic cups, aluminum cans, plastic bottles and glass bottles into the recycling bin. After the game, cleaning crews remove the recyclables to a gondola and take them to a 30 yard recycling compactor at the loading dock. The City of Pittsburgh Recycling Division supported a consultant to work with facility management to secure funding for containers and implementation support. The Steelers and Heinz Field committed to be a full partner in the effort and provide airtime on the Jumbo-Tron as well as a player to serve as a spokesperson. These efforts have contributed to Heinz Field recycling 6-7 tons of material per NFL game.

Contact: Dan Zuber, 412-697-7131, cpsheinzfield@centralpropertieservice.com

FOOD VENDORS

Facility: United Center
Type: Basketball, Hockey, Special Events

Location: Chicago, IL
Capacity: 20,500

Premium beverages such as beer, wine and specialty drinks sold in glass bottles are poured into cups by concession staff and empty bottles are placed in 60 gallon bin carts.



The carts are set outside the concession stand after the event and are transported to the loading dock where they are emptied into a truck destined for a sorting facility. In addition, before an event, vendors set cardboard out on concourses for collection by crews which conduct a pre-game sweep through all concourses to break down, transport and bale it for pick up at the loading dock.

Contact: Jim Koehler, 312-455-4501, jkoehler@unitedcenter.com

Facility: Busch Stadium
Type: Baseball

Location: St. Louis, MO
Capacity: 43,975

At Busch stadium, each concession stand is equipped with 40 gallon recycling bins designated for aluminum cans. Vending staff are instructed to place empty aluminum cans into the bin and break down all cardboard boxes. This effort allowed Busch stadium to recycle 23.7 tons of aluminum during the 2008 season. Furthermore, Busch Stadium had enlisted a team of volunteers to educate fans about the sports venues recycling program and collect recyclables from fans during the game. Wearing green vest, these volunteers walk through the aisles during game breaks to collected recyclables from seated fans. The volunteers collect plastic bottles, plastic cups 1-7, and clean food trays.

Contact: Hosei Maruyama, 314-345-9404, hmaruyama@stlcardinals.com

SHIPPING AND RECEIVING

Facility: Safeco Field
Type: Baseball

Location: Seattle, WA
Capacity: 47,116

Safeco Field primarily generates cardboard, pallets and shrink wrap from shipping and receiving. Cardboard is separated and placed into a compactor by custodial staff at the end of every event. Reusable shipping containers are returned to the vendor while wooden pallets are collected by a third party hauler for reuse. Broken pallets are placed in the organics recycling bin along with the yard clippings and food waste for composting. Shrink wrap generated from shipping containers is occasionally recycled. These efforts have helped Safeco Field compost 67 tons of organic material and recycle

157 tons of paper and cardboard during 2008. Overall, Safeco Field saved \$36,000 in avoided disposal cost as a result of recycling efforts.

Contact: Scott Jenkins, 206-346-4021, sjenkins@mariners.com

PARKING / TAILGATE

Facility: Qualcomm Stadium
Type: Football

Location: San Diego, CA
Capacity: 71,294

Qualcomm Stadium has the second largest parking lot in the NFL, covering 166 acres with 18,500 parking spaces. To encourage recycling among tailgating fans, more than 350 recycling bins are located in sidewalk areas surrounding lots, near turnstiles, light posts and garbage cans. Plastic, aluminum and glass bottles are collected. Volunteers from Urban Corps of San Diego County, a nonprofit organization working to educate and train at-risk youth, collect recyclables using golf carts towing open-well trailers. Side-loader recycling trucks empty bins, and then haul materials to a local recycling facility. The recycler provides monthly reports indicating the weight of materials recycled, and Urban Corps retains money generated to fund programs. Recycling revenues in 2006 were about \$10,000.⁸ The use of community groups to assist in recycling efforts enhances the public image for both the team and the stadium.

Contact: Erik Stover, 619-641-3102, estover@sandiego.gov

Facility: Gillette Stadium
Type: Football

Location: Foxborough, MA
Capacity: 68,756

Gillette Stadium contracts with a local non-profit group to organize and operate tailgate recycling efforts. A crew of 25 people arrives five hours before kick-off for a training and logistics meeting. Staff members are given translucent recycling bags and assigned a parking lot entrance. As fans enter the parking lots, they are handed a bag for their recyclables and instructed to leave bags by their cars for collection. If the traffic flow is too great, staff will withdraw from the gate strategy and begin walking around the parking lot distributing bags to fans. Bags are collected during the game and taken to a central location for collection by the stadium recycler. Furthermore, Gillette Stadium strategically places recycling bins outside the stadium for fans to deposit the bottles and cans carried from the tailgate area to the stadium.

Contact: Kelly Heard, 508-549-0148, kellyh@partiot.com

⁸ See <http://www.epa.gov/epawaste/conserve/rrr/rogo/documents/qual508.pdf> for this EPA Recycle on the Go (ROGO) success story.

JANITORIAL AND MAINTENANCE

Facility: Lincoln Financial Field
Type: Football

Location: Philadelphia, PA
Capacity: 68,532

The Philadelphia Eagles have an in-house project manager in charge of drafting the Request for Proposals (RFP) for all of the contracted work at Lincoln financial field. The last page of the RFP requests the bidding contractors to research eco-friendly substitutes to traditional material. As a result, the Eagles have employed the use of low VOC paint, carpet containing 10-15% recycled plastic, concentrate eco-friendly cleaning materials and toilet paper containing 100% recycled paper.

Contact: Dave Durenberger, 267-570-4092, duernberger@eagles.nfl.com

KITCHEN AND RESTAURANTS

Facility: PETCO Park
Type: Baseball

Location: San Diego, CA
Capacity: 42,445

PECTO Park implements a recycling program to collect traditional recyclables and organics. The process for collecting organics requires food preparation staff to discard all organic waste into green 35 gallon bins. As the containers are filled, the bins are removed to a trash-sorting area and placed on a hydraulic lift to be emptied into a 10-ton capacity compactor. The bins are then taken to a washing station where residual organic material is removed and the bins are returned to their staging area. Similar to the organics process, traditional materials such as metal, glass and plastics are placed into large blue recycling bins strategically placed throughout the food prep areas and emptied into a commingled compactor. As a result, PETCO Park was able to recycle 153 tons of organics and 85 tons of commingled recyclables during the 2008 baseball season.

Contact: Alina Aguilar, 619-795-5700, aaguilar@padres.com

ADMINISTRATIVE OFFICES

Facility: Lambeau Field
Type: Football

Location: Green Bay, WI
Capacity: 72,928

All administrative offices are equipped with blue recycling bins for paper collection, while co-mingled recycling bins for aluminum cans, plastics and glass are located in high traffic areas throughout offices. Employee break-rooms are equipped with fountain drink stands and water coolers to reduce the number of plastic bottles and cans generated. Staff is also continually trained and education about the recycling program through flyers, monthly meetings and postings on an Intranet site. Furthermore, the Packers work closely with janitorial and office supply vendors to purchase supplies that contain

recycled content and/or are environmentally friendly. In 2007, Lambeau Field recycled over 159,000 pounds of paper, plastic, glass, and cardboard.

Contact: Aaron Popkey, 920-569-7211, popkeya@packers.com

SPECIAL EVENTS

Facility: U.S. Pro Bowl, Aloha Stadium
Type: Football

Location: Aiea, HI
Capacity: 50,000

U.S. EPA and the NFL teamed up with tailgating fans to collect more than 17,500 “HI-5” labeled bottles and cans in the parking lot areas of Aloha Stadium at the 2007 Pro Bowl. The Boys and Girls Club of Hawaii and Honolulu Recovery Systems collected the recyclables. Community Energy, a green energy marketer and developer, matched the revenue generated, resulting in a contribution of \$1,740 to the Boys and Girls Club of Hawaii.

Contact: Marc Mowrey, 415-972-3324, mowrey.marc@epa.gov

Facility: Rose Bowl
Type: Football

Location: Pasadena, CA
Capacity: 92,542

The Rose Bowl Stadium, in coordination with the Los Angeles Conservation Corps and SCS Engineers, recycled over 6 tons of material during the 2008 Rose Bowl game. Recycling strategies within the stadium included pre-event training for all vendors/concessionaires, placement of recycling containers throughout the concourse area and performing a post-game bowl pick. Recycling events outside the stadium included offering recycling assistance to pre-event parties and providing recycling bags to tailgaters. These recycling efforts allowed the Rose Bowl to recover approximately 21,000 cans, 51,000 plastic bottles, 9,000 glass bottles, and over 2 tons of cardboard. The plastic bottle recovery increased by over 60% from the recycling effort in 2007.

Contact: Julie Benavidez, 626-577-3206, jbenavidez@rosebowlstadium.com

CONSTRUCTION

Facility: Citi Field
Type: Baseball

Location: New York, NY
Capacity: 45,000

Citi Field, hosted its first game in 2009. It features recycled steel beams (95% of 12,500 tons of structural steel used was made from recycled steel). In order to save CO₂ emissions, landfill space, and energy, over 2 million pounds of a coal combustion by-product such as fly ash, were mixed into concrete. Approximately 25,000 square feet of planted space around the plaza was designed to control the flow of storm water runoff. Bike racks are strategically placed around the facility to support alternative modes of transportation. Waterless urinals will be utilized to conserve water. A light bulb

recycling program to reduce the environment's exposure to mercury contained in fluorescent light bulbs.

Contact: Eric Saretsky, 718-559-3169, EricS@sterl.com

Facility: Nationals Park
Type: Baseball

Location: Washington, DC
Capacity: 41,888

The home of the Washington Nationals was the first U.S. stadium to achieve a Silver rating under the U.S. Green Building Council's LEED rating system. The ballpark features numerous environmentally-friendly elements, including high efficiency lighting, low VOC emitting finishes, recycled materials and low-flow plumbing fixtures. A 6300 ft² green roof covered with plants helps absorb rainwater and a storm water filtration system reduces potentially contaminated runoff to the nearby Anacostia River. State of the art mechanical, electrical, and plumbing systems ensure that all systems run at their most efficient, saving energy and money. The project relied heavily on recycled materials, and during construction, more than 80% of construction waste was diverted from landfills.

Contact: Matt Blush, matt.blush@nationals.com

FAN EDUCATION AND OUTREACH

Facility: Citizens Bank Park
Type: Baseball

Location: Philadelphia, PA
Capacity: 43,647

The Philadelphia Phillies along with Aramark and Global Spectrum created the "Red Goes Green Team" to promote the stadium's greening efforts. The Red Goes Green effort focuses on improving energy efficiency, reducing the stadium's carbon footprint and increasing recycling at the stadium. One of the many focuses of the Red Goes Green campaign is to improve fan awareness and increase participation in the stadium's recycling program. The Phillies use public announcements and the Phillies Ballgirls to educate fans about the stadium's recycling program during the game. Furthermore, the Red Goes Green Team has Phil the Recycling Robot to help educate children about the importance of recycling. During the 2008 Season, the Phillies were able to recycle 3-4 tons of cardboard per game and 1.75 tons of commingled material per game.

Contact: Deborah Rinaldi, 215-218-5391, drinaldi@phillies.com

Facility: Minute Maid Park
Type: Baseball

Location: Houston, TX
Capacity: 40,950

The Houston Astros and Minute Maid Park launched the "Play Green" campaign aimed at increasing fan education and awareness about green initiatives that fans can participate in at the ballpark and at home. On Earth Day 2008, Minute Maid Park hosted a green expo before and after the game to educate fans about various environmental

initiatives occurring within their community. The Houston Astros wore special green hats with the play green logo which were autographed for auction after the game. Every Tuesday home game during the 2008 season, the Houston Astros hosted an environmental organization and made public announcements during the game to alert fans of green activities occurring during the game. The Astros have placed 125 recycling bins throughout the stadium for fans to recycle plastic aluminum and cardboard. Overall, the recycling efforts and green awareness allowed the Houston Astros and Minute Maid Park to recycle over 180 tons of material during the 2008 season.

Contact: Marty Price, 713-259-8952, mprice@astros.com

IV. AVAILABLE RESOURCES

A. Funding

The following sites provide information on state, local and/or industry funding sources which may be available to fund the establishment of stadium recycling programs.

<http://www.epa.gov/epaoswer/non-hw/recycle/jtr/state/index.htm>

B. Bins and equipment sources, vendors

The following links provide information on the many different manufacturers of recycling bins and equipment available.

<http://www.mchenry.edu/recycling/recyclingcontainerdirectory.pdf>

C. Useful Recycling Links

The following links contain valuable information on recycling in general as well as recycling at sports venues.

<http://www.nrdc.org/greenbusiness/guides/sports/>

<http://www.epa.gov/epaoswer/non-hw/reduce/wstewise/pubs/howtopdf.pdf>

<http://www.epa.gov/msw/pubs/bus-guid.htm>

<http://www.napcor.com/pdf/SingleServeToolkit.pdf>

<http://www.greensports.org>

<http://www.besmart.org/publicplacerecycling/sporting-venues/page1-sporting.html>

http://www.eurekarecycling.org/bg_event_rec.cfm

D. Professional Associations

<https://www.greensportsalliance.org>

<http://www.stadiummanagers.org/>

<http://www.iaam.org>

E. Tools and Calculators

The following links contain useful tools and calculators for estimating the impact on recycling efforts are sports venues.

http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_home.html

<http://www.epa.gov/waste/conserve/rrr/rmd/econres.htm>

<http://earth911.org/>

<http://www.epa.gov/recycleonthego/>

F. Green Venues Checklists or Certification Programs

The following links contain check lists and examples of certification programs.

[http://www.michigan.gov/documents/dleg/Green_Venues_Self-Assessment_Checklist -
_Fillable_Form_304171_7.pdf](http://www.michigan.gov/documents/dleg/Green_Venues_Self-Assessment_Checklist_-_Fillable_Form_304171_7.pdf)

<http://www.crra.com/vserc/index.html>

<http://www.usgbc.org/DisplayPage.aspx?CategoryID=19>

Appendix A. Public Venue Waste Management and Recycling Cost Worksheet

This worksheet is designed to help perform a “back of the envelope” calculation of the waste management and recycling costs at venues.

On-Site Trash Collection Labor

Personnel Hours (list separately):

- (1) List individual personnel and regular hours for each per week.
- (2) List individual personnel and overtime hours for each per week.
- (3) Annualize number of regular and overtime hours for individual personnel (keep hour categories separate for tracking purposes).

Define Hourly Personnel Rates:

- (1) List individual personnel comprehensive regular hourly rates (wages plus 1.3 overhead factor).
- (2) List individual personnel overtime hourly rates (time and a half).
- (3) Keep regular and overtime hourly rates for individual personnel separate for tracking purposes.

Calculate Annual Trash Collection Labor Cost (Hours x Rates):

- (1) Multiply annual regular individual personnel hours by their comprehensive regular hourly rates.
- (2) Multiply any annual overtime individual personnel hours by their overtime hourly rates.
- (3) Combine the annual regular and overtime cost totals for each person, then combine personnel totals.

Add Trash Maintenance Contractor Cost:

- (1) List any contractor service fees (weekly, monthly) associated with on-site trash collection.
- (2) Annualize contractor service fees by multiplying service payments by # mo/yr service provided.

Annual Trash Equipment Cost:

- (1) List all equipment used in trash handling (e.g., receptacles, carts, dumpsters, compactors, vehicles).
- (2) List total purchase price for each equipment type (e.g., __ number of receptacles x \$__ ea = \$__).
- (3) For each equipment category type, divide the total purchase price by the estimated number of useful life years to determine the estimated annualized cost.
- (4) For each applicable equipment category type, list the estimated annual operation and maintenance cost (e.g., vehicle service fees, fuel, other).
- (5) For rented equipment, list contract dollar amount and rental time period, and annualize the expense.
- (6) Add the estimated annualized equipment cost to the annual O & M cost and rental cost for each equipment category to determine the estimated annual trash equipment cost.

Annual Off-Site Trash Hauling Service Fee:

- (1) Determine type of off-site trash hauling service and annualize the total. Alternatives include:
 - (a) Flat Fee Basis: Constant hauling rate charged for a specific period of time, regardless of fluctuations in waste generated.
 - (b) Weight or Volume Basis: Fee charged based on weight or volume of waste generated (e.g., \$/ton or cubic yard).
 - (c) Per Pull Basis: Fee charged each time waste is picked up from site.

Cost Associated with Off-Site Trash Hauling by In-House Personnel:

- (1) Determine if there is any in-house staff delivery of trash to a disposal facility.
- (2) If so, separately document annual labor costs specifically associated with such activities.
- (3) Document any specific additional annual vehicles expenses (e.g., purchase, lease, operations and maintenance costs) associated with such activities.

Annual Trash Disposal Fee and Tonnage:

- (1) Determine how much is being charged for trash disposal at the disposal facility and disposal frequency.
- (2) Annualize the trash disposal fee based on the tipping rate (e.g., \$ per ton) and quantity of trash disposed of at the disposal facility.
- (3) Separately list the annual tons of trash sent to the disposal facility.

On-Site Recycling Collection Labor Cost

Personnel Hours (list separately):

- (1) List individual personnel and regular hours for each per week.
- (2) List individual personnel and overtime hours for each per week.
- (3) Annualize number of regular and overtime hours for individual personnel (keep hour categories separate for tracking purposes).

Define Hourly Personnel Rates:

- (1) List individual personnel comprehensive regular hourly rates (wages plus 1.3 overhead factor).
- (2) List individual personnel overtime hourly rates (time and a half).
- (3) Keep regular and overtime hourly rates for individual personnel separate for tracking purposes.

Calculate Annual Recycling Collection Labor Cost (Hours x Rates):

- (1) Multiply annual regular individual personnel hours by their comprehensive regular hourly rates.
- (2) Multiply any annual overtime individual personnel hours by their overtime hourly rates.
- (3) Combine the annual regular and overtime cost totals for each person, then combine personnel totals.

Add any Recycling Contractor Cost:

- (1) List any contractor service fees (weekly, monthly) associated with on-site recycling collection.
- (2) Annualize contractor service fees by multiplying service payments by the # of mo/yr service provided.

Annual Recycling Equipment Cost:

- (1) List all equipment used in your recycling program (e.g., bins, carts, dumpsters, balers, pickup vehicles).
- (2) List the total purchase price for each equipment category type (e.g., __ number of bins x \$__ ea = \$__).
- (3) For each equipment category type, divide total purchase price by estimated number of useful life years to determine the estimated annualized cost for each.
- (4) For each equipment category type, estimate annual operation and maintenance cost (e.g., vehicle service fees, fuel, other).
- (5) For rented equipment, note contract dollar amount and rental time period, and annualize the expense.
- (6) Add the estimated annualized equipment cost to the annual O & M cost and rental cost for each equipment category to determine the estimated annual recycling equipment cost.

Recycling Program Promotion/Administration Cost:

- (1) List all costs associated current and/or planned public outreach/awareness/management efforts.
Examples: Outside professionals, staff training, advertising, program administration.
- (2) Annualize recycling promotion/management costs on a separate line item basis (for tracking purposes).

Annual Off-Site Recycling Hauling Cost:

- (1) Determine the type of off-site recycling hauling service and annualize the total for worksheet purposes.
Alternatives include:
 - (a) Flat Fee Basis: Constant hauling rate charged for a specific period of time, regardless of fluctuations in recyclables generated.
 - (b) Weight or Volume Basis: Fee charged based on the weight or volume of recyclables generated (e.g., \$/ton or cubic yard).
 - (c) Per Pull Basis: Fee charged each time recyclables are picked up from site.

Cost Associated with Off-Site Recyclables Hauling by In-House Personnel:

- (1) Determine if there is any in-house staff delivery of recyclables to a processing facility.
- (2) If so, separately document annual labor costs specifically associated with such activities.
- (3) Separately document any additional annual vehicle expenses (e.g., purchase, lease, operations and maintenance costs) specifically associated with such activities.

Annual Recycling Revenues and Tonnage:

- (1) Determine how much revenue is received by the public venue for recyclable material sales. List each material type separately and the accounting time period (e.g., weekly, monthly).
- (2) Annualize revenue received for each material type based on the # of weeks/months venue is in operation, and total each material type to determine the annual recycling revenues.
- (3) Document how much material tonnage is associated with each material type recycled (i.e., whether or not revenue is received) on an annual basis and combine the material type categories to determine the annual tonnage of recyclable materials.

Estimate Avoided Disposal Cost:

- (1) Add the total cost associated with on-site waste collection, off-site waste hauling, and waste disposal.
- (2) Take this combined total waste management cost number and divide it by the total annual tons of waste disposed to determine the program cost per ton of waste handled during the year.
- (3) Multiply calculated annual tons of recyclables diverted from disposal by the \$/ton associated with waste management to determine the estimated avoided cost of waste management due to recycling.

Simplified Example: Assume \$1,000 total waste management cost, divided by 100 tons of waste generated, equals \$10/ton of waste managed. Next, assume 50 tons of materials recycled (diverted from disposal), multiplied by \$10/ton of waste managed, equals a \$500 diversion savings (not taking into consideration the recycling costs/revenues).

Total Waste Management and Recycling Program Cost

A more accurate picture of the total waste management and recycling program costs at your public venue, including any possible savings associated with recycling, may be estimated as follows:

Determine Annual Trash Management Cost:

- (1) Add total annual cost of on-site waste collection, off-site waste hauling, and waste disposal.
- (2) Take the combined waste management number and divide it by the total annual tons of waste disposed to determine the annual program cost per ton of waste generated.

Determine Annual Recycling Program Net Cost

- (3) Next, separately add the total annual cost associated with on-site recycling collection, off-site recycling hauling, and subtract the total annual revenue received from the sale of recyclables.
- (4) Take this combined recycling program cost/revenue number and divide it by the total annual tons of recyclables diverted from disposal to determine the cost per ton associated with the recyclables handled during the year.

Compare \$/Ton Difference between Trash Management and Recycling Programs

- (5) Take the \$/ton value associated with the trash management program and subtract it from the \$/ton value associated with the recycling program. Then multiply this \$/ton difference by the total tons of materials recycled during the year to determine the estimated cost savings (or added expense, if the recycling program has a higher \$/ton value) associated with recycling.

Simplified Example: Assume \$1,000 total waste management cost, divided by 100 tons of waste generated, equals \$10/ton of waste managed. Next, assume \$300 total gross recycling program cost, less \$50 from materials sales, equals \$250 total net recycling program cost. Divide \$250 by an assumed 50 tons of materials recycled (diverted from disposal), equals \$5/ton for the recycling program. Subtract \$5/ton for recycling from \$10/ton for waste management (i.e., \$10/ton less \$5/ton) to determine a \$5/ton program savings associated with the recycling tonnage (diverted from disposal). Multiply the \$5 savings by 50 tons of recyclables to determine a \$250 program savings (taking into consideration recycling program expenses/revenues).

Appendix B. Recycling Bin Selection Guide

A. Materials to Collect

- Talk to your hauler and local recycling officials about whether local ordinances require collecting certain materials and what materials are recyclable locally.
- Ask your hauler how they want to receive the materials and what price you will be paid if they are co-mingled. If they take plastic bottles, aluminum cans and glass bottles mixed, collect them together. If you anticipate a high level of aluminum cans, however, check to see if you could get a higher return by collecting them separately, even if you need to deliver them yourself or hire a separate hauler. (The same applies for newspapers, mixed paper and office paper.)

B. Bin Type and Signage

- Recycling bins should look different from trash cans.
- Recycling bin lids should only allow the recyclables to enter. Keep in mind that recycling bins with flat tops sometimes get trash placed on them, so consider getting recycling bins with the opening on the side or sloped lids. Avoiding flat tops is more important in venues where the trash and recycling bins are not emptied until an event is over, leading to a possible overflow.
- Containers should have enough room in highly visible areas to clearly indicate what can be recycled, using both graphics and words. Anticipate people's misguided actions. If only the word "Plastic" appears above an opening in the container, people are likely to put their plastic sandwich bags and other plastic, which may contaminate the plastic bottles.
- Place signage above the bins so they can be seen from a distance.
- Clearly label trash cans.

C. Bin Placement

- Place a trash can next to each recycling bin, and make sure it doesn't get moved. This argues for having the trash collection integrated into the recycling bin, so they cannot be separated. Otherwise you are likely to have very high rates of contamination.
- Distribute the bins throughout the stadium concourses, placing more in high-traffic (i.e., near bathroom entrances) and food service areas.

D. Liners

- Clear liners allow custodial staff to spot contamination, and possibly to collect bags of trash and recyclables together and separate at the loading dock.
- Consider whether large amounts of glass will be recycled. Bins that receive high levels of glass may need thicker liners (greater than 1.5 mil) than those that receive little glass.

E. Monitor and Track Recyclables

- Assign a staff person to carefully monitor the recycling and trash bins for contamination, particularly at the beginning of the program.
- Empty trash and recycling bins frequently. Overflowing trash cans will result in people throwing trash in recycling bins.
- Ask your hauler or recycling processor to provide you with reports on amounts of each material recycled and the contamination rates of each, so you can make changes to your program if necessary and track your progress.