Food Waste Minimisation Guidebook

FOR FOOD RETAIL ESTABLISHMENTS



AVA
Agri-Food & Veterinary Authority of Singapore

National Environment Agency
Safeguard · Nurture · Cherish

Disclaimer

This Guidebook aims to provide guidelines to assist food retail establishments in developing their own food waste reduction plans, and should be read in conjunction with applicable legislation/regulations. NEA and AVA shall not be responsible for any errors or omissions appearing in this guide. All references and sources of the information appearing in this guide have been cited and credited to the best of our knowledge.

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- Grand Hyatt Singapore
- Mandarin Oriental, Singapore
- Marina Bay Sands Ptd Ltd

and the many others who have shared with us their valuable insights and suggestions to develop this guidebook.

CONTENTS

Chapter I: Introduction 01

Chapter II: REDUCE 04
1. Planning 04
   Conduct waste audit 04
   Assess the cost of food waste 06
   Design menus to optimise usage of ingredients 07

2. Purchasing 08
   Improve inventory management 08
   Avoid over-purchasing 08

3. Storage 09
   Inspect incoming goods 09
   Label upon receiving 09
   Control storage conditions 09
   Adopt first-in-first-out (FIFO) and first-expire-first-out (FEFO) policy 10

4. Handling 10
   Adopt cold chain management 10

5. Sales and Service 11
   Consider demand-based production and different approaches to food display 11
   Offer food portion options and recommendations 12
   Encourage customers to reduce wastage 12
   Gather feedback 12

6. Staff training 13
   Provide adequate staff training 13
   Ensure high level of hygiene standards 13
   Keep staff motivated 13

Partnership 14
   Government 15
   Suppliers 15

Chapter III: REDISTRIBUTE 16
Food distribution organisations 16

Chapter IV: RECYCLE 18
Food waste treatment system suppliers 18

Conclusion 19

Checklist 20

References 21

Annex 1 22
Annex 2 23
Annex 3 27

CHAPTER I: INTRODUCTION

Singapore's mounting food waste is a challenge that needs to be addressed. Over the last 10 years, the amount of food waste produced in Singapore has increased by about 40%, and is expected to increase further with our growing population and economic activity. In 2016, 791,000 tonnes of food waste was generated in Singapore. This accounted for 10% of the total waste generated. Only 14% of the food waste generated was recycled and the rest of the food waste was disposed of at waste-to-energy incineration plants. More can be done to minimise food waste, and ensure that food resources are utilised in a more efficient manner. Moreover, reducing food waste can help lessen the demand on food supply, thereby enhancing food security in Singapore.

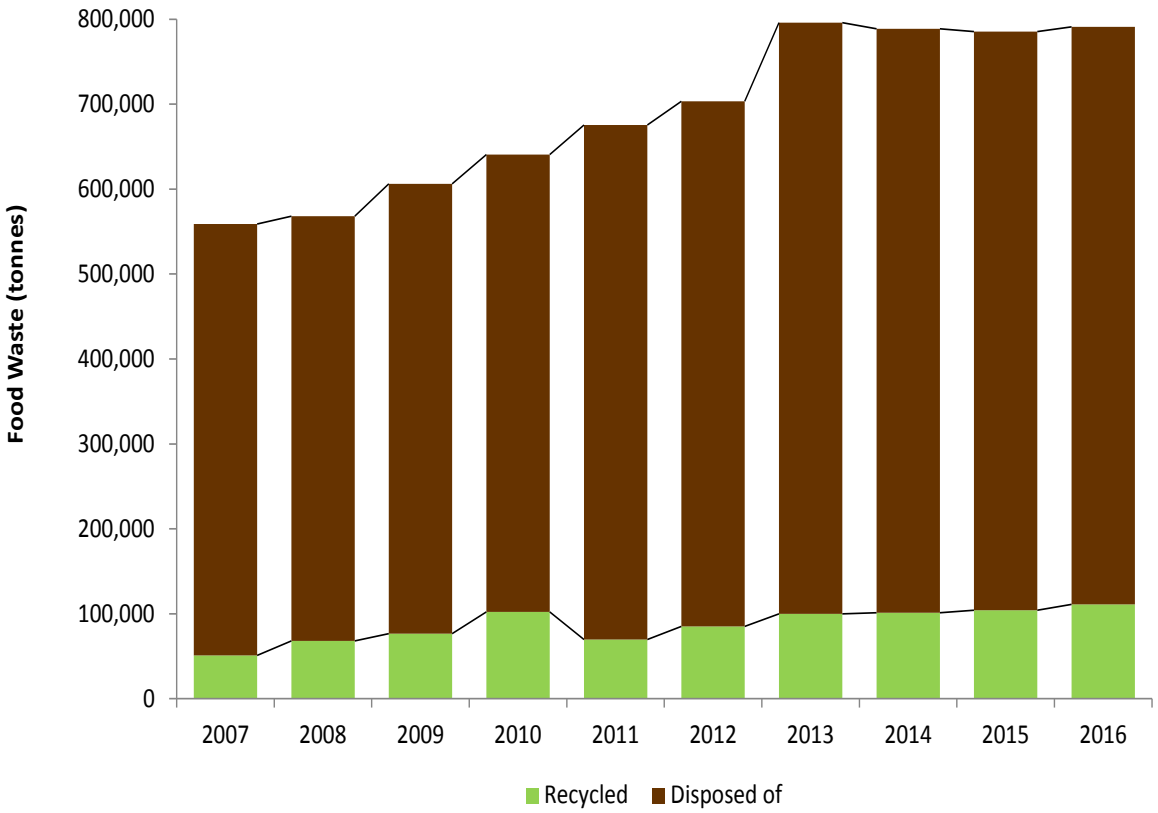


Figure 1: Food waste statistics and recycling rates

WHY SHOULD BUSINESSES CARE

ECONOMICS

Identifying the sources of food waste can uncover inefficiencies in the workplace, such as the wastage of raw materials. For businesses, it makes economic sense to reduce wastage of raw materials that are bought. Not only would there be material cost savings; there would also be savings on disposal fees resulting from less waste. This will ultimately translate to an increase in profits.

SOCIAL

In Singapore, there are about 105,000 households earning below $1,500 a month. Some of these households may face difficulties in securing adequate food supply. Thus, in improving our practices and attitudes towards food production and waste management, food retailers can also consider the donation of surplus or unconsumed food to help those in need.

ENVIRONMENT

When food goes to waste, so do all of the resources (e.g. energy and water) that were used to produce it, making the environmental implications of wasted food more significant.

In addition, food waste disposed of is incinerated with general waste and the ashes produced are sent to our only offshore landfill. Due to Singapore being land-scarce, it is not sustainable to allow food waste to grow uncurbed. If overall waste continues to increase at our current rate, Singapore will need a new landfill every 30-35 years.



Figure 2: In land-scarce Singapore, it is not possible to find more space for new landfills at the rate we are generating waste. (Image: Ministry of the Environment and Water Resources)

[1] *R. Chan, "The Invisible Poor," 26 October 2013. [Online].*

AIM

The aim of this Guidebook is to help food retail establishments such as restaurants, food shops, food courts and other eateries in Singapore contribute to protecting the environment by minimising food waste.

With the guidelines presented here, food retail establishments can develop food waste reduction plans to suit individual business needs. Furthermore, food retail establishments could involve consumers in the food waste reduction effort by spreading the awareness as well as providing various dining options (e.g. offering different portion sizes) which could help consumers to cut food wastage.

The strategies in this Guidebook have been classified according to the food waste management hierarchy shown in Figure 3 below. The preferred approach is to avoid wasting food in the first place, followed by redistributing unsold or excess food and then treating/recycling food waste.

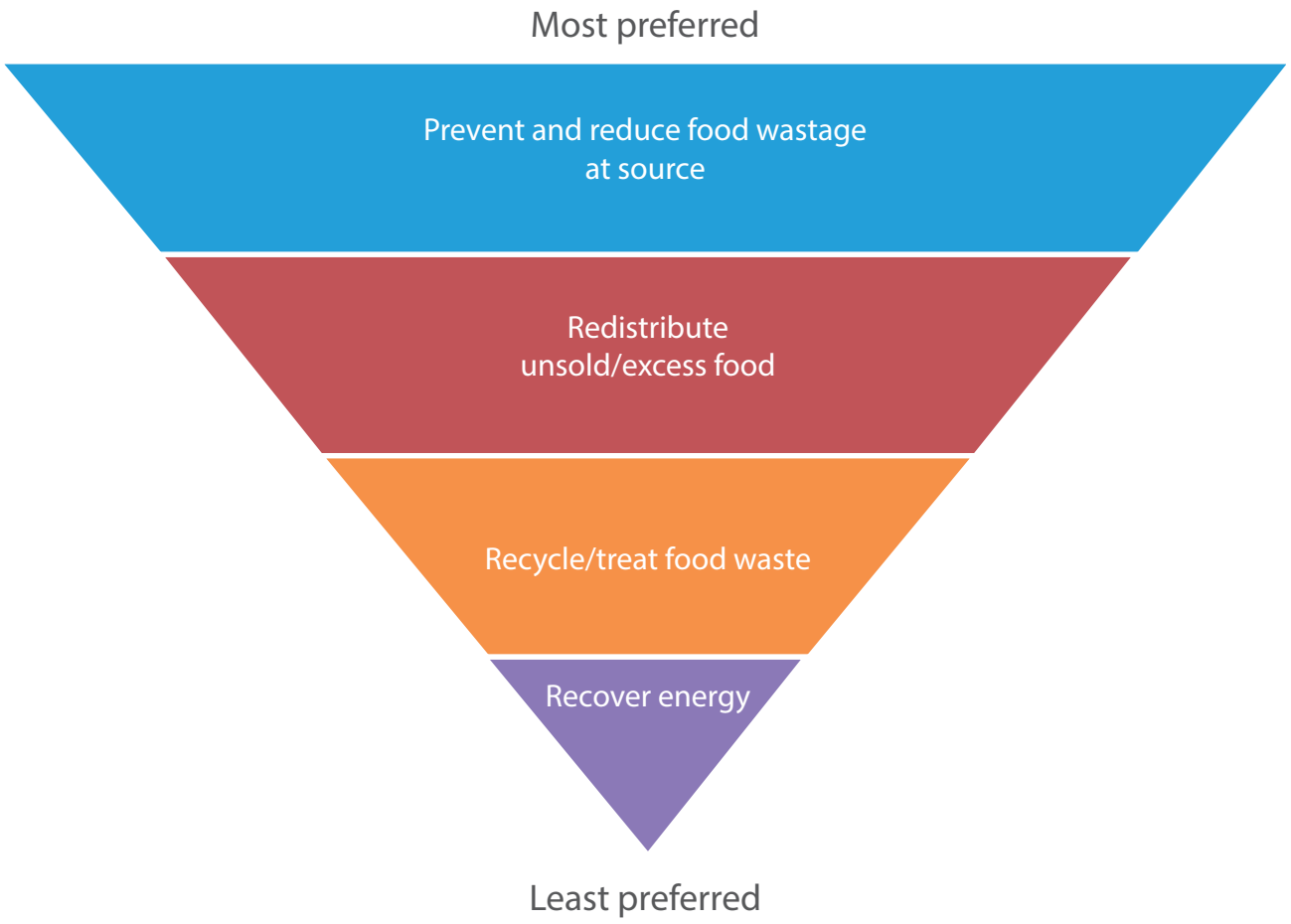


Figure 3: Food waste management hierarchy (Image: NEA)

CHAPTER II: REDUCE

This chapter will outline how food retail establishments can reduce food waste throughout the retail and service processes across the different stages as listed below.



Figure 4: Steps detailed in this guide for food retailers to reduce food waste

1. PLANNING

- Conduct waste audit
- Assess the cost of food waste
- Design menus to optimise usage of ingredients

CONDUCT WASTE AUDIT

Before a meaningful food waste reduction plan can be developed, a baseline waste audit would need to be conducted to analyse the composition of the food waste and allow food retail establishments to pin-point the main sources and reasons for food wastage. Once the sources and causes are identified, the food retail establishments can then target relevant business practices and see how they can be improved to reduce food waste. Thereafter, food waste audits can be conducted periodically (e.g. half-yearly, annually) to review the effectiveness of the measures taken, as well as identify further opportunities to reduce waste for disposal.

A team comprising staff from all stages of the food retail operations e.g. preparation, retail, serving and dishwashing processes could be set up to conduct the waste audits.



Figure 5: Food waste audits can identify inefficiencies in the workplace (Image: Mandarin Oriental, Singapore)

During the food waste audit:

- Collect source-segregated food waste samples daily over a period of time (e.g. for a typical week) to get a better understanding of the food waste generated. If food waste is mixed with other waste, then the waste will first need to be sorted to extract the food waste portion.
- Analyse the food waste to determine the types and quantities of food waste (e.g. vegetable trimmings, chicken/ fish bones) generated at each stage of the retail and service process.
- Identify the reasons for the food waste e.g. whether it is excess food from over-production, or food that has gone bad due to poor inventory management, etc.
- Record how the food waste is managed, e.g. whether the food waste is discarded or recycled.

To facilitate documentation of the findings from the food waste audits, a sample food waste audit template is included in Annex 1. For more detailed procedures on conducting a proper food waste audit, food retail establishments may refer to the Food Loss and Waste Accounting and Reporting Standard by World's Resource Institute.

Some food retail establishments such as Marina Bay Sands and Sofitel Singapore Sentosa Resort & Spa are tracking their food waste with the use of weighing scales or the adoption of smart food waste tracking systems. Some information on smart food waste tracking systems can be found in Annex 2.

Case Study - Marina Bay Sands



Figure 6: Weighing scales in MBS

Marina Bay Sands has adopted food waste tracking with the use of weighing scales to track the amount of food waste generated by their kitchens. The tracking information also serves to facilitate the collection of food waste from the different locations around their premises for on-site food waste treatment.

Case Study - Sofitel Singapore Sentosa Resort & Spa

Sofitel Singapore Sentosa Resort & Spa has installed Winnows' smart food waste tracking system in one of its kitchens to monitor its food waste generation. The Winnow System is a smart meter that is integrated with a kitchen's waste bin and comprises a scale, an LCD panel and wireless connectivity. The information obtained enables Sofitel to better estimate the amount to cook to avoid overproducing. According to Sofitel, the adoption of such a system has reduced its food waste by 2 to 4 percent[2].

ASSESS THE COST OF FOOD WASTE

By assessing the cost of food waste, food retail establishments can estimate the potential savings from reducing food waste and put up a case for a change in their business practices. The actual cost of food waste is not just the cost of food ingredients wasted, but should also take the following into consideration:

1. Waste Collection & Disposal Costs

These costs can either be fixed or variable according to the amount of waste. On top of the haulage fees and waste disposal gate fees, fees for rental of waste compactors should be included where applicable; and

2. Staff & Utilities Cost

To compute the staff and utilities costs, first estimate the proportion of food prepared that is eventually discarded, then estimate the time spent by staff in preparing all the food and the associated utilities cost (electricity/gas/water). Finally, multiply the associated utilities cost by the estimated proportion.

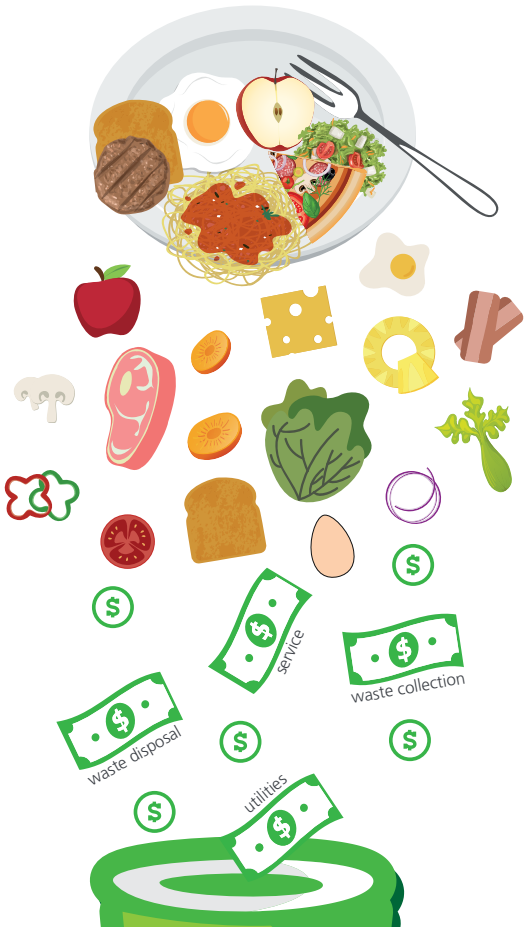


Figure 7: The true cost of food waste is higher than what it appears to be.

[2] *L. Ting, "Smart kitchen system checks food wastage," 27 July 2016. [Online]. Available: http://www.straitstimes.com/tech/smart-kitchen-system-checks-food-wastage.*

DESIGN MENUS TO OPTIMISE USAGE OF INGREDIENTS

Food retail establishments could consider the following approaches:

1. Avoid designing menus where specific ingredients are used for only one or two dishes. If customers do not order those dishes, the ingredients are likely to turn bad over time, especially so if they have a short shelf-life.
2. Monitor what is being sold and consider removing dishes that are not in demand from the menu, saving on ingredients that would have been unused.
3. Consider reusing ingredient offcuts that are generated during the food preparation process to create new dishes. For example, fish skin could be seasoned and fried to make a delicious crispy fish skin snack, fruit pulps could be used to make jam, while bones and fish heads could be utilised in soups.



Figure 8: Salmon skin is one example of foods that can be reused

2. PURCHASING

- Improve inventory management
- Avoid over-purchasing

IMPROVE INVENTORY MANAGEMENT

Research has shown that much food is wasted due to poor inventory management which may result in an overstocking of shelves. Not all the food is used and has to be thrown away because of its perishable nature. An electronic inventory management system or software may help track stock levels more effectively.

Some companies also select a single staff to be a primary purchaser. The assigned role helps to prevent overlaps in ordering and receiving by different employees.



Figure 9: Proper inventory management is important for reducing food waste

AVOID OVER-PURCHASING

Order food just before it is to be used so that it does not turn bad while it is kept in storage. Ordering food only when needed also ensures that the food sold is fresh. Moreover, this reduces the possibility of food waste due to last-minute cancellations.

Food retail establishments should order in bulk only after assessing demand. The cost savings of buying in bulk could be outweighed by the cost of the food that has to be disposed of when it ends up unused.

3. STORAGE

- Inspect incoming goods
- Label upon receiving
- Control storage conditions
- Adopt first-in-first-out (FIFO) and first-expire-first-out (FEFO) Policy

INSPECT INCOMING GOODS

Always inspect incoming goods for any spoilage during transportation or due to improper handling during delivery and ensure that the food is kept within the safe temperature range and properly handled. Ensuring that food is kept in good conditions prevents premature spoilage and potential food poisoning.

LABEL UPON RECEIVING

Food retailers can consider labelling food once they are received. Labels should include the product description, date of receipt, expiry date (where applicable)[3] and may also include storage instructions. Labels help staff to store food in proper conditions and adopt first-in-first-out (FIFO) and first-expire-first-out (FEFO) policy.

CONTROL STORAGE CONDITIONS

Ensure proper storage procedures and proper control of time and temperature to prevent spoilage of stored food. Whenever possible, enhance ventilation to prevent spoilage of fresh produce[4]. For cooked food, hot food should be kept at above 60^{O}C and cold food below 5^{O}C.

Areas designated for food storage and packaging materials should be situated away from toilets, dust, smoke, objectionable odours and other contaminants. Racks and pallets for food storage should also be in good and sanitary conditions.

Good hygiene practices prevent contamination of and ensure the safety of the food. Food retail establishments should also invest in appropriate equipment for different food types. Ensuring that food is handled hygienically would prevent wastage due to the need to discard contaminated or spoilt food.



Figure 10: Pallets that are used for food storage should be cleaned regularly

[3]Refer to the Agri-Food and Veterinary Authority of Singapore (AVA) website for A Guide to Food Labelling and Advertisements (http://www.ava.gov.sg/docs/default-source/tools-and-resources/resources-for-businessesaguidetofoodlabellingandadvertisementsversionjuly2)

[4]Refer to the Agri-Food and Veterinary Authority of Singapore (AVA) website for Good Food Safety Practices (http://www.ava.gov.sg/explore-by-sections/food/food-safety-quality/good-food-safety-practices) and refer to the NEA website for guidelines and educational materials on food hygiene (http://www.nea.gov.sg/public-health/food-hygiene/food-hygiene-practices-guidelines)

ADOPT FIRST-IN-FIRST-OUT (FIFO) AND FIRST-EXPIRE-FIRST-OUT (FEFO) POLICY

FIFO policy refers to using stocks in the order based on the date that they are received while FEFO policy refers to using stocks in the order of their expiry dates. FIFO and FEFO are methods of stock rotation (e.g. placing the oldest products and products which expire earliest at the front of the shelf), and can be applied to ingredient usage, packaging, display and serving of food products.

4. HANDLING

- Adopt cold chain management

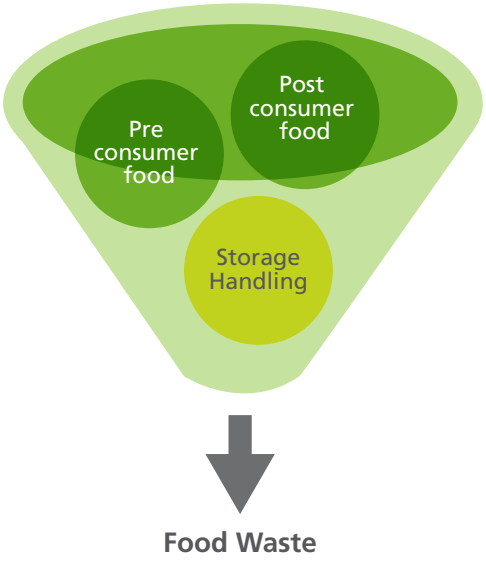


Figure 11: Food waste can be attributed to a variety of sources

ADOPT COLD CHAIN MANAGEMENT

Some of the bigger food retail establishments may have food storage warehouses or central kitchens to receive goods from suppliers or manufacturers before distributing the food products to the retail shops. Besides maintaining a high standard of hygiene during the handling process, food retail establishments should ensure the safety and quality of the perishable food products by adopting cold chain management when redistributing them to the outlets. The cold chain is a temperature-controlled supply chain that can help to ensure the shelf-life of perishable products during temporary storage or en-route to their destination. Examples of such products include fresh agricultural produce, seafood, chilled and frozen food.

It is recommended for food retailers to use logistics vessels such as trucks with refrigerated docks or multiple refrigeration zones to maintain the quality and safety of food products at the right temperatures (frozen, refrigerated or dry) during delivery. References can be made to the Singapore Standards for the cold chain management of vegetables, chilled pork, and milk and dairy products.

5. SALES AND SERVICE

- Consider demand-based production and different approaches to food display
- Offer food portion options and recommendations
- Encourage customers to reduce wastage
- Gather feedback

CONSIDER DEMAND-BASED PRODUCTION AND DIFFERENT APPROACHES TO FOOD DISPLAY

Food retail establishments often produce dishes in bulk to cope with high table turnover rates as well as display food in abundance for visual appeal. However, food left unsold or unconsumed is usually disposed of.

To minimise food waste, food retail establishments could consider preparing food in smaller batches, according to demand. For restaurants offering buffets, an a la carte buffet could be considered in place of a traditional buffet spread to best match the amount and type of food prepared to consumers' preference and demand.

Food retail establishments can consider different approaches of displaying food to give the impression of abundance, while reducing the amount of food served. For example, a bakery could use smaller-sized trays and shelves to display fewer confectioneries. Buffet lines could also use shallower trays.



Figure 12: Smaller batches of food can still provide the impression of abundance when displayed in proportionally-smaller trays.

OFFER FOOD PORTION OPTIONS AND RECOMMENDATIONS

Food retail establishments could also consider offering different portion sizes for dishes, recommending the number of people each dish should be shared amongst, as well as offer set-menus catering to different group-sizes. These allow customers to better manage the amount of food that they order, and reduce the likelihood of ordering in excess.



Figure 13: Food retail establishments could have a set-menu catering to groups of varying sizes.

ENCOURAGE CUSTOMERS TO REDUCE WASTAGE

Food retail establishments can encourage customers to reduce food wastage by displaying signs to remind customers not to waste food or provide smaller plates to encourage customers to take smaller portions at buffets. Small incentives, such as desserts or discounts, can be given to customers for finishing the food on their tables. Alternatively, food retail establishments could consider imposing charges on food waste to discourage customers to take more food than they can finish.

GATHER FEEDBACK

There are many ways in which food waste can be generated. Customers may have ordered too much or found the food unsuitable for their palates. Food retail establishments that experience large amounts of food waste from customers can consider gathering feedback from customers on food portions, quality or variety. The gathered feedback is a good way to understand the needs of customers and to better serve them.

6. STAFF TRAINING

- Provide adequate staff training
- Ensure high level of hygiene standards
- Keep staff motivated

PROVIDE ADEQUATE STAFF TRAINING

Food retail establishments could conduct training for their staff on ways to reduce food waste. Staff could be trained to assess how responsive customers are to the establishment's food waste reduction initiatives. As staff are often dealing with customers directly, they should be well-informed on portion sizes and ingredients of dishes in the menu to better advise customers. This could potentially reduce food wastage by customers.

In addition, staff could also be trained in the area of food handling. For example, fruits such as bananas can be bruised easily due to rough handling and should be handled with care. Chefs and cooks should also be equipped with proper culinary skills. Poor knife skills could result in ingredient wastage. Similarly, cooked food that is burnt or undercooked cannot be served and would have to be disposed of.

ENSURE HIGH LEVEL OF HYGIENE STANDARDS

Storage places such as refrigerators and shelves should be cleaned regularly to prevent pest infestation, as this would render stored food inedible, and result in it becoming food waste. Work benches should be cleaned throughout the day and thoroughly sanitized at the end of the work day.

Food retail establishments should ensure that staff maintain a high standard of hygiene as unhygienic practices may lead to food wastage.

KEEP STAFF MOTIVATED

Keeping staff motivated to reduce food waste can result in improvements and innovation in work processes. For example, food preparation staff can help to identify areas for improvement in existing food preparation processes and chefs can come up with innovative menus to further reduce food waste.

In order to keep staff motivated, food retail establishments could:

1. Foster a food waste reduction culture
2. Set food waste reduction goals
3. Encourage innovative solutions for food waste reduction
4. Make adoption of food waste reduction practices a key performance indicator for employee evaluations
5. Recognise staff who undertake food waste reduction initiatives

PARTNERSHIP

To ensure and improve on the effectiveness of food waste minimisation initiatives, food retail establishments could partner with various organizations. Possible partnerships involve food waste treatment suppliers, the Government, food suppliers, as well as food distribution organisations.



Figure 14: Food retail establishments can collaborate with various organizations to reduce food waste

GOVERNMENT

Food retail establishments can tap on government assistance schemes for implementing food waste minimisation initiatives. For instance, organisations can tap on the NEA's 3R Fund. It co-funds up to 80% of the qualifying cost, with a cap of $1 million, for an organisation's waste reduction or recycling project. Food retail establishments may also consider looking at other available grants, such as the Productivity and Innovation Credit (PIC) by IRAS or the Capability Development Grant (CDG) by SPRING Singapore.

SUPPLIERS

Food retail establishments often feel the need to keep contingency stock on hand to avoid being caught off-guard by sudden changes in demand. Overstocking often translates into food wastage as most of these extra stocks are not needed and discarded when they expire or deteriorate in quality.

Food retail establishments should work closely with their suppliers to ensure that the amount of food purchased matches their customers' demand. Reducing the need of keeping contingency stock would also mean lower inventory costs for retailers and a higher level of quality of food products for their customers.

Partnership between the food retail establishments and suppliers in the area of goods delivery can also help to reduce food waste by preventing damage to or spoilage of food produce during the transportation process.

Case Study - Marina Bay Sands

Marina Bay Sands (MBS) provides their suppliers with reusable plastic baskets when supplying fresh produce like fruits and vegetables. This offers better protection than carton boxes as they minimise the probability of fresh produce from being damaged during transportation.



Figure 15: Plastic baskets (right) protect products better than carton boxes (left)

CHAPTER III: REDISTRIBUTE

FOOD DISTRIBUTION ORGANISATIONS

Food retail establishments can donate excess food products (e.g. unused canned food, surplus perishables) to the needy. A list of food distribution organisations are listed below:



Figure 16: Food retailers are an important source for food banks (Image: Food Bank)

Food distribution organisations	Examples of acceptable types of food	Contact
Fei Yue Community Services	Canned food and non-perishables items	Tel: 6563 1106 Website: www.fycs.org Email: admin@fycs.org
Food from the Heart	Bread, groceries	Tel: 6280 4483 Website: foodheart.org Email: info@foodheart.org
The Food Bank Singapore	Canned food, discontinued food types, mislabelled foods	Tel: 6831 5395 Website: foodbank.sg Email: enquiries@foodbank.sg
Willing Hearts	Groceries, non-perishable items	Tel: 6476 5822 Website: www.willinghearts.org.sg Email: willingheartsingapore@gmail.com

Food from the Heart accepts edible but unsold bread from close to 115 bakeries and hotels, one of which being Mandarin Oriental Singapore, who tied in donation efforts with their Corporate Social Responsibility (CSR) programs. Besides donating unsold bread and pastries to Food from the Heart, Mandarin Oriental Singapore also engages its staff to help pack bags containing food items like rice, cooking oil, noodles, biscuits and canned food, which will be given to families in need.

Some hotels have also turned to donating excess cooked food which is still suitable for consumption. The donated food is blast-chilled or blast-frozen to below 5°C prior to redistribution and reheated to above 60°C rapidly before consumption.

Case Study[5] - Grand Hyatt Singapore

Grand Hyatt Singapore partners Kerbside Gourmet, a social enterprise gourmet food truck, to donate its excess cooked food from buffet kitchens including rice, stews and noodles after blast chilling them. The food is first packed into vacuum bags or plastic containers and labelled with production and expiry dates. They are subsequently blast-chilled to below 5°C. The food is then collected by Kerbside Gourmet within 2 days from preparation for reheating and redistribution to needy families. To ensure the safety of the donated food, Grand Hyatt Hotel performs random lab tests on the chilled food to test for bacteria count before handing it to Kerbside Gourmet.

Case Study[5] - Marina Bay Sands

Marina Bay Sands (MBS) has embarked on a cooked food donation programme with Food Bank Singapore. Under this programme, MBS donates excess food from their banquet events that was ordered but not served. These food items, such as rice, noodles, soups and stews, are put into shallow containers to be blast-frozen to -18°C, and are then collected by The Food Bank Singapore the following day. To ensure the safety of the donated food, MBS monitors the chilling procedure and collects samples to be sent for testing. MBS also ensures that appropriate containers and/or vehicles are used when transporting the food.

For more information relating to safety guidelines for food donations, please refer to the Guidelines on Food Donation in Annex 3.

[5] *The procedures involved in blast chilling/ blast freezing of food differs according to the type, quantity and preparation method of the food. Organisations involved in food donation are responsible for ensuring that food donated is safe for consumption.*

CHAPTER IV: RECYCLE

FOOD WASTE TREATMENT SYSTEM SUPPLIERS

While food retail establishments try to reduce food waste as much as possible, some waste is inevitable. There are times when food items cannot be donated for human consumption. In such cases, food retailers can consider recycling the food waste instead.

Food retail establishments may consider installing on-site food waste treatment systems to manage food waste. These systems convert food waste to non-potable water or compost/ fertilizer, thereby helping food retailers to cut down on disposal costs.

A list of companies that provide on-site food waste treatment systems is included in the table below. More information about the individual systems can be found in Annex 2.

On-site food waste treatment system suppliers	Contact	
Biomax Green Pte Ltd	Mr Jeffrey Yap Tel: 6274 8606 Email: jeffrey.yap@biomaxgreen.com or info@biomaxgreen.com Website: www.biomaxgreen.com	
Eco-Wiz (SG) Pte Ltd	Ms Renee Tan Tel: 9112 1291 Email: renee@eco-wiz.com Website: www.eco-wiz.com	Mr Jack Weng Tel: 9667 1893 Email: jackweng@eco-wiz.com Website: www.eco-wiz.com
Flexi Systems (Singapore) Pte Ltd / Enerprof Pte Ltd	Mr Owen Yeo Tel: 6758 8209 Email: owen.yeo@enerprof.com.sg Website: http://enerprof.com.sg/	
Westcom Solutions Pte Ltd	Ms Ruby Fang Tel: 6743 7364 Email: ruby_fang@westcomsolutions.com.sg Website: www.westcomsolutions.com.sg	

Disclaimer: The list of companies and organisations are compiled to provide reference for users to facilitate food waste treatment and recycling. This list contains a non-exhaustive list of suppliers of on-site food waste treatment systems which operates in Singapore. Users should refer to the NEA Food Waste Management webpage for the updated contacts of the suppliers.

CONCLUSION

Food retail establishments play a crucial role in reducing food waste generated in Singapore. By reducing the generation of food waste along supply chains, as well as encouraging customers to play their part, food retail establishments have a lot of potential to be a key influencer in reducing the amount of food waste generated.

One key method is to ensure the proper storage and handling of food supplies. Furthermore, food retail establishments can contribute to food waste reduction by offering more portion options and recommendations to better suit customers' needs. Apart from operating in a sustainable manner, reducing food waste would bring about cost savings for food retail establishments.

Beyond that, use of innovative technologies and greater partnership with the government, other suppliers, food distribution organisations, and food waste treatment system suppliers will indeed help in ensuring that food waste is minimised.

We hope the above guide has been helpful in supporting retail food businesses in formulating a plan to achieve food waste reduction goals. With a better understanding of which areas can be focused on to reduce food waste, food retail establishments could share their knowledge, reach out and engage their stakeholders, especially consumers, to achieve greater success in reducing the amount of food waste disposed of in Singapore.

CHECKLIST

1. PLANNING

- Conduct waste audit
- Assess the cost of food waste
- Design menus to optimise usage of ingredients

2. PURCHASING

- Improve inventory management
- Avoid over-purchasing goods

3. STORAGE

- Inspect all incoming goods to ensure quality
- Label the food received with expiry dates
- Control storage conditions
- Adopt first-in-first-out (FIFO) and first-expire-first-out (FEFO) policies

4. HANDLING

- Adopt cold chain management

5. SALES AND SERVICE

- Consider demand-based production and display products in a way that reduces food waste
- Improve on food portion management
- Encourage customers to reduce wastage
- Gather feedback from customers regarding portion size and food quality

6. STAFF TRAINING

- Ensure that staff are knowledgeable about the prevailing food waste policy
- Ensure high level of hygiene standards
- Keep staff motivated by setting waste reduction goals

PARTNERSHIP

- Explore possible cooperation with the government through funding
- Improve communication with industry partners (suppliers, retailers)
- Explore ways of working with food distribution organisations to donate surplus and edible food safely
- Explore food waste recycling/treatment options

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2. D. C. J. H. Mairead Creddon, "Less Food Waste More Profit - A Guide to Minimising Food Waste in the Catering Sector," CIT Press, Cork Institute of Technology, Bishopstown, Cork.
3. Natural Resources Management and Environment Department, "Toolkit - Reducing the Food Wastage Footprint".
4. Winnow Solutions, [Online]. Available: http://www.winnowsolutions.com/.

Food waste audit template

Audit Period (week/month):													
Location/ Area:													
Date	Time	Recorded by	Description of food waste (e.g. vegetable trimmings, chicken/ fish bones)	Amount (kg)	Sources of food waste (to tick)					Amount of food redistributed (kg)	Amount of food waste treated/ recycled (kg)	Amount of food waste disposed of (kg)
					Preparation waste	Over-production	Spoilt / Expired products	Plate waste	Others, please state			
			TOTAL						TOTAL			
Recipient(s) of redistributed food: Treatment/recycling of food waste (e.g. on-site food waste treatment to convert to compost, recycling into animal feed):													

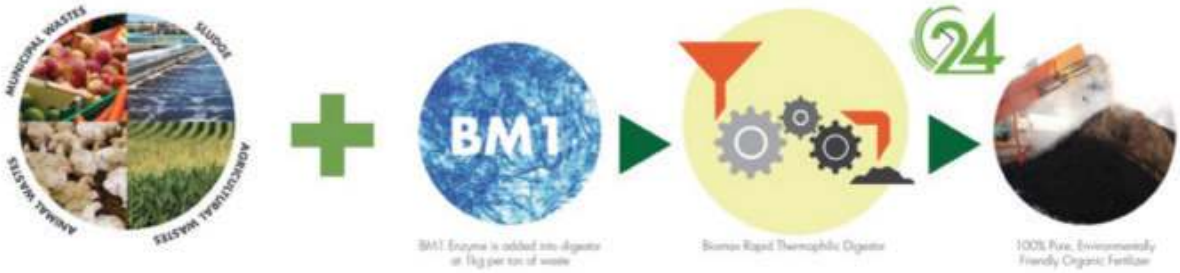
ANNEX 2

Biomax Green Pte Ltd

Biomax Green Pte Ltd, a Singapore-based green high technology company, provides an environmentally-friendly and sustainable solution to recycle organic waste (such as food, horticulture, paper and other forms of organic waste) into organic fertiliser within 24 hours.

The output produced is odourless and pathogen free and can be directly applied to plants, rejuvenating the soil. In addition, the technology is fast and compact and the process does not create any environmentally harmful substances or any residual waste as all the organic matter will be converted into organic fertiliser.

The following diagram describes the Biomax Technology system flow.



Eco-Wiz (SG) Pte Ltd

The Eco-Wiz ecoDigester system provides an on-site food waste management solution by converting food waste into an end product that can be recycled on site. Digestion occurs under a controlled internal environment with proprietary formulated microbial bacteria which decomposes food waste into greywater within a short period of 24 hours.

The system may also include a customized sludge management system which separates the sludge from the water. Through further filtration, the water can be recycled into the ecoDigester system or reused for non-potable uses such as washing floors and watering plants.

Depending on the type of food waste, 3 to 5% of organic solids will also be produced as by-products of the system. The organic solids may be disposed of as general waste or reused as compost if they have been processed according to composting guides and requirements.

The ecoDigester system has been adopted in more than 20 developments, which includes mixed development malls, schools, hotels, supermarket chains, hawker centre etc. Some examples are JEM, Changi Airport, Amara Singapore and 100AM, Mandarin Orchard, Singapore Polytechnic, Resorts World Sentosa, several NTUC FairPrice outlets and Ang Mo Kio Blk 628 Market.

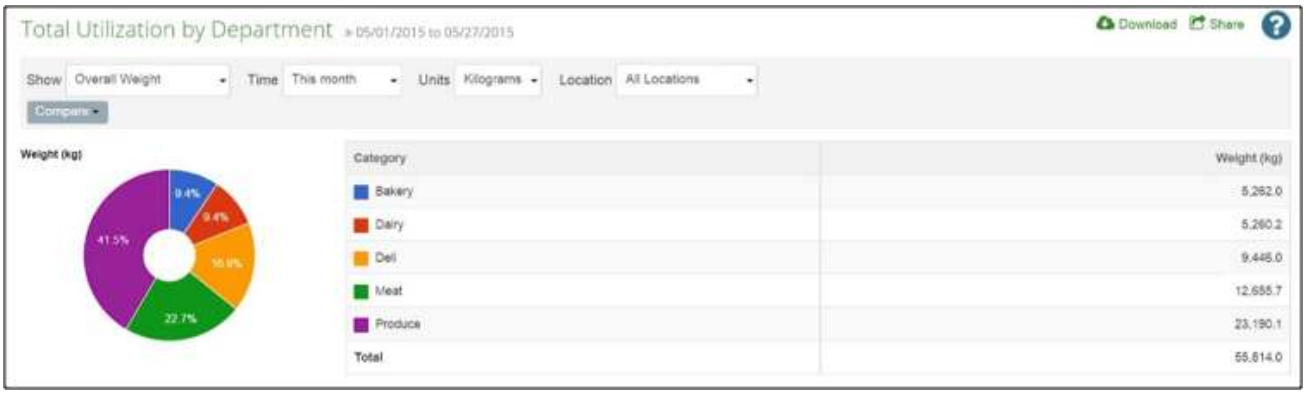
The ecoComposter system is an alternative solution offered by Eco-Wiz for managing food waste on-site. It is capable of generating 20% to 30% of compost with each throw of food waste, with the remaining food waste being digested by the microbes in the system. The compost can be directly applied to plants in small amount as a soil conditioner or further processed into plant fertiliser. The ecoComposter system has been adopted at premises such as Swissotel the Stamford, Pioneer Junior College and Koufu at Singapore Polytechnic.

Flexi Systems (Singapore) Pte Ltd/ Enerprof Pte Ltd (BioHiTech digester)

Manufactured in USA, the BioHiTech Eco-safe food waste digester converts food waste to non-potable water via aerobic digestion by microorganisms and their enzymes. The enzymes break down complex compounds into smaller compounds for the microorganisms to digest. Working in tandem, the conversion of food waste into greywater occurs within 24 hours and the resulting effluent is passed through a locally designed wastewater treatment system for the end product to be suitable for reuse or for safe discharge into sewers.

The food waste digester comes equipped with in-built load cells and can be connected to a Cloud-based portal, which allows users to quantify the amount and record the origin of food waste deposited into the digester. Basic data is stored and accessed on the control panel while advanced data analytics can be obtained via the Cloud-based portal. Users can select the Cloud-based portal option to compare waste data across all their sites via a single portal. The portal provides real-time notifications of the system's performance, leading to faster service response time.





Winnows Solutions

Developed in the UK, Winnow Solutions' smart food meter tracking system allows users to measure food waste in their kitchens and from the customers' plates. The system is able to track the amount and types of food discarded. With pre-programming from the user, the system is also able to indicate the associated monetary value of the food that is disposed of. Through tracking the volume and value of food waste disposed, the system aims to raise awareness of food wastage and spur users to adopt changes to reduce their food waste generation.

The smart meter system incorporates an electronic scale and an accompanying tablet app which is linked to a computer. The tablet enables staff to log food that is thrown away via tapping on customisable pre-defined categories. Thereafter, the food waste date is uploaded to Winnow's cloud platform to be aggregated and analysed. The resulting analysis can be sent to chefs via daily reports detailing the top areas of waste by value.

The obtained information provides users the insight needed to make adjustments to their operations. For instance, restaurants can adjust their purchase of ingredients accordingly to avoid over-purchasing, which could help save up to 50-60% of ingredient costs, adding up to significant savings for the user.

ANNEX 3

Guidelines on Food Donation

A public health document prepared by:

National Environment Agency
Safeguard · Nurture · Cherish

Intended Audience	All organisations who intend to donate, prepare, cook and/ or transport food for the needy.
Legal Status	This guideline should be read in conjunction with legislation and is intended to help people comply with the law and regulations, where applicable.
Last Review Date	24 Oct 2016

INTRODUCTION

In Singapore, the donation of food to the needy by various organisations (e.g. food manufacturers, F&B retail establishments, non-governmental/profit, organisations, etc.) may consist of the following operations:

a) donating/collecting and redistributing pre-packed (not easily perishable) food items (e.g. canned food, instant noodles, rice, flour, sugar, dry beans, salt, jam, sauce) and perishable food items (e.g. bread, cakes and pastry);

b) preparing and cooking food;

c) transporting donated food to recipients.

Responsible organisations should ensure the wholesomeness of food donated and prepared so that recipients can benefit from the donated food.

This set of guidelines serves to assist organisations in providing safe food to the needy. Food that is not wholesome or prepared unhygienically can cause people who consume it to come down with foodborne illness. As the sick, young, old and expecting women have lower immunity, they are more susceptible to foodborne illnesses. Hence it is important to exercise care when food is served to people with lower immunity.

GUIDELINES

A. Donation/Collection and Redistribution of Pre-packed (not easily perishable) and Perishable Food

1. Visually inspect the food to ensure that it is in a clean and wholesome condition. If in doubt, discard the food.
2. Pre-packed (not easily perishable) Food
   i. Examples of pre-packed (not easily perishable) food include canned food, instant noodles, rice, flour, sugar, dry beans, salt, jam, sauce, etc.
   ii. Only accept and redistribute pre-packed (not easily perishable) food in their sealed original enclosed packaging (properly labelled with food name, ingredients and expiry date). Ensure they are not expired and in good condition.
   iii. Discard:
      a. Food with mould, odd smell, discolouration, unusual product appearance/separation, and/or signs of insect infestation.
      b. Food in cans that are swollen/bulging, deeply dented, rusty, leaking and/or with improperly formed or defective seam. A deep dent on a can often has sharp points and could affect the integrity of the can.
      c. Food in glass or plastic containers with bulged, loose or crooked cap, leaks (e.g. stained label), cracks or chips on the containers.
3. Perishable Food
   i. Bread, Cakes and Pastry
      a. Limit redistribution to non-cream cakes, pastry without fillings and plain bread.
      b. If expiry date is not provided, only collect and redistribute bread and pastry that are produced on the day of collection. It is recommended that organisations check and verify with donors that the donated baked items are produced on the same day of collection.
   ii. Fresh Produce
      a. Examples of fresh produce include shell eggs, vegetables, fruits and meat etc.
      b. Upon receipt, check the colour and smell of the fresh produce. Chilled meat to be received and maintained at 4°C and below and frozen meat to be received and maintained at -12°C and below.
      c. Discard:
         - Fresh produce that are mouldy, slimy, dried out, wrinkled, smell bad, and/or with excessive bruises/scars/soft spots.
         - Potatoes that are green.
         - Raw meat that is discoloured, gives out rotten meat odour and/or with significant amount of blood/liquid found in the package.

B. Preparation and Cooking of Food

1. The kitchen should have/be:
   i. Adequate number of sinks with potable water for the purpose of food preparation and washing.
   ii. Proper hand washing facilities with soap and paper towels provided for all food handlers.
   iii. Adequate working space for proper handling and segregation of raw and cooked food.
   iv. Adequate refrigeration and cooking equipment.
   v. Adequate pedal-operated refuse bins lined with plastic bags.
   vi. Pest-proof with proper pest management.
   vii. Cleaned before and after food preparation.
2. Safe Food Handling Practices:
   i. Training
      a. It is recommended that persons involve in food preparation undergo the Workforce Skills Qualification (WSQ) on Basic Food Hygiene Course to learn and practise good hygiene and food safety measures.
   ii. Personal Hygiene
      a. People who are ill should not handle or prepare food. Any cut on the hand should be covered by a clean, brightly-coloured bandage.
      b. All food handlers should wash their hands:
         - After using the toilet
         - Before starting work
         - After handling raw food
         - Before handling cooked/ready-to-eat food
         - After cleaning duties
         - After handling waste
         - In between tasks
      c. Do not use bare hands to handle cooked/ready-to-eat food. Wear clean disposable gloves or use clean utensils to handle cooked/ready-to-eat food. Change gloves regularly, especially after different tasks and when they are torn or soiled. Clean clothing should be worn by food handlers.
      d. Food handlers should refrain from behaviour that could cause contamination to food, for example, smoking, spitting, eating, sneezing or coughing when handling or preparing food.
      e. Jewellery and accessories should not be worn when handling or preparing food.
      f. No personal belongings should be kept in production areas.
   iii. Food Storage
      a. Pre-packed (Not easily perishable) Food
         - Store pre-packed (not easily perishable) food items in a designated storage place according to the instructions on the product label or by the manufacturer.
         - Keep doors, windows and roofs well sealed to prevent pest entry.

- Place the food products in a first expired first out (FEFO) manner, so that food with the nearest expiry date is always used/ distributed first.
- Store food 15cm from the floor and away from the walls, e.g. store on shelves or racks to carry out easy cleaning.
- Store non-food items, such as liquid soap, detergent and pesticides, separate and away from food items.
- Clean the storage area, including the floor and shelves, regularly.
- Perform periodic checks (e.g. monthly) to ensure all food products are safe for use. Expired food products should be disposed of immediately.

b. Fresh Produce

- Store frozen food in a freezer at -12°C or below.
- Store chilled food in a chiller at between 0°C and 4°C.
- Check temperature of the chiller and freezer regularly.
- Always store raw food below cooked/ready-to-eat food to prevent juices from raw food dripping onto cooked/ready-to-eat food.
- Do not over-stuff the chiller and freezer.
- Clean and maintain chiller and freezer, including the rubber lining regularly.

iv. Food Preparation

a. Thaw frozen food:

- in the chiller
- in the microwave oven
- in their original sealed packaging under running water

b. Do not refreeze thawed food.

c. Use different colour-coded utensils, chopping board and knives for handling raw/ uncooked food and cooked/ready-to-eat food.

d. Wash all vegetables and fruits properly, especially if these are to be eaten raw.

e. Do not prepare food on the floor or in the toilet. Water from the toilet should not be used for food preparation.

v. Cooking

a. Cook food thoroughly. Cook meat to an internal temperature of 75°C.

b. Reheat food thoroughly before serving. Cooked food should not be reheated more than once.

c. Cover cooked/ready-to-eat food.

d. Place cooked/ready-to-eat food in clean containers or packages.

vi. Cleaning

a. Thoroughly wash and sanitize surfaces that have come in contact with raw food.

b. Clean all food contact surfaces, utensils, cutting boards and crockery before and after each task.

c. Dispose refuse in a pedal-operated refuse bin lined with plastic bag.

d. Empty refuse bin when it is three-quarter full and at the end of the day's operations.

C. Transportation of Donated Food to Recipients

1. Food Transport Vehicle
   i. Transportation vehicle should be clean and should not be used to transport animals, hazardous chemicals or detergents, together with the food.
   ii. Clean the transportation vehicles before and after every use.
2. Transportation of Raw Food Items
   i. Maintain chilled meat at 4°C and below and frozen meat at -12°C and below.
3. Transportation of Cooked/Ready-to-eat Food
   i. Food should be stored in clean containers.
   ii. Avoid transporting cooked/ready-to-eat food together with raw food items.
   iii. Keep hot food above 60°C and cold food below 5°C. Food needs to be transported within the shortest time possible to reduce microbial growth
   iv. If cooked food is kept in the temperature danger zone of between 5°C and 60°C, the food should not be served after 4 hours of cooking.

It is important that donors and recipients play their part to ensure overall food safety in the food donation supply chain. Key responsibilities of each party include the following:

1. Donors: Ensure that information on the source and condition of donated food, as well as measures to ensure its safe consumption is properly communicated to recipients. Ensure that donated food is held at appropriate temperatures and transported within the shortest time possible.
2. Recipients: Check the condition of the food upon receipt. Request for information on its source as well as measures to ensure safe consumption if they are not available.

For latest updates on the guidelines, please refer to NEA website.