Food Waste Minimisation Guidebook FOR FOOD MANUFACTURING ESTABLISHMENTS

AVA
Agri-Food & Veterinary Authority of Singapore

National Environment Agency
Safeguard · Nurture · Cherish

Published on: 1 November 2017

ACKNOWLEDGEMENTS

This Food Waste Minimisation Guidebook for food manufacturing establishments is developed by NEA and AVA, with inputs from various stakeholders. This Guidebook outlines steps that different stakeholders can take in embarking on their food waste minimisation journey.

NEA and AVA would like to thank all the organisations which have contributed insights aiding the development of this guidebook.

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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 generated in Singapore has increased by about 40% and is expected to further increase with our growing population and economic activity. In 2016, 791,000 tonnes of food waste was generated in Singapore and this accounted for 10% of total waste. Only 14% of food waste generated was recycled and the rest of the food waste was disposed of at the 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 reduce the unnecessary depletion of food supplies, thereby enhancing food security in Singapore.

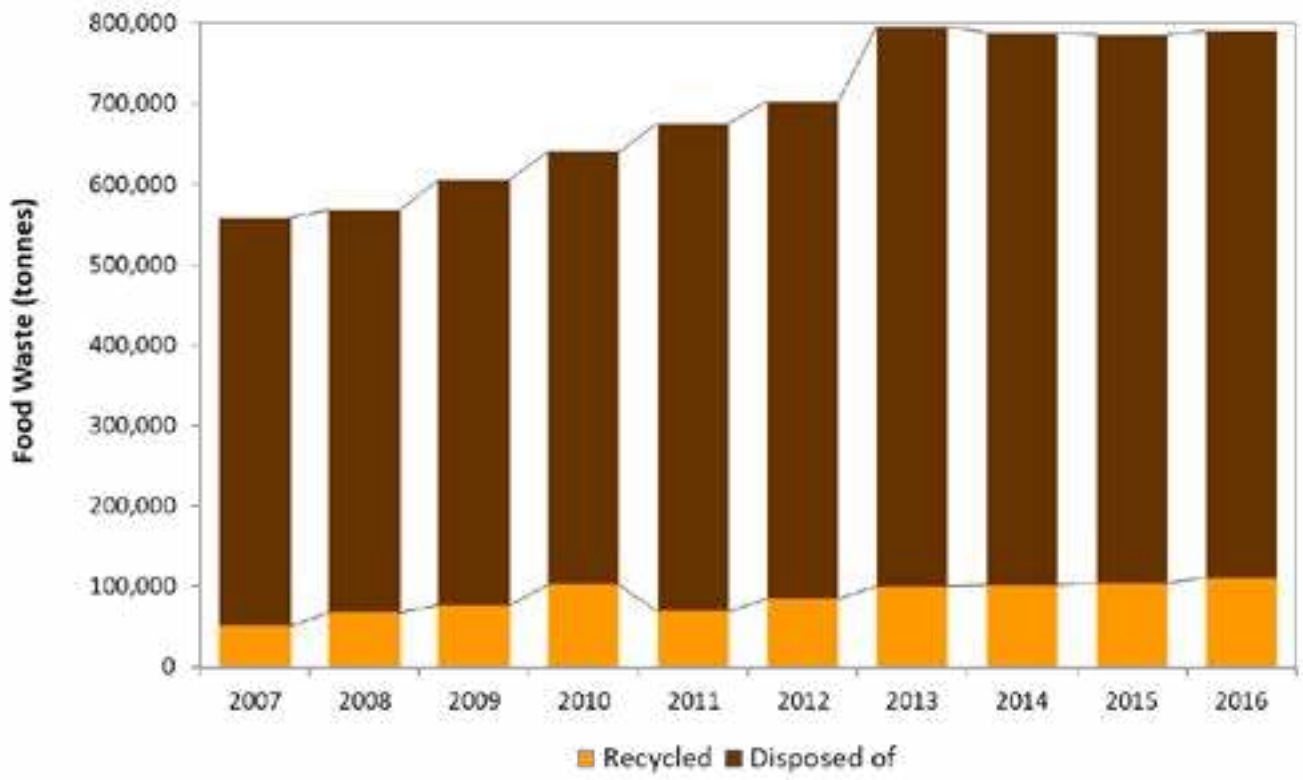

Figure 1: Food waste statistics and recycling rates

WHY SHOULD BUSINESSES CARE

ECONOMICS

Identifying the sources of food waste can uncover inefficiencies in the supply chain, such as the wastage of raw materials. For businesses, it makes economic sense to reduce wastage of raw materials that are bought. Apart from material cost savings, companies also save on disposal fees. These ultimately translate to an increase in profits.

SOCIAL

In Singapore, there are about 105,000 households earning below $1,500 a month[1]. Some of these households may face difficulties in securing adequate food supply. Thus, in a bid to maximise the utilisation of precious food resources, food manufacturers 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. As a land-scarce country, it is not sustainable to allow food waste to grow uncurbed in Singapore. 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 manufacturing establishments in Singapore contribute to protecting the environment by minimising food waste.

With the guidelines presented in this Guidebook, food manufacturing establishments should be able to develop their own food waste minimisation plan to suit their business needs and benefit from the resultant cost savings from reducing food waste disposed of.

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.

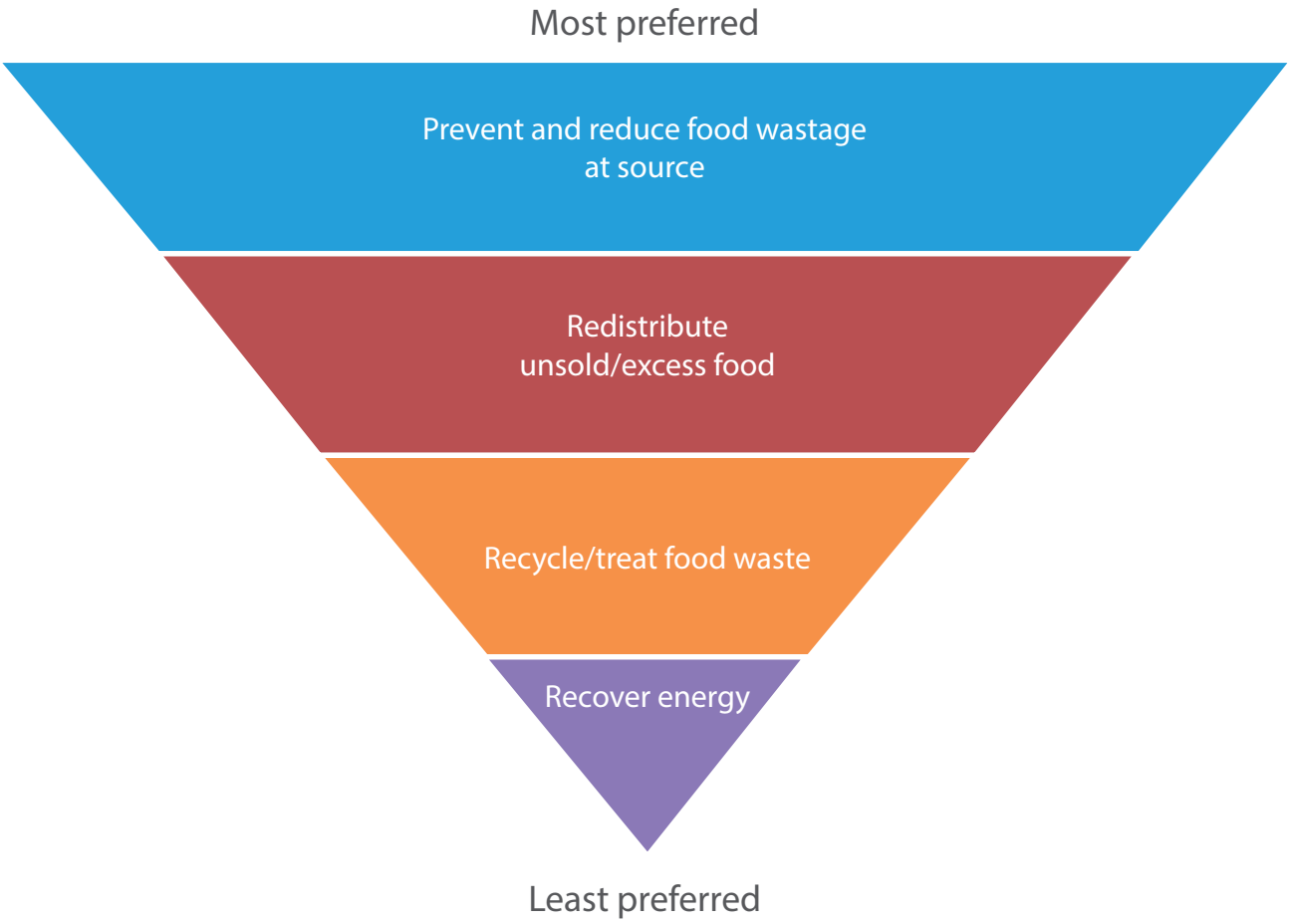

Figure 3: Food waste management hierarchy (Image: NEA)

CHAPTER II: REDUCE

This chapter will outline how food manufacturing establishments can reduce food waste throughout the manufacturing process across the different steps as listed below.

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

1. PLANNING

- Conduct waste audit
- Assess the cost of food waste
- Take action to reduce waste

CONDUCT WASTE AUDIT

Before a meaningful food waste minimisation plan can be developed, a baseline waste audit would need to be conducted to analyse the composition of the food waste and allow food manufacturers to pin-point the main sources and reasons for food wastage. Once the sources and causes are identified, the food manufacturers 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 manufacturing operations e.g. storage, processing, packaging and distribution processes could be set up to conduct the waste audits.

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 food processing.
- Identify the reasons for the food waste e.g. whether it is excess food from over-production, trimmings of edible parts due to customer stringent specification, 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 manufacturers may refer to the Food Loss and Waste Accounting and Reporting Standard by World's Resource Institute.

Some information on smart food waste tracking systems can be found in Annex 2.

ASSESS THE COST OF FOOD WASTE

By assessing the cost of food waste, food manufacturers 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.

2. Fresh Food Costs

Assess the average cost per kilogram of food ingredients from a sample set of invoices and multiply the cost by the weight of the food wasted.

3. 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.

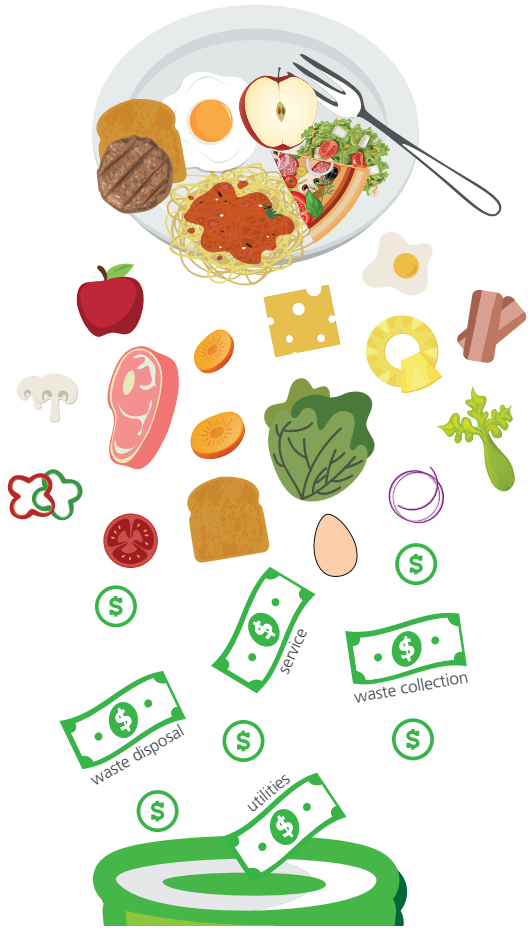

Figure 5: The true cost of food waste is higher than what it appears to be.

The total sum of these 3 costs is the true cost of food waste. After quantifying the cost components of food waste, food manufacturers can develop a well-defined plan to tackle the issue.

TAKE ACTION TO REDUCE WASTE

STAFF TRAINING & PERFORMANCE MANAGEMENT

It is important to set food waste reduction goals and communicate them to your employees. The set targets can motivate employees to reduce food waste and enable the tracking of food wastage reduction.

Some companies may want to consider making food waste reduction a key performance indicator for department-level and employee-level evaluations. Doing so can help incorporate food waste reduction as part of corporate expectation and culture. Food manufacturers can also consider incorporating food waste reduction practices into their Standard Operating Procedures (SOP).

In addition, food manufacturers should provide adequate staff training in the areas of food storage and handling. Having good knowledge of product shelf life and quality control could help to prevent food waste. Staff could also be trained to maintain high standards of hygiene for storage and work areas. These areas should be cleaned regularly to prevent pest infestation.

INVENTORY MANAGEMENT

Research has shown that much food is wasted due to poor inventory management which may result in the 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.

Manufacturers can also take into consideration to purchase food just before use. This prevents food from turning bad when it is kept in storage, while ensuring that the food remains fresh.

Figure 6: Proper inventory management is important for reducing food waste

2. 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 delivery to ensure that the food delivered is of high quality and ensure that the food is kept within a safe temperature range and properly handled during delivery. Ensuring that food is safe and handled under suitable conditions prevents premature spoilage and potential food poisoning.

LABEL UPON RECEIVING

Food manufacturers can consider labelling food once it is received. Labels should include the product description, date of receipt, expiry date (where applicable)[2] 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[3]. For cooked food, hot food should be kept at above 60°C and cold food below 5°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 manufacturers 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.

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.

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[2] *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-businesses/aguidetofoodlabellingandadvertisementsversionjuly2)*

[3] *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)*

3. FOOD PROCESSING

- Reduce wastage of raw materials

REDUCE WASTAGE OF RAW MATERIALS

Losses during food processing include food trimmings of both the edible parts (i.e. skins and peels) and inedible parts (i.e. bones) of fresh produce. For example, in the meat industry, the lack of demand for certain parts of the meat (i.e. offal) contributes to food wastage.

Companies can reduce food trimmings as much as possible, whether through the use of machines or through other means. Some companies also adopt the use of technology in their processes or embark on new innovation for the trimmings to minimise wastage of their products.

Case Study - Heinz

H. J. Heinz, an American company, redesigned its sauce packing process by filling machines through immediate holding tanks rather than using lining bags. This reduces sauce wastage while saving plastic packaging during the manufacturing process.

Figure 7: Food processing of chicken.

4. PACKAGING

- Protect product down supply chain
- Safeguard product quality for consumers
- Packaging to reduce consumer wastage

PROTECT PRODUCT DOWN SUPPLY CHAIN

Aside from production, food waste may also be generated as products move along the supply chain. Food manufacturers can reduce the amount of wastage down the supply chain by ensuring food is protected through prudent use of packaging. Use of appropriate transport packaging can keep food fresh for longer periods, protect the product and even extend its shelf-life.

One example of such packaging is aseptic packaging, which is sterilized prior to filling with Ultra High Temperature (UHT) treated food. Food manufacturers can also consider using more durable, rigid containers to transport products as they offer better protection against mechanical injury.

SAFEGUARD PRODUCT QUALITY FOR CONSUMERS

Food manufacturers also have the ability to help consumers reduce food wastage further down the supply chain. By designing products with re-sealable packaging, manufacturers allow products, once in the hands of consumers, to retain their freshness and palatability for longer. This reduces the likelihood of households disposing of products due to deteriorated quality.

Examples of re-sealable packaging include zip-lock bags and pouches and screw top jars.

Figure 8: Re-sealable packaging allows food to retain its best quality

Food manufacturers can constantly look out for new packaging materials available on the market. New innovative packaging methods or materials could help to increase shelf-life and lifespan of perishable food items and reduce food wastage.

Food manufacturers can also provide detailed storage information to ensure the quality of their products. Storage advice such as where and how to store their products could be printed on product packaging for consumers' reference. Improved food storage practices can prolong the quality and shelf-life of products.

Case Study - National University of Singapore (NUS)

NUS researchers have created a new packaging material similar to the plastic used in cling wrap or zip-lock bags from natural ingredients like grapefruit seed extract and chitosan, a biomaterial derived from the shells of crustacean[4]. The inherent anti-microbial properties of these materials help to extend the shelf-life of food products and minimise food wastage.

PACKAGING TO REDUCE CONSUMER WASTAGE

Food manufacturers can consider creating products with materials that reduce wastage by consumers. A start up, LiquiGlide, developed a slippery coating that can be coated on the insides of bottles and containers[5]. The coating allows food such as leftover sauces to be emptied easily. Manufacturers can consider such technologies as they also enhance customers' experience.

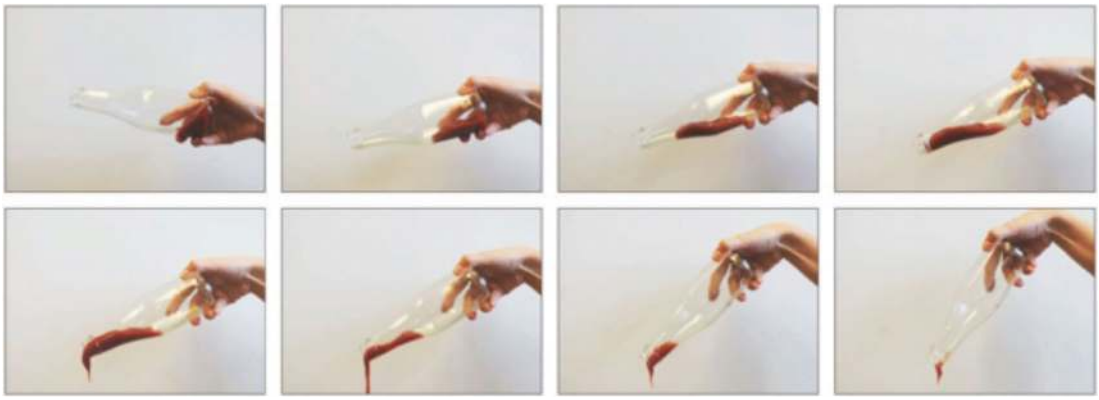


Figure 9: LiquiGlide's coating allows all food to be used up

More product packaging sizes could also be made available to meet the demand of different consumers. For instance, instead of providing a standard packaging size, there could be smaller packaging options to cater for smaller households. In this way, consumers can opt to buy smaller quantities instead of purchasing the standard amount, which could result in food wastage when they are unable to finish consuming before the food expires.

[4] *Channel NewsAsia, "NUS researchers create new biodegradable packaging material," 22 February 2016. [Online]. Available: http://www.channelnewsasia.com/news/singapore/nus-researchers-create/2536998.html.*

[5] *R. Lingle, "LiquiGlide gives foods the slip to reduce waste," 25 February 2013. [Online]. Available: http://www.packagingdigest.com/food-packaging/liquiglide-gives-foods-slip-reduce-waste.*

5. DISTRIBUTION

- Adopt cold chain management
- High standards of hygiene

ADOPT COLD CHAIN MANAGEMENT

Food manufacturers can employ cold chain management across the supply chain. The cold chain is a temperature controlled supply chain that can be used to help extend and 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 and frozen food.

It is recommended for food manufacturers 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.

HIGH STANDARDS OF HYGIENE

It is important for manufacturers to ensure the cleanliness of delivery vessels during the transportation of food. For example, food manufacturers could conduct regular hygiene inspections on delivery vehicles and ensure that a high standard of hygiene is maintained in the transportation of food.

Figure 10: Regular inspection of delivery vans and trucks is important for ensuring hygiene

Maintaining a high standard of hygiene gives food products a longer shelf-life by preventing food from spoiling prematurely and safeguarding the quality of the goods. This would result in lower rejection rates by retailers, and ultimately a reduction in the amount of food waste generated.

PARTNERSHIP

In addition to working on improving their work processes, food manufacturers may also partner other stakeholders to reduce, redistribute or recycle food waste generated.

Figure 11: Food manufacturers can collaborate with various parties to reduce food waste

GOVERNMENT

Food manufacturers 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 manufacturers 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 & RETAILERS

Food manufacturers can collaborate with their retailers downstream on demand forecasting and suppliers upstream on inventory planning to avoid the need to keep buffer stock on hand to cope with the volatility and uncertainty of demand for products. Through closer working relationships with retailers, food manufacturers can better plan their production and reduce the risk of overproduction as this could result in food wastage.

Likewise, closer collaborations with suppliers could allow food manufacturers to obtain production supplies more readily when required instead of overstocking in advance. Ordering supplies only when needed could prevent wastage of ingredients that are thrown away when they are unused or turned bad during storage.

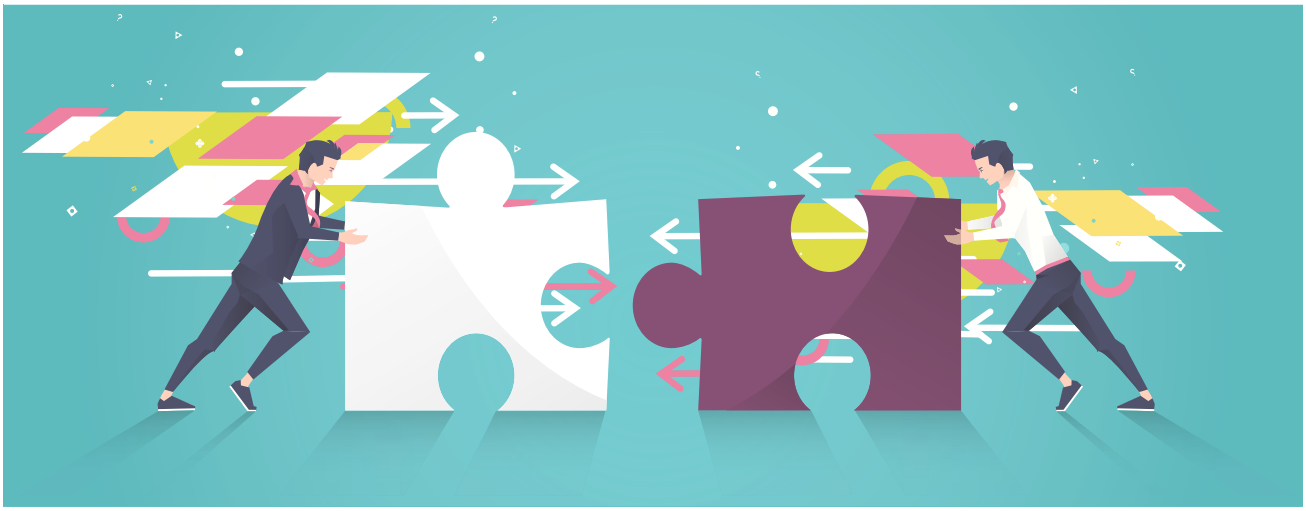


Figure 12: Closer collaboration with suppliers and retailers reduces uncertainty

CHAPTER III: REDISTRIBUTE

FOOD DISTRIBUTION ORGANISATIONS

Food manufacturers can also look to partner food distribution organisation to reduce food waste effectively by donating excess food products (e.g. unused canned food, surplus perishables nearing their expiry date) to the needy. Sometimes, products that get returned to manufacturers due to them not meeting certain specifications could also be donated if they are still edible.

A few food distribution organisations are listed below:

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

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

CHAPTER IV: RECYCLE

- Food waste recycling companies
- Food waste treatment system suppliers

FOOD WASTE RECYCLING COMPANIES

While food manufacturers try to reduce food waste and redistribute unsold and excess food as much as possible, some waste is inevitable. There are times when food items cannot be donated for human consumption. In such cases, food manufacturers can consider the recycling of homogenous food waste into animal feed. Animal feed manufacturers must obtain a feedmill license from AVA and are responsible in ensuring that their ingredients (including recycled food waste), manufacturing process and end products are suitable and safe for consumption as animal feed.

A list of local food waste recycling companies is included in the table below. Please refer to the NEA website for an updated list of contacts.

Food waste recycling company	Acceptable types of food waste	Contact
Bee Joo Industries Pte Ltd	Spent Grains, soybean waste and rejected milk powder	Mr Tan Jing Yuan Tel: 6536 2489 Email: jingyuan@ecowise.com.sg or enquiries@ecowise.com.sg Website: www.ecowise.com.sg
Eng Cheong Leong Agri Chem Pte Ltd	Bread waste	Mr Tay Tho Bok Mr Kao Yu-Hui Tel : 6863 6118 / 6268 1185 Email: eclac@singnet.com.sg

FOOD WASTE TREATMENT SYSTEM SUPPLIERS

Aside from food waste recycling companies, manufacturers can look to installing on-site food waste treatment systems to manage non-homogenous food waste. These systems convert food waste to non-potable water or compost/fertiliser, helping manufacturers to cut down on disposal costs.

Listed below are some companies which offer food waste management systems and technologies that may help companies to address their challenges with food waste. 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 system which operates in Singapore. Users should refer to the NEA Food Waste Management webpage for the updated contacts of the suppliers.

CONCLUSION

Food waste in Singapore has been increasing over the years, and food manufacturers have the potential to reduce food waste along their supply chain. This guide was developed to support food manufacturers in the formulation of their own step-by-step food waste minimisation plan. With a better understanding of the areas which can be focused on to minimise food waste, food manufacturers would be better equipped to share knowledge with, reach out and engage their stakeholders and partners to help minimise food waste in Singapore.

CHECKLIST

1. PLANNING

- Conduct waste audits
- Assess the cost of food waste
- Take action by motivating staff and managing inventory

2. STORAGE

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

3. PROCESSING

- Reduce wastage of raw materials

4. PACKAGING

- Package products such that they are protected down the supply chain
- Package products to safeguard product quality for consumers
- Package products such that they reduce wastage by consumers

5. DISTRIBUTION

- Adopt cold chain management
- Ensure high standards of hygiene during transportation

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 options

REFERENCES

1. National Environment Agency, Food Waste Management, [Online]. Available: http://www.nea.gov.sg/energy-waste/3rs/food-waste-management
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. LeanPath, "Short Guide to Food Waste Management Best Practices".
5. Winnow Solutions, [Online]. Available: http://www.winnowsolutions.com/.

ANNEX 1

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):

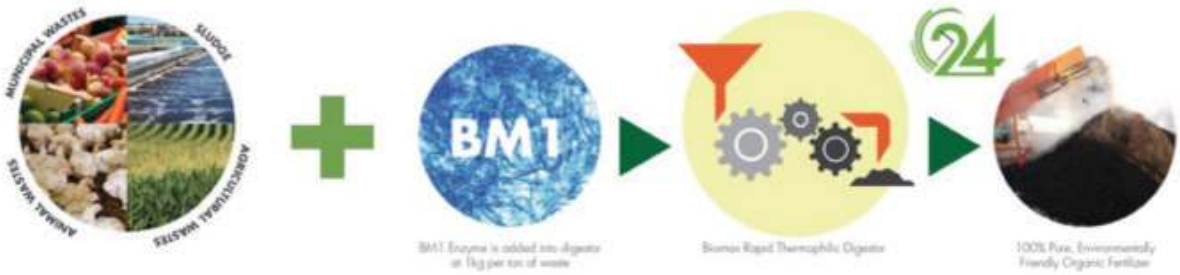
ANNEX 2

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.

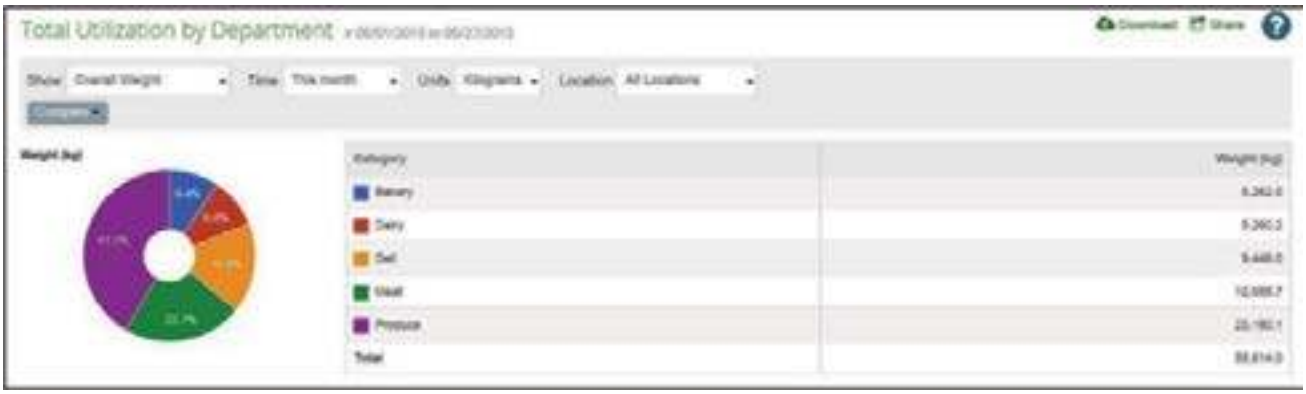
The ecoDigester system has been adopted in more than 20 developments, which includes mixed development malls, schools, hotels, supermarket chains, hawker centre etc. Some examples are JEM, Changi Airport, Amara Singapore and 100AM, Mandarin Orchard, Singapore Polytechnic, Resorts World Sentosa, several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

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.