



GREAT LAKES LEARNING

LESSONS & ACTIVITIES BASED ON THE
MONTHLY GREAT LAKES NOW PROGRAM

EPISODE 2306 | FOOD WASTE

COMBATTING FOOD WASTE



OVERVIEW

This lesson will explore a variety of topics related to food waste. They'll gain insights into the reality of food waste, research efforts in their local communities to combat it, and conduct an experiment to investigate the impact of food storage methods on food waste.

LESSON OBJECTIVES

- **Know** current statistics and facts about food waste
- **Understand** how different food storage methods preserve food or accelerate waste
- **Be able to** identify efforts in the local community to address the problem of food waste

WHAT YOU'LL NEED

- Computer or mobile device with Internet access to view video and online resources
- Notebooks and pencils
- Chart paper
- Sticky notes
- Markers
- Lab supplies (see individual activities for a full list)
- Copies of the Student Handouts

INTRODUCTION

The Environmental Protection Agency (EPA) estimates that in the United States roughly one third of food intended for human consumption ends up as food waste. That's a big problem, because when food is discarded, all the inputs used in producing, processing, transporting, preparing, and storing food are wasted and carbon dioxide is produced, sometimes in vain. And when food waste ends up in landfills, it rots and creates methane - a harmful greenhouse gas that is a major contributor to climate change. So what can be done to curb food waste, or prevent it in the first place?

This lesson includes multiple activities, including lab activities, that can span the course of several sessions or be adapted to fit the needs of your group's meeting format.

Some prior knowledge* with which students should be familiar includes:

- states of matter
- properties of matter
- chemical and physical change
- chemical reactions
- climate change and the greenhouse effect



Follow this QR Code or hyperlink to the [Episode Landing Page!](#)

**Check out our full collection of lessons for more activities related to topics like these.*

****The sequence of these activities is flexible, and can be rearranged to fit your teaching needs.**

NGSS CONNECTIONS

Phenomenon: Food Waste

- | | |
|-------------|---------|
| • MS-PS1-3 | • SEP 2 |
| • MS-ESS3-3 | • SEP 3 |
| • MS-ETS1-1 | • SEP 4 |
| • MS-ETS1-2 | • SEP 6 |
| • MS-ESS3-4 | • SEP 7 |

During the course of the lesson, students will progress through the following sequence** of activities:

- Class discussion to elicit and activate prior knowledge about **food waste**
- Teacher notes on the statistics and facts of **food waste**
- Watch a segment from *Great Lakes Now*
- Class discussion to debrief the video
- Experiment with chemistry by baking with limited ingredients
- Research local efforts to address food waste
- Investigate the impact of different food storage methods on food preservation
- Read about **efforts in Ohio to reduce food waste**

The lesson progresses through three major sections: **launch, activities, and closure**. After the launch of the lesson, you are ready to begin the lesson activities. Once finished with the activities, students will synthesize their learning in the closure. You can select the activities that are best suited for your learners and teaching goals, and then sequence them in a way that makes sense within your learning progression and the scaffolds of the lesson.

If you use this lesson or any of its activities with your learners, we'd love to hear about it!

Contact us with any feedback or questions at:
GreatLakesNow@DPTV.org

LESSON LAUNCH

A. Warm Up

The warm up is intended to be structured as teacher-facilitated, whole-group student discussion activities. It helps students to begin thinking about the topic at the center of the lesson.

1. Ask students to list out on a piece of paper five things that come to mind when thinking of **food waste**.
2. Have students pair up with a partner to share their five ideas with each other. If any ideas appear on both lists, have students circle those.
3. Then, engage students in a whole-group discussion to ask them to share any ideas that were circled.
4. Generate a list of the circled ideas.
5. Ask for volunteers to share any ideas that were not circled that they think are really important to include in this topic.
6. Generate a separate list of those ideas.
7. At the end of making the two lists, have students copy down one single list of all the circled ideas and important ideas in their notebooks or on their paper.
8. Ask students individually to rank the ideas in the list from most to least relevant.
9. Ask for some students to share which term should be most relevant and why they think that is. Engage the whole group in discussion to arrive at consensus about the most relevant idea related to **food waste** that they already know about or that came to mind during this exercise.



B. Bridge to Learning

Activate prior knowledge and get students thinking about the composting of various foods with the following demonstration:

1. Gather various foods (or photos of the foods) that are ideal for composting, including fruits, vegetables, eggs, coffee, tea, rice, and bread. Add a few non-ideal-to-compost foods such as meat, fish, cheese, and processed foods with preservatives or artificial ingredients.
2. Show the food items to students one by one, randomizing the order in which they're shown to the students.
3. Ask the class to vote whether each food is compostable or not-compostable
4. Sort the food items (or photos of the foods) into two groups—compostable and non-compostable—based on the students' responses.
5. Conclude by revealing the correct categorization for each food item and regrouping any misplaced items.

C. Notice and Wonder

Have students complete the **Notice and Wonder** student handout for the two groups of food items after they have been corrected. With a partner, and their notice and wonder handout, have them discuss the question: **what makes something compostable?** Then, solicit ideas from several students until the group reaches consensus about a working definition for compostable. Explain to them what makes something compostable and why certain foods are in each category, emphasizing that most organic food waste, including processed foods, can be composted, but that some exceptions for certain chemical additives, dairy, meat, and oils exist because it has an adverse effect when composting.

D. Background Information Notes

Explain that we are about to learn more about composting and how it reduces food waste. Then provide **Teacher Background Information** on food waste.

TEACHER BACKGROUND INFORMATION

by Gary G. Abud, Jr., *Great Lakes Now Contributor*

**This information can be presented by the teacher as notes to students at the teacher's discretion.*

Have you ever heard of the "clean plate club?" It's a phrase that refers to when someone leaves no leftovers on their dish after finishing their meal. It's basically when no food goes to waste. But unfortunately, the majority of us waste a considerable amount of food on a regular basis—despite our best efforts to the contrary.

Food waste can vary significantly from one country to another in the industrialized world, but general trends emerge all over. Cultural attitudes, economic factors, infrastructure, consumer education, and government policies all contribute to food waste levels; however, portion sizes, income levels, supply chains, consumer awareness, and supportive regulations play significant roles in reducing waste.

Organizations like the United Nations' Food and Agriculture Organization (FAO), the Environmental Protection Agency (EPA), and other research institutions often conduct studies and provide estimates to compare food waste levels globally. In the U.S. alone, 30-40% of the food supply goes to waste annually, amounting to 133 billion pounds (e.g., 60 million metric tons) of food at a value of \$161 billion. Household waste contributes to 21% of that total, while retail and food service sectors account for 40%. This level of food waste poses significant economical challenges and has detrimental environmental effects, including greenhouse gas emissions and resource depletion. Despite its potential, only 10% of food waste is currently being recovered, while a considerable portion of the population experiences food insecurity.

Efforts to mitigate food waste, while simultaneously addressing food insecurity and environmental impact are under way, including the utilization of 'imperfect foods' for the needy, meal planning, improved food storage, and composting among others.

Composting is a natural process that breaks down organic materials, including food waste, into nutrient-rich soil known as compost, which can then be used for gardening or farming. Composting helps eliminate food waste in several ways.

When food waste is sent to landfills, it not only takes up space that non-compostable garbage could use, but the food itself decomposes anaerobically (e.g., without oxygen), producing methane, a potent greenhouse gas. By composting food waste, it is diverted from landfills, reducing methane emissions and the strain on landfill capacity.

Composting also allows food waste to be transformed into compost, which is rich in nutrients. This compost can then be used to enrich soil in gardens, farms, and landscaping, providing valuable nutrients to plants and reducing the need for chemical fertilizers and recycling nutrients.

Since compost can help improve the quality of soil, it in turn can lead to increased plant growth, which then captures more carbon out of the air—known as sequestration—and improves the overall health of an ecosystem, its soil, and reduces atmospheric greenhouse gases.

Since most foods can break down naturally and contribute to nutrient recycling in soil, composting is an effective way—whether done individually or at a large scale by a municipality or an organization—to reduce food waste, promote sustainable practices in the ecosystem, and support the health of the environment.

Ultimately, addressing food waste needs to be done in a all-around approach that includes measures to prevent excess food in the first place, as well as sustainable responses to the food that does go to waste in homes and businesses.

ACTIVITY 1: WATCH A GREAT LAKES NOW SEGMENT

This activity is a video discussion of a *Great Lakes Now* episode segment.

First, inform students that they will be watching a *Great Lakes Now* segment discussing a Cleveland organization's effort to fight food waste. During the video they need to jot down four things they took away from the video using the **4 Notes Summary Protocol**.

Then, if students are not already familiar, introduce them to the 4 Notes Summary Protocol, which they will use after they finish watching the video, where they write down one of each of the following notes:

- **Oooh!** (something that was interesting)
- **Aaah!** (something that was an ah-ha moment)
- **Hmmm...** (something that left them wanting to know more)
- **Huh?** (a question they have afterward)

Next, have students watch the segment from episode 2306 of *Great Lakes Now* called [**Battling Food Waste for People and the Planet**](#).

Last, have students complete their individual 4 Notes Summary and then discuss those in groups of 3-4 students.

Post-Video Discussion

After the groups have had time to go over their 4 Notes Summaries, invite a handful of students to share out some of their notes, eliciting at least 1-2 of each of the 4 Notes and listing those somewhere for the whole group to see.

Ask students to turn back and talk with their groups to make connections between the *Great Lakes Now* video and what they remember from the warm-up activities.

How is what we saw in the video related to what we discussed earlier during the lesson launch activities?

After giving the groups some time to talk, bring the whole group back together for a shareout and discussion of ideas.

In this culminating discussion, the goal is to help students make connections between the video segment and what they discussed during the launch activities earlier in the lesson about what they knew about **food waste**.

Once the discussion finishes, have each student write a "**Sum It Up**" statement in their notebooks. This is a single sentence that captures the big idea of what was just learned.

Have 2-3 students share out their **Sum It Up** statements before concluding this activity.

Teaching Tip: Use the Student Handouts to help students organize their thinking in writing around each of the lesson protocols.

ACTIVITY 2: READ ABOUT CLEVELAND'S CIRCULAR ECONOMY

In this activity, students will read about initiatives like Circular Cleveland that are promoting a circular economy to create jobs, reduce waste, and improve the environment by advocating for policies that encourage sustainable practices like reuse, recycling, and remanufacturing at the state and national level.

In this activity, students will use a **Think Pair Square Protocol** for discussing what they will read about this very topic.

First, have students partner up and distribute the article [Circular Economy Programs Aim to Reduce Waste and Build Jobs](#) by Lee Chilcote of *The Land*. Allow time for students to individually read the article, and have them jot down three things they took away from the article using the **Rose Thorn Bud Protocol**—in their notebook or using the handout.

Then, give students time after reading to discuss the article that they read with their partner. Have students share their rose, thorn, and bud with each other, including how those points connect to each other. The pair should come up with a statement to summarize all of their article takeaways.

Next, have two student pairs join up, standing near each other to form the four corners of a square, to discuss the article and what they talked about in their pairs. Encourage them to come to a consensus about which point they found most important or interesting in the article.



Last, have each group craft a summary statement of the most important point from their discussion and ask for a volunteer in each group to share that key point with the whole group. As student groups share their most important point, record their ideas on the board and have students copy the list of student ideas down into their notebooks. Once the shareout is complete, ask students to return to their groups and discuss one last question based on the article:

How can the so-called "circular economy" help address the issue of food waste in our communities?

You can keep this as a class discussion based on the article itself, or this can be extended into a writing assignment, presentation project, or further research on the topic to allow students to engage more deeply with the issue.

Teaching Tip:

If the reading level of the article is going to be tough for some students to read individually, have partners or small groups read the article together aloud while each follows along.

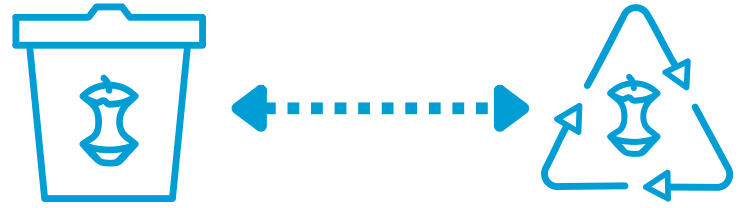
ACTIVITY 3: RESEARCHING FOOD WASTE INITIATIVES

The purpose of this **multi-week activity** is to investigate efforts in the local community to address food waste. This is an open-ended research project and does not have specific parameters for students to follow in researching the issue or reporting their findings. The overarching requirements are that the students find out what's going on in their local communities and devise a way to share what they learned with others.

First, inform students that they will be working with a partner to investigate the efforts in their local community to fight food waste. As inspiration, you can share with them that several organizations are actively engaged in global efforts to combat food waste, but this research project is meant to find out what is happening at the local level. Global examples, which might inspire their research, include: **the Food Recovery Network, Too Good To Go, Feedback, Imperfect Foods, the Ellen MacArthur Foundation, ReFED, OzHarvest, and WRAP.**

Next, have students find a partner and begin discussing their research project. They should come up with a title and an objective for it, such as "Food Waste Warriors" – to research and understand how local restaurants and grocery stores in our community address food waste and manage leftover food.

Then, give students time to plan out their research project, learn more about the issue –perhaps by determining what local businesses/restaurants they will investigate, or by looking more into what some of the above-mentioned global organizations are doing to address food waste. Encourage them to develop a driving question for their project, e.g., **"how might we...?"**



Once they are knowledgeable about the issue and have their list of the businesses, restaurants, and other local organizations they are going to research, have them determine what information they will collect and how they will collect it. For example, they can research the local businesses' websites, they can generate interview questions or a survey to give to business owners (see student handout for example interview/survey questions). After they know their research methods, provide them time to collect data. Encourage students to take notes, record interviews (with permission), and collect data carefully. After data is collected, provide time in class for students to compile all of their data and analyze it. Assist students in organizing the data they collected and looking for patterns or trends. Facilitate discussions to help them identify some of the most significant findings in their data to help them draw conclusions.

Last, instruct students to prepare presentations to showcase their research findings to others, encouraging creativity in the presentation format, such as slideshows, posters, or short videos. Allow time for students to present and for Q&A from the audience.

After all the presentations are concluded, facilitate a whole-group discussion to engage students in reflection about the project experience and the impact of their research in order to arrive at consensus about what the local community is doing to address the issue of food waste locally.

ACTIVITY 4: BAKING WITH LIMITED INGREDIENTS



One way to limit food waste is to plan meals so that you use up as much of the ingredients as possible when you cook, and minimize the leftover food. In chemistry, this same principle applies to chemical reactions. The purpose of this experiment is to teach students about the concept of limiting reactants in a chemical reaction by using a baking activity with food ingredients to model **stoichiometry**. To allow this recipe to be done in any setting, this baking activity will involve a no-bake cookie recipe.

Materials:

- Wax paper
- Measuring cups and spoons
- Mixing bowls
- Mixing spoons
- Baking trays
- Copies of the recipe student handout
- Ingredients: sugar, butter, milk, cocoa powder, peanut butter, gluten-free quick-cooking oats, vanilla extract
- Glass mixing bowls (e.g., Pyrex)
- Hot plate (or microwave)

First, inform students that they will be baking a recipe with limited ingredients.

Teaching Tip:

If you have a peanut butter allergy concern, substitute sunflower butter into the recipe; similarly, with dairy, substitute plant-based milk/butter in the recipe.

Next, allow the students to form groups, or to partner up, before beginning to get the materials and start the recipe. Monitor, guide, and support students as they work their way through the recipe.

Then, after students have had time to make the recipe and their cookies are cooling off, have students discuss their responses to the discussion questions on the student handout for the recipe.

Last, engage the whole class in a conversation about their responses to the discussion questions. Help them make the connection between their baking with the ingredients and how the ratios of each can cause there to be more or less leftover (e.g., excess) afterward and how, by adjusting the amount of each ingredient they can limit the excess and prevent food waste.

Guide students to reflect on how the limited supply of one ingredient affected the quantity and quality of the final product. You can do this with hypothetical questions, such as: "what would happen if we didn't use any of the peanut butter in the recipe at all?" Encourage them to consider the impact of the limiting reactant and its ratio to other ingredients. Culminate this activity by having students observe one another's cookies to see what variations may have come out between groups following the same recipe. Discuss these differences against the procedural steps each group did. And make sure to enjoy some cookies along the way during the observations and discussion!

ACTIVITY 5: INVESTIGATING FOOD STORAGE METHODS



The purpose of this multi-day experiment is to investigate the effects of different storage methods on the rate of food spoilage, simulating real-world scenarios to understand how proper storage can reduce food waste.

Materials:

- Four identical samples of perishable food items (e.g., slices of bread, bananas, berries)
- Different storage conditions, such as refrigerated vs. room temperature; open air vs. sealed container
- Different storage containers: plastic zipper-top bags, plastic takeout containers, styrofoam or cardboard takeout containers, brown paper bags.
- Labels or markers for labeling the storage methods
- Camera or smartphone (optional)

First, inform students that they will be conducting an experiment to investigate how different storage methods affect the lifespan of perishable food and reduce food that goes to waste. Explain to them that they will be researching different conditions, like cold vs. room temperature, and various container types.

Next, have students partner up and choose two storage methods to compare. For example, they might choose the same type of container in the refrigerated vs. room temperature conditions. They could also choose an open container like a styrofoam takeout container vs. a closed one like a plastic zipper-top bag. Make sure that you have groups testing as many methods as possible before allowing groups to double up and experiment with the same methods. That way, there are a variety of results that—as a class—can be summarized for consensus building and large-scale conclusions.

Then, have students plan out their procedures and length of time to track the food storage and collect data before beginning to carry those procedures out. A sample of steps might include a procedure like the following:

1. Place one food sample of the same amount from the same source into each of the storage methods you are testing.
2. Monitor and record initial observations about the food in each storage method.
3. Assign a specific time each day for observations.
4. Observe and record any changes in the appearance, odor, ripening, or mold growth of each food sample.
5. Take photographs (optional) to document the changes over time.
6. Compile the recorded observations for each food sample and storage condition each day.
7. Analyze and compare the rate of spoilage and mold growth across the different storage methods based on the observations you made and any data you collected.
8. Look for patterns and draw conclusions based on the data collected for the storage methods your group investigated.

Last, have all the students share their results with one another, or collect and display all the results from all the groups in a singular place where all the students can view all the results. Have groups summarize their results alongside the results of other groups to draw larger conclusions about all the methods and what the data of other groups might mean about the methods they individually investigated and what their results mean for other storage method outcomes. Finally, engage the whole class in a discussion about what the results reveal about which storage methods might have the most beneficial impact on reducing food waste and how the data supports that conclusion. Have them make some recommendations for food storage in everyday life to help people combat food waste.

Note: Ensure safe disposal of spoiled food, reminding students not to consume any food samples used in the experiment at any point.

LESSON CLOSURE

After the conclusion of all the activities, help students to make connections* between everything they did in the lesson and what they learned overall.

A. Free Recall

Group students in pairs or triads (e.g., in groups of 2-3 partners) and distribute the **Free Recall Protocol handout**. Alternatively, you can have students do this in their notebooks. Set a 3-min timer and have students generate a list of everything they can remember learning about in this lesson related to the central topic of the lesson. This doesn't have to be in depth, just whatever each group can call to mind. Have them draw lines between any terms that relate to one another. After the timer finishes, give groups a chance to volunteer to share aloud 2-3 things from their free recall lists and any of the connections that they made with those. Jot down any ideas that come up multiple times during the shareout for the whole group to see.

B. Lesson Synthesis

Give students individual thinking and writing time in their notebooks to synthesize their learning, by jotting down their own reflections using the **Word, Phrase, Sentence Protocol**.

In the Word-Phrase-Sentence Protocol, students write:

- A **word** that they thought was most important from the lesson
- A **phrase** that they would like to remember
- A **sentence** that sums up what they learned in the lesson



C. Cool Down

After the individual synthesis is complete, students should share their synthesis with a partner.

After sharing their syntheses, have students complete a **3, 2, 1 Review** for the lesson with their partner, recording in their notebooks or, optionally, on exit ticket slips to submit, each of the following:

- **3 things** that they liked or learned
- **2 ideas** that make more sense now
- **1 question** that they were left with

Invite several students to share aloud what they wrote in either the synthesis or 3, 2, 1 Review.

Lastly, ask one student volunteer to summarize what has been heard from the students as a final summary of student learning.

**Optionally here, the teacher can revisit the learning objectives and make connections more explicit for students.*

Teaching Tip: Use the Student Handouts to help students organize their thinking in writing around each of the lesson protocols.

NAME: _____

A Word, Phrase, Sentence Protocol

What is a **word** that you thought was most important from this lesson?

What is a **phrase** that you would like to remember from this lesson?

What is a **sentence** that sums up what you learned in this lesson?

3, 2, 1 Review Protocol

What are **3 things that you liked or learned** from this lesson's activities?

-
-
-

What are **2 ideas that make more sense** now to you?

-
-

What is **1 question that you were left with** after this lesson?

-

NAME: _____

Notice & Wonder Protocol

NOTICE

Things that you noticed about the topic

WONDER

Things that you wondered about the topic

NAME: _____

Rose, Thorn, Bud Protocol

ROSE

Something that "blossomed" for you in your learning

THORN

Something that challenged your thinking or was difficult to understand

BUD

Something that's new and growing in your mind — a "budding" idea

NAME: _____

4 Notes Summary Protocol

OOOH!

Something that was interesting to you

AAAH!

Something that became clearer; an "ah-ha" moment

HMMM...

Something that left you wanting to learn more

HUH?

Something you questioned or wondered

Sum It Up Statement:

Summarize your group discussion about your 4 Notes Summaries below:

NAME: _____

Think Pair Square Protocol

THINK

Write down your own individual ideas

PAIR

Summarize what you and your partner discussed

SQUARE

Summarize what your group discussed

NAME: _____

Free Recall Protocol

With 1-2 partners, generate a list of everything you can remember learning about in this lesson related to the central topic of the lesson. Draw lines between any terms that relate to one another.

NAME: _____

Baking With Limited Ingredients: No Bake Cookie Recipe

INGREDIENTS

- 1 $\frac{3}{4}$ cup white sugar
- 1 stick (e.g., $\frac{1}{2}$ cup) of butter (or plant-based butter)
- $\frac{1}{2}$ cup milk (or plant-based milk)
- 4 tablespoons unsweetened cocoa powder
- $\frac{1}{2}$ cup peanut butter (or sunflower butter)
- 3 cups quick-cooking oats
- 1 teaspoon vanilla extract

STEPS

1. Combine sugar, butter, milk, and cocoa in a medium saucepan (or heatable glass bowl, e.g., Pyrex); bring to a boil, stirring often.
2. Boil the mixture for exactly 90 seconds.
3. Remove from heat, and stir in peanut butter.
4. Add oats and vanilla; stir until well combined.
5. Drop by teaspoonfuls onto waxed paper. Let cool until hardened.
6. If cookies do not flatten out while cooling, place a small piece of wax paper over each cookie and gently press down on the wax paper with your hand or the bottom of a glass to flatten them out further.
7. Once cooled and fully hardened, cookies are ready to be removed from the wax paper and enjoyed.

DISCUSSION

- Based on the amount of each ingredient that you needed to make the recipe, and the amount of each ingredient that comes in the packaged container, which ingredient do you have the most left over of? The least?
- What would happen to the number of cookies you could make if you only had 1.5 cups of oats available to use?
- If you were to increase the number of cookies you made by doubling, tripling, etc. the recipe, which ingredient would be your limiting ingredient (e.g., which ingredient would you run out of first?)
- Based on the ratios of ingredients in the recipe, consider the butter—which comes in packages of 4 sticks while the recipe called for only one stick—if you wanted to bake with NO BUTTER leftover at the end, how would you have to adjust the rest of your recipe, and what would be the outcome of the cookies? How would this affect the other ingredients and the amount left over of each?

NAME: _____

SAMPLE RESEARCH QUESTIONS

The following are sample questions that can be adapted to fit the local context of your research into the efforts of your local area businesses to combat food waste. You can choose to use any of these questions, edit them, or create your own inspired by these questions as well. However you choose to create your survey or interview questions, be sure to make them unique and word them in a way that fits your personality before sharing them with local business owners.

1. Do you have a formal policy or program in place to address food waste within your business?
2. How do you track and measure food waste within your business?
3. What strategies or practices do you implement to prevent food waste during food preparation and cooking processes?
4. Do you have procedures in place to manage food expiration dates and ensure minimal food waste?
5. Do you donate excess unused or unsold food to local charities, food banks, or shelters? If yes, could you please provide details? If no, what informed your decision not to donate food?
6. Have you implemented any initiatives to educate your staff and customers about food waste reduction? If yes, please describe. If no, would you be open to educating them?
7. Do you utilize composting or other methods of food waste recycling? If yes, please explain the process.
8. Are there any partnerships or collaborations with local organizations or initiatives focused on food waste reduction that you are involved with or aware of in our area?
9. Have you implemented portion control or menu adjustments to minimize food waste? Please provide examples, if so.
10. How do you handle leftover unused food at the end of each day? Please describe your approach.