



Sustainability with Darling Ingredients

Created: 07/2022 by the National FFA Organization

Description of Lesson: Dive into the world of agricultural byproducts and sustainability by learning about Darling Ingredients, one of the world's leaders in utilizing sustainable ingredients and maximizing the use of natural resources.

Student Learning Objectives:

After completing these activities, students will ...

1. Utilize resources and activities to discover opportunities within Darling Ingredients.
2. Develop a foundational understanding of the necessity of sustainability to meet our growing needs.
3. Develop a foundational understanding of the need to give back to nature.

Suggested Grade Level:

Grades 9 and 10 (This lesson is written so instructors can scale up or down based on class needs.)

Suggested Time: 240 minutes (*Time requirements may vary based upon student understanding and class schedule.)

Resources/References:

1. Website: Darling Ingredients, <https://www.darlingii.com/>
2. Video: Biofuels for a Growing Population, <https://vimeo.com/304388616>
3. Video: Retrieving Nutrients From Manure, <https://vimeo.com/352030137>
4. Video: Feeding Tomorrow's World, <https://vimeo.com/372647401>
5. Video: Ecozone: Giving Back to Nature, <https://vimeo.com/309301311>
6. Article: Protectors of the Planet, https://d1ip4ji950xau.cloudfront.net/Corporate/Brochures/Protectors%20of%20the%20Planet_Biosecurity_Final.pdf
7. Article: Gatekeepers of the Food Chain, https://d1ip4ji950xau.cloudfront.net/Corporate/Brochures/GP1b_Gatekeepers_of_the_food_chain_f.pdf
8. Website: AgExplorer, AgExplorer.FFA.org/
9. Website: Darling Ingredients Blog Posts, <https://www.darlingii.com/media/blog>
10. Video: Diamond Green Diesel, <https://vimeo.com/304388616>

Related Resources:

1. Link: [Career and Leadership Development Events](#)
 - a. Agricultural Communications, FFA.org/participate/cde-1de/agricultural-issues-forum/
 - b. Agricultural Issues, FFA.org/participate/cdes/environmental-and-natural-resources/
 - c. Environmental and Natural Resources, FFA.org/participate/cdes/food-science-and-technology/
 - d. Food Science and Technology, FFA.org/participate/cdes/marketing-plan/
 - e. Marketing Plan, FFA.org/participate/cdes/marketing-plan/
2. Link: [Agriscience Fair](#)

Equipment and Supplies Needed:

1. A copy of the "Darling Ingredients Key Vocabulary" list and the "Darling Vocabulary Exercise"
2. A copy of the "Choice Board" worksheet and appendices for each student
3. Internet access to play the video in real time or embed it in a PowerPoint ahead of time

Virtual Instruction Ideas:

This entire lesson can be taught virtually. All student handouts can be sent or posted electronically.

Student Activity Sheets:

Direct access to student activity sheets without lesson plan or answer key for easy upload to a learning management system or printing for classwork.

Link (Word) <https://ffa.app.box.com/file/1027540726529?s=yq2p0gwl8c9iyb8z1gyleotigpnov6sd>

Link (PDF) <https://ffa.app.box.com/file/1027540733729?s=n3i5iklenf8o4an6euc2eycvkjvafgwy>

Link (Google)

https://docs.google.com/document/d/1ybuQ3E_IDyALNLq9AG6APFcoidgh38Bd0a7la8WeIOE/edit?usp=share_link

These Activities are Aligned to the Following Standards:

AFNR Performance Element

- CS.01 Analyze how issues, trends, technologies and public policies impact systems in the Agriculture, Food and Natural Resources Career Cluster.
- CS.02. Evaluate the nature and scope of the Agriculture, Food and Natural Resources Career Cluster and the role of agriculture, food and natural resources (AFNR) in society and the economy.
- BS.03. NCAE Standard: Demonstrate the application of biotechnology to solve problems in Agriculture, Food and Natural Resources (AFNR) systems (e.g., bioengineering, food processing, waste management, horticulture, forestry, livestock, crops, etc.).
- ESS.04. Demonstrate the operation of environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management and energy conservation).
- NRS.01. Plan and conduct natural resource management activities that apply logical, reasoned, and scientifically based solutions to natural resource issues and goals.
- NRS.04. Demonstrate responsible management procedures and techniques to protect, maintain, enhance, and improve natural resources.
- AS.08. Analyze environmental factors associated with animal production.

FFA Precept

- FFA.CS-O. Flexibility/Adaptability: Be flexible in various situations and adapt to change.
- FFA.CS-N. Decision Making: Analyze a situation and execute an appropriate course of action.
- FFA.CS-P. Technical/Function Skills in Agriculture: Obtain knowledge and skills needed for a career in agriculture and related industries.

Common Career Technical Core

- AG1 Analyze how issues, trends, technologies and public policies impact systems in the Agriculture, Food and Natural Resources Career Cluster.
- AG2 Evaluate the nature and scope of the Agriculture, Food and Natural Resources Career Cluster and the role of agriculture, food, and natural resources (AFNR) in society and the economy.
- AG3 Examine and summarize the importance of health, safety, and environmental management systems in AFNR businesses.
- AG6 Analyze the interaction among AFNR systems in the production, processing, and management of food, fiber, and fuel and the sustainable use of natural resources.

NASDCTEc

- AGC10.03 Compare and contrast issues affecting the AFNR industry including biotechnology, employment, safety, environmental and animal welfare to demonstrate an understanding of the trends and issues important to careers in this industry.
- AGC10.04 Envision emerging technology and globalization and project its influence on widespread markets to demonstrate an understanding of technologies and trends that will impact the AFNR industry.

Common Core – Reading: Informational Text

- CCSS.ELA-Literacy.RI.9-10.1 Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
- CCSS.ELA-Literacy.RI.9-10.2 Determine a central idea of a text and analyze its development over the course of the text, including how it emerges and is shaped and refined by specific details; provide an objective summary of the text.

Common Core – Writing

- CCSS.ELA-Literacy.W.9-10.1 Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
- CCSS.ELA-Literacy.W.9-10.2 Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

Common Core – Speaking and Listening

- CCSS.ELA-Literacy.SL.9-10.2 Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.
- CCSS.ELA-Literacy.SL.9-10.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Common Core – Science & Technical Subjects

- CCSS.ELA-Literacy.RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

Common Core – Literacy in Science & Technical Subjects: Writing

- CCSS.ELA-Literacy.WHST.9.10.1 Write arguments focused on discipline-specific content.
- CCSS.ELA-Literacy.WHST.9.10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Common Core – Math Practices

- MP2 Reason abstractly and quantitatively.

Green/Sustainability Knowledge and Skill Statements

- AFNR Career Cluster, Statement 6 Use green technologies and sustainability practices to maintain safe and healthful working environments that sustain the natural environment and promote well-being in the AFNR workplaces.
- AFNR Career Cluster, Statement 3 Communicate the impact of “green” and sustainability principles on agriculture, food and natural resource systems.

AFNR Career Ready Practices

- CRP.02. Apply appropriate academic and technical skills. Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive.
- CRP.04. Communicate clearly, effectively, and with reason. Career-ready individuals communicate thoughts, ideas and action plans with clarity, whether using written, verbal and/or visual methods.
- CRP.05. Consider the environmental, social and economic impact of decisions. Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organizations and the environment.
- CRP.06. Demonstrate creativity and innovation. Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization.
- CRP.07. Employ valid and reliable research strategies. Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies.
- CRP.08. Utilize critical thinking to make sense of problems and persevere in solving them. Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem.
- CRP.11. Use technology to enhance productivity. Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems.

Partnership for 21st Century Skills

- Communication
- Critical Thinking and Problem Solving
- Financial, Economic, Business, and Entrepreneurial Literacy
- Global Awareness
- Information, Communications, and Technology Literacy
- Think Creatively

Lesson Plan:

1. **Introduction:** The Darling Ingredients "Choice Board" is designed to help students learn about sustainability and the future of agriculture while exploring Darling Ingredients, a leader in sustainability and repurposing our resources. There is a vocabulary list and activities to complete with this choice board.
2. **Suggested Use:**
 1. If you have ample time to complete an entire unit, then these activities could be stretched over two or more weeks. Some activities require more work than others. If time is limited, this [Choice Board](#) could be used as substitute lesson plans, a grading period long-term project or however else you see fit in your classroom.
 2. Grading: How you determine if a student has completed the tasks depends on your preference and what resources are available to you. Suggestions include having them email or print something that proves they completed a task or for them to write a summary paragraph of a video they watched or article they read.
 - a. Work can be collected weekly or every few weeks for grading.
 - b. Tip: Count the entire choice board grade (each is worth 100 points) as a test or project grade or have it count twice.
3. **Follow-up:** Have students present their findings to other students, teachers and community members to help educate and advocate for sustainability in agriculture.



***Key Vocabulary**

Bioenergy is renewable energy derived from biological sources, to be used for heat, electricity or vehicle fuel.

Biofuel is a liquid fuel produced from renewable sources, such as new and used vegetable oils and animal fats and is a cleaner-burning replacement for petroleum-based fuel. It is nontoxic and biodegradable and is produced by combining alcohol with vegetable oil, animal fat or recycled cooking grease.

Byproduct: an incidental or secondary product made in the manufacture or synthesis of something else

Carbon footprint is the total greenhouse gas (GHG) emissions caused by an individual, event, organization, service, place or product, expressed as carbon dioxide equivalent (CO₂e).

Climate change: long-term shifts in temperatures and weather patterns

Entrepreneurship: An entrepreneur is someone who organizes, manages and assumes the risks of a business or enterprise.

Greenhouse gas emissions (GHG): the emission into the earth's atmosphere of any of various gases, especially carbon dioxide, that contribute to the greenhouse effect

Humic acid: one of two classes of natural acidic organic polymer that can be extracted from humus found in soil, sediment or aquatic environments

Integrity: the quality of being honest and having strong moral principles

Low-carbon biofuel: made from sustainably produced nonfood biomass; can dramatically reduce CO₂ emissions from the transportation sector while providing the high-energy density and easy storage of a liquid transportation fuel

Nutraceutical: a food containing health-giving additives and having medicinal benefit

Nutrient rich: food that is high in nutrients but relatively low in calories

Nutrient-dense foods contain vitamins, minerals, complex carbohydrates, lean protein and healthy fats. Examples of nutrient-dense foods include fruits and vegetables, whole grains, low-fat or fat-free milk products, seafood, lean meats, eggs, peas, beans and nuts.

Organic residuals: includes several different waste categories; among them are the organic fraction of municipal solid waste, animal wastes or manure and municipal biosolids that comprise the organic solids remaining after sewage treatment

Pharmaceutical: any kind of drug used for medicinal purposes

Rendering: the cooking and drying of meat and/or other animal byproducts not used for human consumption to recover fats and proteins

The process reuses materials that would otherwise be discarded and repurposes them for various applications, such as fuel and livestock feed.

Renewable diesel is made of nonpetroleum renewable resources such as natural fats, vegetable oils and greases.

Because renewable diesel is chemically the same as petroleum diesel, it may be used in its pure form—called R100—as a drop-in fuel, or it can be blended with petroleum diesel and/or with biodiesel in various amounts. Renewable diesel-petroleum diesel blends are labeled with an R followed by the percentage (by volume) of the renewable diesel content. For example, a blend of 20% renewable diesel and 80% petroleum diesel is called R20. A blend of 20% biodiesel and 80% renewable diesel is called B20R80 to make a 100% biofuel. A blend of 20% biodiesel, 20% renewable diesel and 60% petroleum diesel is called B20R20.

Sustainable refers to the ability to maintain or support a process continuously over time.

Name: _____

Darling Vocabulary Exercise

Directions: *Match the vocabulary term to the correct definition and write your answer in the box next to the corresponding definition. See word bank below.

	the quality of being honest and having strong moral principles			
	renewable energy derived from biological sources, to be used for heat, electricity or vehicle fuel			
	any kind of drug used for medicinal purposes			
	an incidental or secondary product made in the manufacture or synthesis of something else			
	a food containing health-giving additives and having medicinal benefit.			
	Food that is high in nutrients but relatively low in calories Nutrient-dense foods contain vitamins, minerals, complex carbohydrates, lean protein and healthy fats. Examples of nutrient-dense foods include fruits and vegetables, whole grains, low-fat or fat-free milk products, seafood, lean meats, eggs, peas, beans and nuts.			
	the emission into the earth's atmosphere of any of various gases, especially carbon dioxide, that contribute to the greenhouse effect			
	refers to the ability to maintain or support a process continuously over time			
	the cooking and drying of meat and/or other animal byproducts not used for human consumption to recover fats and proteins The process reuses materials that would otherwise be discarded and repurposes them for various applications, such as fuel and livestock feed.			
	the total greenhouse gas (GHG) emissions caused by an individual, event, organization, service, place or product, expressed as carbon dioxide equivalent (CO ₂ e)			
	includes several different waste categories. Among them are the organic fraction of municipal solid waste, animal wastes or manure and municipal biosolids that comprise the organic solids remaining after sewage treatment			
	An entrepreneur is someone who organizes, manages and assumes the risks of a business or enterprise.			
	It is made of nonpetroleum renewable resources such as natural fats, vegetable oils and greases.			
	a liquid fuel produced from renewable sources, such as new and used vegetable oils and animal fats and is a cleaner-burning replacement for petroleum-based fuel It is nontoxic and biodegradable and is produced by combining alcohol with vegetable oil, animal fat or recycled cooking grease.			
	one of two classes of natural acidic organic polymer that can be extracted from humus found in soil, sediment or aquatic environments			
	long-term shifts in temperatures and weather patterns			
	made from sustainably produced nonfood biomass; can dramatically reduce CO ₂ emissions from the transportation sector while providing the high-energy density and easy storage of a liquid transportation fuel			
Word Bank				
Bioenergy	Biofuel	Byproduct	Carbon footprint	Climate change
Entrepreneurship	Greenhouse gas emissions	Humic acid	Integrity	Low-carbon biofuel
Nutraceutical	Nutrient rich	Organic residuals	Pharmaceutical	Rendering
Renewable diesel	Sustainable			

Name: _____

Key: Darling Vocabulary Exercise

Directions: *Match the vocabulary term to the correct definition and write your answer in the box next to the corresponding definition. See word bank below.

below.

Integrity	the quality of being honest and having strong moral principles			
Bioenergy	renewable energy derived from biological sources, to be used for heat, electricity or vehicle fuel			
Pharmaceutical	any kind of drug used for medicinal purposes			
Byproduct	an incidental or secondary product made in the manufacture or synthesis of something else			
Nutraceutical	a food containing health-giving additives and having medicinal benefit.			
Nutrient rich	Food that is high in nutrients but relatively low in calories Nutrient-dense foods contain vitamins, minerals, complex carbohydrates, lean protein and healthy fats. Examples of nutrient-dense foods include fruits and vegetables, whole grains, low-fat or fat-free milk products, seafood, lean meats, eggs, peas, beans and nuts.			
Greenhouse gas emissions	the emission into the earth's atmosphere of any of various gases, especially carbon dioxide, that contribute to the greenhouse effect			
Sustainable	refers to the ability to maintain or support a process continuously over time			
Rendering	the cooking and drying of meat and/or other animal byproducts not used for human consumption to recover fats and proteins The process reuses materials that would otherwise be discarded and repurposes them for various applications, such as fuel and livestock feed.			
Carbon footprint	the total greenhouse gas (GHG) emissions caused by an individual, event, organization, service, place or product, expressed as carbon dioxide equivalent (CO ₂ e)			
Organic residuals	includes several different waste categories. Among them are the organic fraction of municipal solid waste, animal wastes or manure and municipal biosolids that comprise the organic solids remaining after sewage treatment			
Entrepreneurship	An entrepreneur is someone who organizes, manages and assumes the risks of a business or enterprise.			
Renewable diesel	It is made of nonpetroleum renewable resources such as natural fats, vegetable oils and greases.			
Biofuel	a liquid fuel produced from renewable sources, such as new and used vegetable oils and animal fats and is a cleaner-burning replacement for petroleum-based fuel It is nontoxic and biodegradable and is produced by combining alcohol with vegetable oil, animal fat or recycled cooking grease.			
Humic acid	one of two classes of natural acidic organic polymer that can be extracted from humus found in soil, sediment or aquatic environments			
Climate change	long-term shifts in temperatures and weather patterns			
Low-carbon biofuel	made from sustainably produced nonfood biomass; can dramatically reduce CO ₂ emissions from the transportation sector while providing the high-energy density and easy storage of a liquid transportation fuel			
Word Bank				
Bioenergy	Biofuel	Byproduct	Carbon footprint	Climate change
Entrepreneurship	Greenhouse gas emissions	Humic acid	Integrity	Low-carbon biofuel
Nutraceutical	Nutrient rich	Organic residuals	Pharmaceutical	Rendering
Renewable diesel	sustainable			

Name: _____

Aligned to the following standards: CS.02. BS.03. ESS.04. NRS.01. NRS.04. AS.08. FFA. CS-O
FFA.CS-N. FFA.CS-P. AG1 AG2 AG3 AG6 AGC10.03 AGC10.04 CCSS.ELA-Literacy.RI.9-10.1
CCSS.ELA-Literacy.RI.9-10.2 CCSS.ELA-Literacy.W.9-10.1 CCSS.ELA-Literacy.W.9-10.2

Choice Board

Directions:

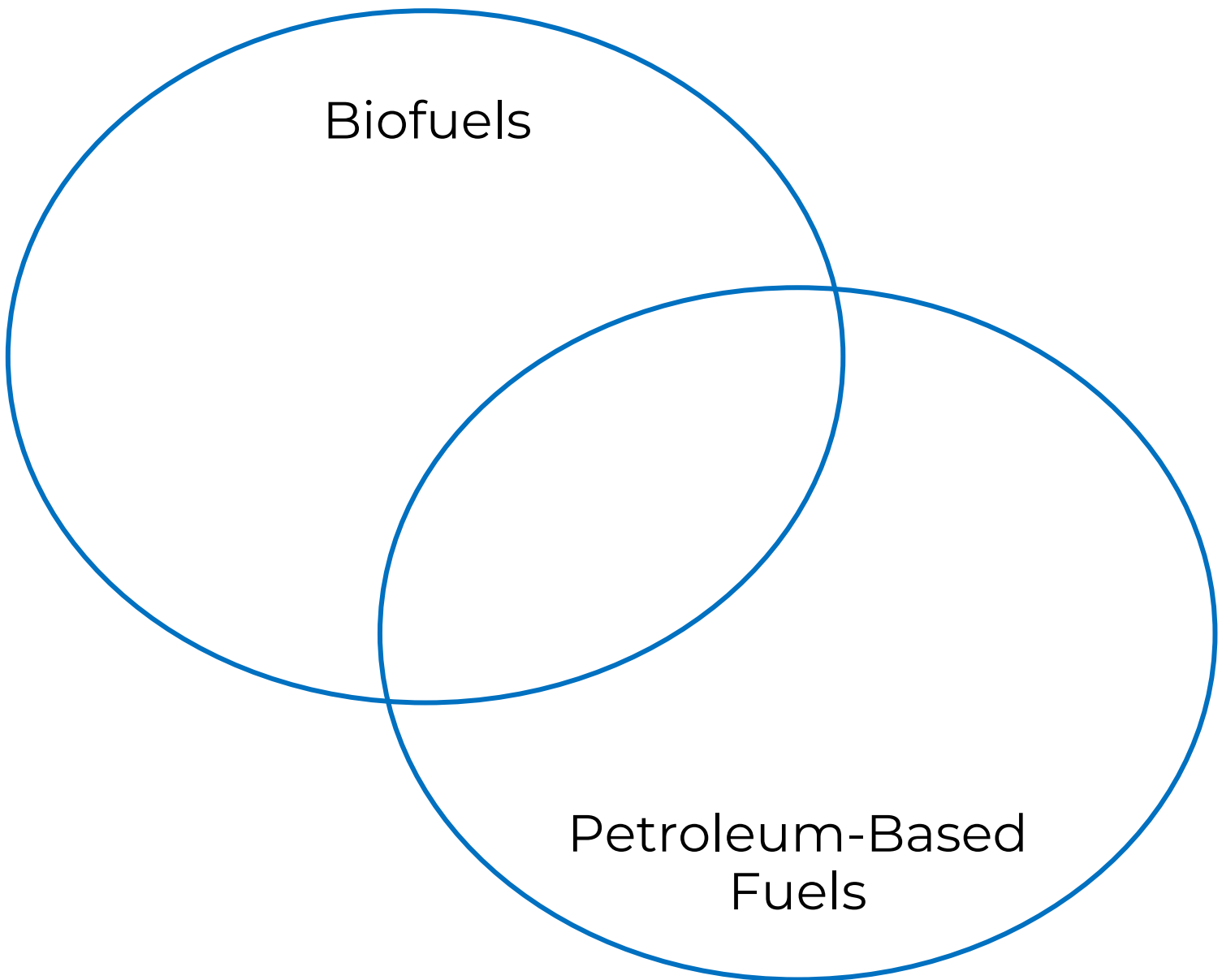
You will explore different sustainability concepts from Darling Ingredients to complete the tasks below. Some tasks will take longer than others, but you can complete them in *any order you choose*. Your due date for completion of this board is _____. Shade or color in each block below as you complete it.

Remember/ Understand	Watch the " Biofuels for a Growing Population " video and complete "Appendix 1: Fuel Sources Venn Diagram."	Watch the " Retrieving Nutrients from Manure " video and complete "Appendix 2: Sustainable Manure."	Watch the " Feeding Tomorrow's World " video and complete "Appendix 3: Hungry for Insects."	Watch the video " Ecozone: Giving Back to Nature " and complete "Appendix 4: The Ecozone."
Apply/Analyze/Evaluate	Read the publication <i>Protectors of the Planet</i> (Article Link) and complete "Appendix 5: Rendering for Earth's Protection."	Utilizing the Darling Ingredients website and AgExplorer , complete "Appendix 6: Career Discovery."	Utilizing the Darling Ingredients website , choose one of their four main pillars and write a two-paragraph summary giving an overview of your chosen pillar and what it means to you. Use "Appendix 7: Diving Into Darling."	Utilize the Darling blog posts to choose a blog to review. Write a paragraph summary of the blog and what it means to you. Use "Appendix 8: Blog Review."
Create	Select one of the topic areas presented in one of the Darling Ingredients Showcase Videos and create a blog post about the topic. Use "Appendix 9: Darling Ingredients Blog Post" to plan.	Create counterclaims for topics that could be seen as misunderstood. Use "Appendix 10: Let's Talk It Out."	Utilize the information from the publication <i>Gatekeepers of the Food Chain</i> (Article Link) to create an infographic. Use "Appendix 11: Informing the Public" to complete this activity.	Create your own ecozone that would benefit the environment near your home or school. Use "Appendix 12: Create Your Own Ecozone."

Name: _____

Appendix 1: Fuel Sources Venn Diagram

Directions: Watch the video “Diamond Green Diesel” (<https://vimeo.com/304388616>) to learn more about Darling Ingredients biodiesel production. Then, complete the Venn diagram below comparing biodiesel and petroleum-based fuels.



Which type of fuel do you think is more sustainable and realistic for our growing population? Cite at least three supporting factors to support your decision.

Name: _____

Appendix 2: Sustainable Manure

Directions: View the video “Retrieving Nutrients from Manure,” <https://vimeo.com/352030137>, to complete this activity.

How does Darling Ingredients help farmers with their excess manure?

Darling Ingredients knew how to produce _____ from manure but were left with a _____. This _____ contained crucial building blocks like _____ that can work as soil _____.

Problems came about when the company tried completing the processing of the residue. Identify the following pieces to this problem and how Darling Ingredients came to a resolution:

Piece of equipment malfunctioning:

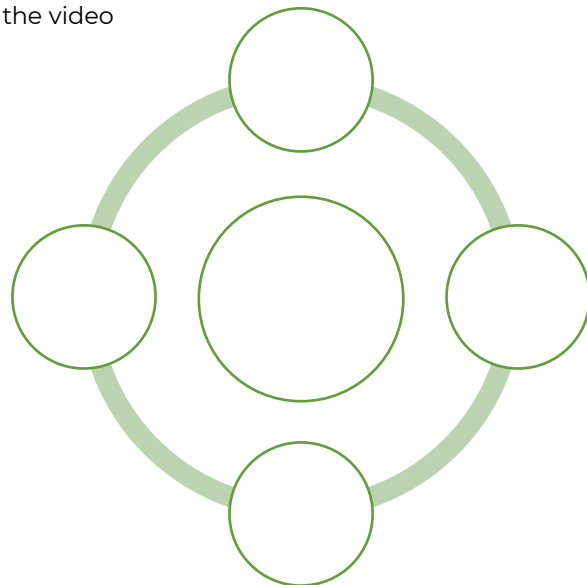
Cause of the clogging filter:

Who resolved the problem?

What changes did they make?

End results:

- Complete the flow chart with the images shown in the video that allow farmers to be more sustainable.



Name: _____

Appendix 3: Hungry for Insects

Directions:

Watch the video "Tomorrow's Nutrition Today," <https://vimeo.com/372647401>, to complete this activity.

Global population is expected to reach ten billion people by _____.

2025	2030	2042	2050
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A **LARGE** problem can have _____ solutions.



What is the common name of the insect mentioned in the video?



- Feeding tomorrow's population means we must double the _____ food we are producing today.
- Give two examples of protein-rich food you like to eat.



ENTOMOPHAGY

Using your own words and pictures, describe what this term means.

In what state was the first commercial insect farm in the United States started?



Darling uses a farm-raised insect that can be fed as a protein source in animal diets. Draw three animals the insect can be fed to.



Do you feel this innovation is a realistic tool to help approach our food production problems in the future? Explain.

Name: _____

Appendix 4: The Ecozone

Directions:

Watch the video "Ecozone: Giving Back to Nature," <https://vimeo.com/309301311>, and complete the questions below.

*Answer each of the questions on the map to the right.

*Shade and outline the country to represent the colors of this country's flag.



Describe the terms "flora" and "fauna" that are mentioned in the video by drawing visual representations of each.

Name: _____



Water is a byproduct retrieved through plant operations. Darling captures this water, then recovers and treats the water from the raw materials. Lastly, the company gives this water back to the environment. Daily, it retrieves 3,600 cubic meters of water and 1.3 million cubic meters per year. Complete the math to convert that to the number of gallons Darling gives back to the environment. (1 cubic meter = 265 gallons)

Amount in Cubic Meters	Conversion to Gallons	Total Gallons Retrieved	Number of Olympic-Size Pools That Could Be Filled
3,600 cubic meters			
1,300,000 cubic meters			



Darling Ingredients receives an excess of raw materials such as _____ that they repurpose into valuable ingredients for _____.



Identify the three major tasks that were completed so that Darling could start giving water back to the environment.

- 1.
- 2.
- 3.



How do the efforts of Darling Ingredients giving back water impact you? _____

The ecozone brought many new visitors to the area. What did Darling provide for its new visitors?

Who could be found resting at ecozone? Draw and label an example below.

Identify an area near your school that could be turned into an environmentally friendly space like the ecozone.

Location: _____

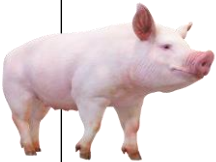
Why is this an ideal location?

Name: _____

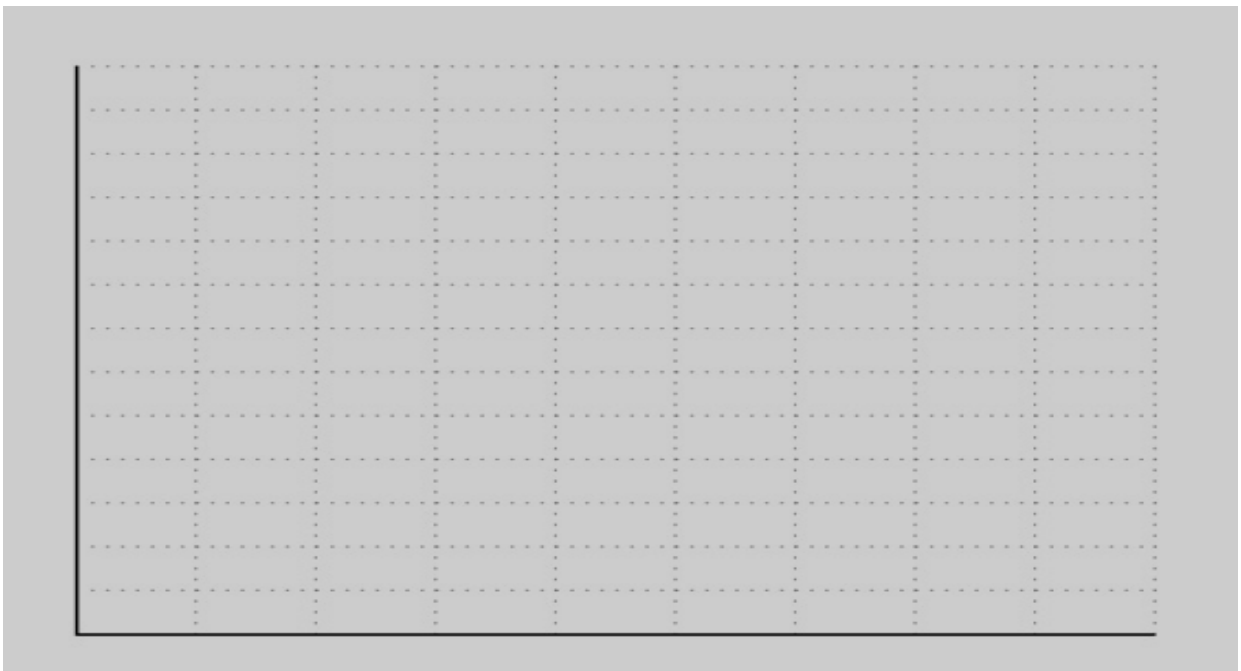
Appendix 5: Rendering for Earth's Protection

Directions: Utilizing the "<https://ffa.app.box.com/file/1027540724129>" publication, complete this activity to gain a better understanding of how the rendering industry protects our health and well-being.

Meat-animal diets generate a lot of waste. In the space below, draw what you believe are three items that generally would go to waste from the animal butchering process.



Complete a line graph below to show the correlation of human population and meat-animal consumption. Label your x-axis and y-axis.



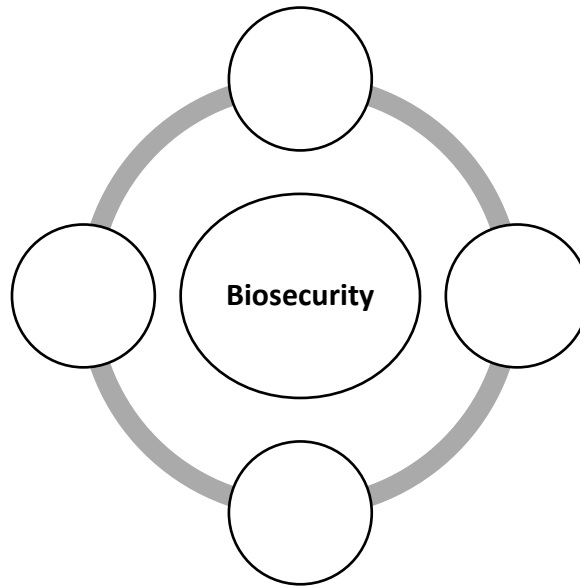
Which are potential problems that can result from the natural decomposition of animals? Shade the correct answer choices **ORANGE**.

E. coli	Protozoa	Salmonella	Pneumonia
Warts	Pathogenic bacteria	Diarrhea	Viruses

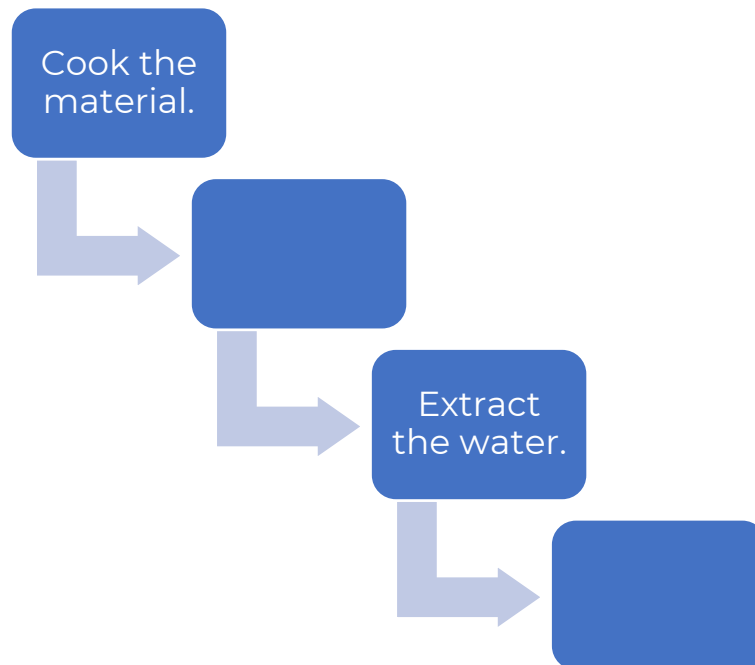
Name: _____



Complete the mind map below depicting what biosecurity represents in the food animal industry. (Example: using high heat to kill bacteria)



Complete the general steps of the rendering process below.



Rendering companies spend _____ of dollars on equipment, analytical labs and monitoring instrumentation to meet _____, state and _____ standards and obtain operating permits for each rendering facility.

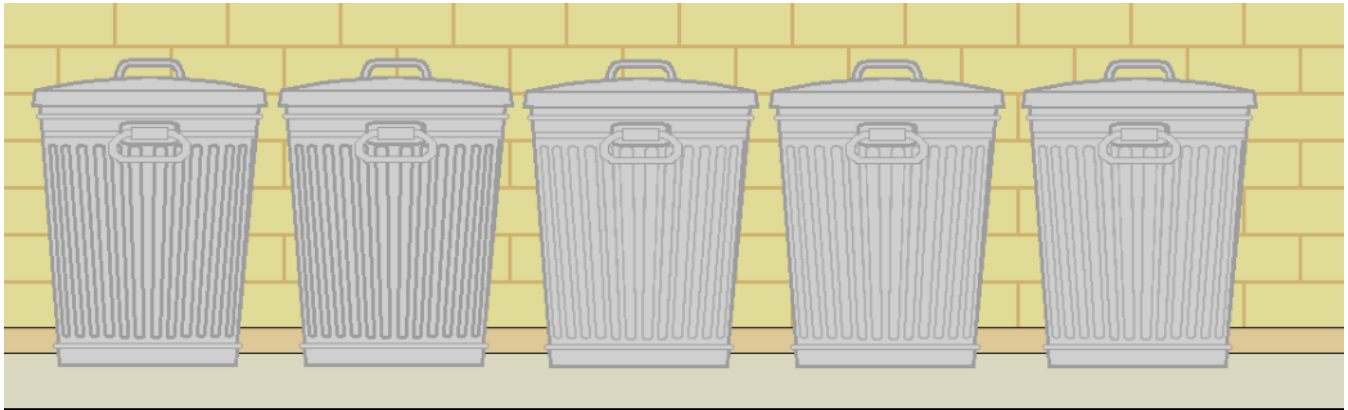
Name: _____

As of 2019, Darling
owns and operates
_____% of the
industry-certified
rendering facilities in
the United States.

Rendering processes use high
temperatures between ____
and ____ degrees F that
destroy harmful pathogens and
microorganisms within the first
____ minutes of processing.



On the trash cans below, identify the common disposal methods for animal mortalities or meat byproducts.



Identify at least three examples of why rendering is a more effective disposal method than landfills and composting.

Example 1

Example 2

Example 3

Name: _____



Identify the four major government agencies that play an integral role in the regulation of the rendering industry and describe their roles.

Agency: _____

Agency: _____

Agency: _____

Agency: _____

Role:

Role:

Role:

Role:



What are the three biggest takeaways from this publication from your viewpoint? In the space below, use words and pictures to describe them.

Name: _____

Appendix 6: Career Discovery

DIRECTIONS:

Choose three agriculture careers that [Darling Ingredients](#) offers and that interest you. Once you have identified your careers, utilize the Career Profiles from [AgExplorer](#) to complete this handout.

Career 1: _____

- Responsibilities:



- Education/Training:



- Where They Work:



- Job Outlook:



Name: _____

Career 2: _____

- Responsibilities:



- Education/Training:



- Where They Work:



- Job Outlook:



Name: _____

Career 3: _____

- Responsibilities:



- Education/Training:



- Where They Work:



- Job Outlook:



Name: _____

Appendix 7: Diving Into Darling

DIRECTIONS:

Utilizing the Darling Ingredients website, <https://www.darlingii.com/>, choose one of their four main pillars of the company and write a two-paragraph summary giving an overview of the chosen pillar and what it means to you or how it impacts your life.

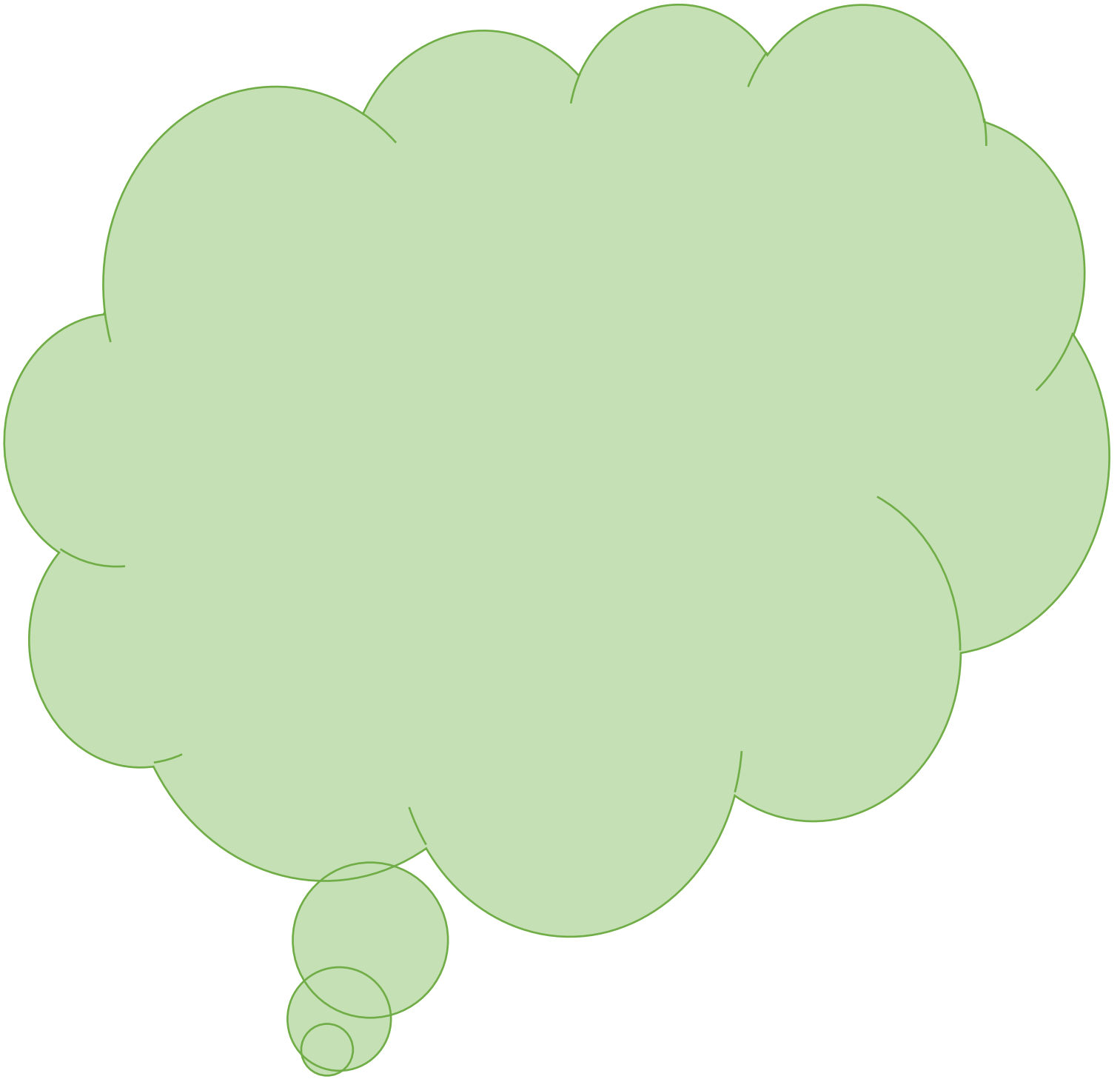


Name: _____

Appendix 8: Blog Review

Directions:

Utilizing the [Darling blog posts](https://www.darlingii.com/media/blog) (<https://www.darlingii.com/media/blog>), choose a blog to review. Write a paragraph summary of the blog and what it means to you.



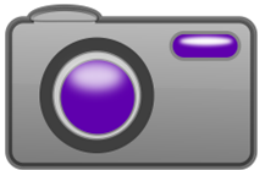
Name: _____

Appendix 9: Darling Ingredients Blog Post

Directions:

Select one of the topic areas presented in one of the Darling Ingredients showcase videos (<https://www.darlingii.com/csr/darling-cares/showcases>) and create a blog post about the topic. A blog is a regularly updated website or webpage typically run by an individual or small group that is written in an informal or conversational style.

Title: Create an “attention-getting,” creative title.



Every blog post needs a picture. Describe the picture (in one sentence) and draw the picture you will have on your blog post page in the box below.

You want to leave your readers with a question that will prompt them to comment. What question will you ask your readers?

Main Body of the Blog: In this section, include these key factors:

- Why you chose this topic
- A brief introduction/explanation about this topic
- 3 or 4 facts about the topic

Name: _____

Blog Post Rubric

Area	4 Points	3 Points	2 Points	1 Point
Content	All content is accurate. There are no factual errors.	Most of the content is accurate, but there is one piece of information that seems inaccurate.	The content is generally accurate, but one piece of information is clearly inaccurate.	Content is confusing or contains more than one factual error.
Clarity and Neatness	The blog post is easy to read, and all elements are clearly written, labeled and drawn. Creativity was used.	The blog post is easy to read, and most elements are clearly written, labeled and drawn. Some creativity was used.	The blog post is hard to read with rough drawings, labels and color. Little creativity was used.	The blog post is hard to read, and one cannot tell what goes where or what the illustrations represent. No creativity was used.
Organization of Thoughts	Clearly organized in a logical sequence Excellent introduction and conclusion	Adequate evidence of a logical sequence of information Satisfactory introduction and conclusion	Order and sequence could be improved. Weak introduction and conclusion	No logical organization, unclear and confusing No introduction or conclusion
Picture	Student included a picture that matches the blog topic and is appealing to readers.	Student included a picture that matches the blog topic and is not appealing to readers.	Student included a picture that does not match the blog topic but is appealing to readers.	Student did not include a picture that matches the blog topic, and/or it is not appealing to readers.

Comments:

Name: _____

Appendix 10: Let's Talk It Out

Directions:

To complete these activities, utilize the animal rendering information from Darling Ingredients and any other research you feel necessary from reliable resources (Ex. educational institutions). Next, select a topic of your choice that could be misunderstood and complete the counterclaim sentence starters. Counterclaims are an argument offered in opposition to another argument. Example: After a bank sues a customer for an unpaid debt, the customer counterclaims (sues back) against the bank for fraud in procuring the debt.

Animal Rendering	Your Topic: _____
Critics argue that ...	Critics argue that ...
While it might be true that ...	While it might be true that ...
Still, all in all, ...	Still, all in all, ...
Others might say that ...	Others might say that ...
but I argue ...	but I argue ...
A common argument against this position is ...	A common argument against this position is ...
but ...	but ...
It may be true that ...	It may be true that ...
but ...	but ...
It's easy to think ...	It's easy to think ...
but when you look at the facts, ...	but when you look at the facts, ...
It is often thought ...	It is often thought ...

How are these counterclaims effective in having a conversation about a topic that may be misunderstood?

Why is it important to be nonaggressive and nonconfrontational when discussing a misunderstood topic?

Name: _____

Appendix 11: Informing the Public

Directions:

You work for Darling Ingredients. You are expected to create an infographic that depicts the food waste problems we have here in the United States. Your boss wants to display this infographic on the company's website and social media platforms. Read the memo from your boss below for additional instructions.

To: All Agricultural Education Students
From: **(Teacher's name here)**, Darling Ingredients CEO
Date: (Use current date of project)
Subject: Food Waste Infographic Project

Dear Employee,

I have another project for you! We really want to educate American society about our food waste problems and how we here at Darling Ingredients can help resolve these problems. The board of trustees has decided to use infographics to display this information. We're hoping you can help us create a detailed infographic on food waste and the rendering process. Utilize the *Green Paper: Gatekeepers of the Food Chain* <https://ffa.app.box.com/folder/167842846537> to develop the content of your infographic. Here's some information that **must** be included:

- Five statistics or facts about food waste in America
- Five statistics or facts about roles of the gatekeepers
- One graph or chart
- Concise statement on the impact Darling has through rendering
- Two pictures
- Darling Ingredients logo

If this information isn't included, then you won't be getting paid (or a grade). You **MUST** cite all your sources at the bottom of your infographic to get paid. Citations should use APA style. This infographic will be displayed on our website, on our social media platforms and in other literacy publications. So, it must be professional. Grammar, spelling and citations matter. Please see the attached document for more information about my expectations.

Suggested websites to help create your infographic:

- Canva, <https://www.canva.com/>
- Venngage, <https://venngage.com/templates/infographics>

If you have any questions, let me know.

Thanks,

Darling Ingredients CEO

Name: _____

Rubric for Infographic

	A	B	C	D
Information	Detailed information from multiple sources including all required information from the checklist	Detailed information from one source including all required information from the checklist	Information from one or more sources lacking in detail All items from the checklist are included; however, some information is vague.	Missing information from checklist Information contradicts other information and/or is incorrect.
Visuals	All visuals are cited. Captions are present where needed. Visuals support the infographic and are appealing. A clear color scheme was chosen that attracts the viewer. There is great attention to arrangement and font.	Visuals are cited. Visuals support the infographic and are generally appealing. A color scheme was chosen	Visuals somewhat support the information. The color scheme, font and/or arrangement is messy and unorganized.	Color scheme is random, and applicable visuals are lacking.
Professionalism	All information is cited in APA style with correct formatting. No grammar/spelling errors	All information is cited in APA style with mostly correct formatting. Very few grammar errors	Information is cited with some errors. Some grammar/spelling errors are present.	Multiple errors Citation was attempted; however, key information is missing.

Name: _____

Appendix 12: Create Your Own Ecozone

Directions:

Develop your own ecozone to benefit an area near your school. Utilize the information below and reference the Darling Ingredients video “Ecozone: Giving Back to Nature” (<https://vimeo.com/309301311>) to help you plan out your project.

1. Project Choice
 - a. 3-D Model and Poster Display
 - b. 3-D Model and Interactive Presentation (Google Slides, video, Prezi, etc.)
2. Required Information
 - a. Name
 - b. Specific location (include a Google Earth image)
 - c. Size: breakdown and layout of the land
 - d. Purpose/Goals of the ecozone
 - e. Specific components (pond, woods, walking trails, etc.)
 - f. Resources needed to construct the ecozone (people, places, things)
 - g. Benefits of the space
 - h. Images/Drawings of plan
 - i. Why: Explain your decisions of location, purpose, size, etc.
3. Use the rubric on the next page to guide you as you create your ecozone.

Name: _____

4. Evaluation of Project

Topic	25–20 Points	19–15 Points	14–8 Points	7–1 Points
Content	Thoroughly and clearly states the main points and precise details that are accurately focused on the topic Includes detailed information on each item: • Name • Specific location (include a Google Earth image) • Size: breakdown and layout of the land • Purpose/Goals of the ecozone • Specific components (pond, woods, walking trails, etc.) • Resources needed to construct the ecozone (people, places, things) • Benefits of the space • Images/Drawings of plan • Why: Explain your decisions of location, purpose, size, etc.	Generally states the main points and details that discuss the topic Includes information on each of the following: • Name • Specific location (include a Google Earth image) • Size: breakdown and layout of the land • Purpose/Goals of the ecozone • Specific components (pond, woods, walking trails, etc.) • Resources needed to construct the ecozone (people, places, things) • Benefits of the space • Images/Drawings of plan • Why: Explain your decisions of location, purpose, size, etc.	States most of the main points and details that focus on the topic Leaves out necessary information on one or two of the following: • Name • Specific location (include a Google Earth image) • Size: breakdown and layout of the land • Purpose/Goals of the ecozone • Specific components (pond, woods, walking trails, etc.) • Resources needed to construct the ecozone (people, places, things) • Benefits of the space • Images/Drawings of plan • Why: Explain your decisions of location, purpose, size, etc.	States few main points and details that focus on the topic, or information does not relate to topic Missing information on three or four of the following: • Name • Specific location (include a Google Earth image) • Size: breakdown and layout of the land • Purpose/Goals of the ecozone • Specific components (pond, woods, walking trails, etc.) • Resources needed to construct the ecozone (people, places, things) • Benefits of the space • Images/Drawings of plan • Why: Explain your decisions of location, purpose, size, etc.
Educational Display	Clearly organized in a logical sequence Neat, accurate and illustrative representations All pictures, charts and graphs are clear and distinct. Text is of adequate size and font to read.	Adequate evidence of a logical sequence Representations are accurate and illustrative. Pictures, charts and graphs are clear and distinct. Text is of adequate size and font to read.	Order and sequence could be improved Representations are illustrative but lack accuracy and neatness. Pictures, charts and graphs are legible. Text is difficult to read.	No logical organization; unclear and confusing Representations are unclear and difficult to read. Pictures, charts and graphs are indistinct.
Three-Dimensional Model	Effectively and creatively models all components of the ecozone	Models the components of the ecozone	Models most components of the ecozone	Model is missing a majority of components of the ecozone.
Works Cited	Includes three or more sources from a mix of books and Internet sites Each citation is correctly formatted in APA style.	Includes three sources, all of which are internet sites Each citation is correctly formatted in APA style.	Includes two sources Each citation attempts formatting in APA style.	Includes two sources No attempt at proper APA style formatting
Teacher Comments				
Total Score	/100			

Name: _____

Key: Appendix 2: Sustainable Manure

Directions: View the video “Retrieving Nutrients from Manure,” <https://vimeo.com/352030137>, to complete this activity.

How does Darling ingredients help farmers with their excess manure?

Collect the excess manure in a sustainable way and process it into a useable product

Darling Ingredients knew how to produce

biphosphate from manure but were left with a

large volume of unprocessed material. This residue

contained crucial building blocks like

humic acid that can work as soil

improvers.

Problems came about when the company tried completing the processing of the residue. Identify the following pieces to this problem and how Darling Ingredients came to a resolution?

Piece of equipment malfunctioning: **Reactor**

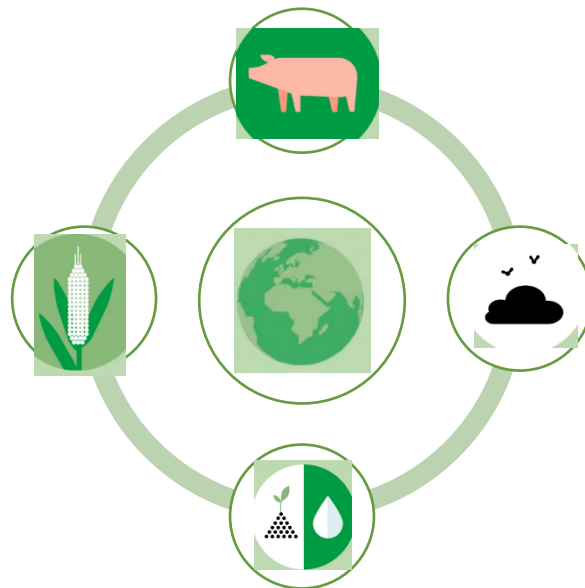
Cause of the clogging filter: **Humic acid**

Who resolved the problem? **Engineers**

What changes did they make? **Treated the residue in a dedicated bioreactor and reduced the filtration speed**

End results: **The company now fully process all residue. The company retrieves humic acid and generates a large volume of reclaimed water.**

- Complete the flow chart with the images shown in the video that allow farmers to be more sustainable.



Name: _____

Key: Appendix 3: Hungry for Insects

Directions:

Watch the video "Tomorrow's Nutrition Today," <https://vimeo.com/372647401>, to complete this activity.

Global population is expected to reach ten billion people by _____.

2025

2030

2042

2050

A **LARGE** problem can have
tiny solutions.



What is the common name of the
insect mentioned in the video?

Black soldier fly



- Feeding tomorrow's population means we must double the protein-rich food we are producing today.
- Give two examples of protein rich food you like to eat.

Examples:

Meat, eggs, nuts



ENTOMOPHAGY

Using your own words and pictures, describe what this term means.

Answers will vary.

In what state was the first commercial
insect farm in the United States
started?

Kentucky



Darling uses a farm-raised insect that can be fed as a protein
source in animal diets. Draw three animal the insect can be fed to.

Examples: chickens, poultry, fish

Do you feel this innovation is a realistic tool to help approach our food production problems in the future? Explain.

Answers will vary.

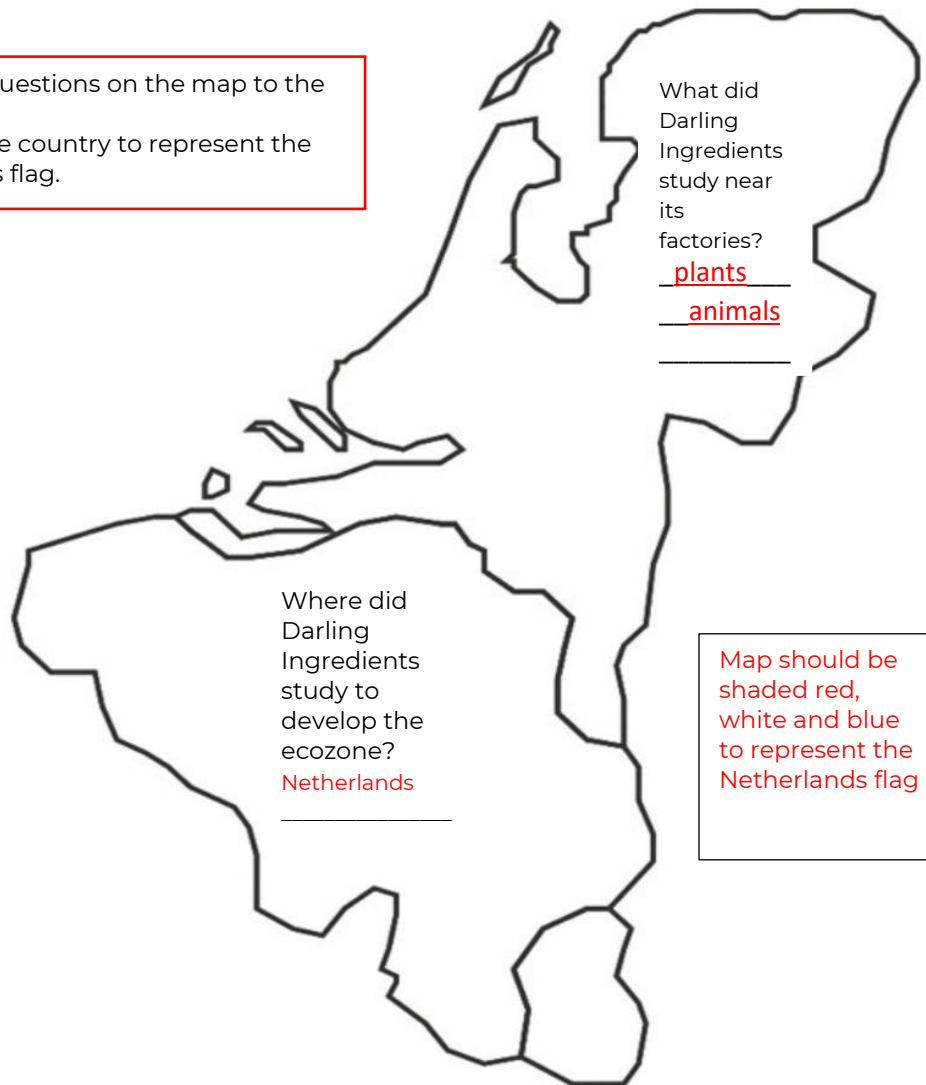
Name: _____

Key: Appendix 4: The Ecozone

Directions:

Watch the video "Ecozone: Giving Back to Nature," <https://vimeo.com/309301311>, and complete the questions below.

*Answer each of the questions on the map to the right.
*Shade and outline the country to represent the colors of this country's flag.



What did Darling Ingredients study near its factories?

plants

animals

Where did Darling Ingredients study to develop the ecozone?

Netherlands

Map should be shaded red, white and blue to represent the Netherlands flag

Describe the terms "flora" and "fauna" that are mentioned in the video by drawing visual representations of each.

Flora



Fauna



Name: _____



Water is a byproduct retrieved through plant operations. Darling captures this water, then recovers and treats the water from the raw materials. Lastly, the company gives this water back to the environment. Daily, it retrieves 3,600 cubic meters of water and 1.3 million cubic meters per year. Complete the math to convert that to the number of gallons Darling gives back to the environment. (1 cubic meter = 265 gallons)

Amount in Cubic Meters	Conversion to Gallons	Total Gallons Retrieved	Number of Olympic-Size Pools That Could Be Filled
3,600 cubic meters	$3,600 \times 265 = 954,000$	954,000 gallons per day	$954,000 / 660,000 = 1.45$ Olympic-size pools per day
1,300,000 cubic meters	$1,300,000 \times 265 = 344,500,000$	344,500,000 gallons per year	$344,500,000 / 660,000 = 521.97$ Olympic-size pools per year



Darling Ingredients receives an excess of raw materials such as manure, feed scraps and animal byproducts that they repurpose into valuable ingredients for fertilizer, feed and fuel.



Identify the three major tasks that were completed so that Darling could start giving water back to the environment.

1. Digging
2. Reshaping surroundings
3. Planting trees and reeds



How do the efforts of Darling Ingredients giving back water impact you? Answers will vary.

The ecozone brought many new visitors to the area. What did Darling provide for its new visitors?

Information about the flora and fauna found in the Ecozone

Who could be found resting at ecozone? Draw and label an example below.

Migratory and local bird species

Identify an area near your school that could be turned into an environmentally friendly space like the ecozone.

Location: _____

Why is this an ideal location?

Answers will vary.

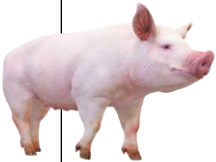
Name: _____

Key: Appendix 5: Rendering for Earth's Protection

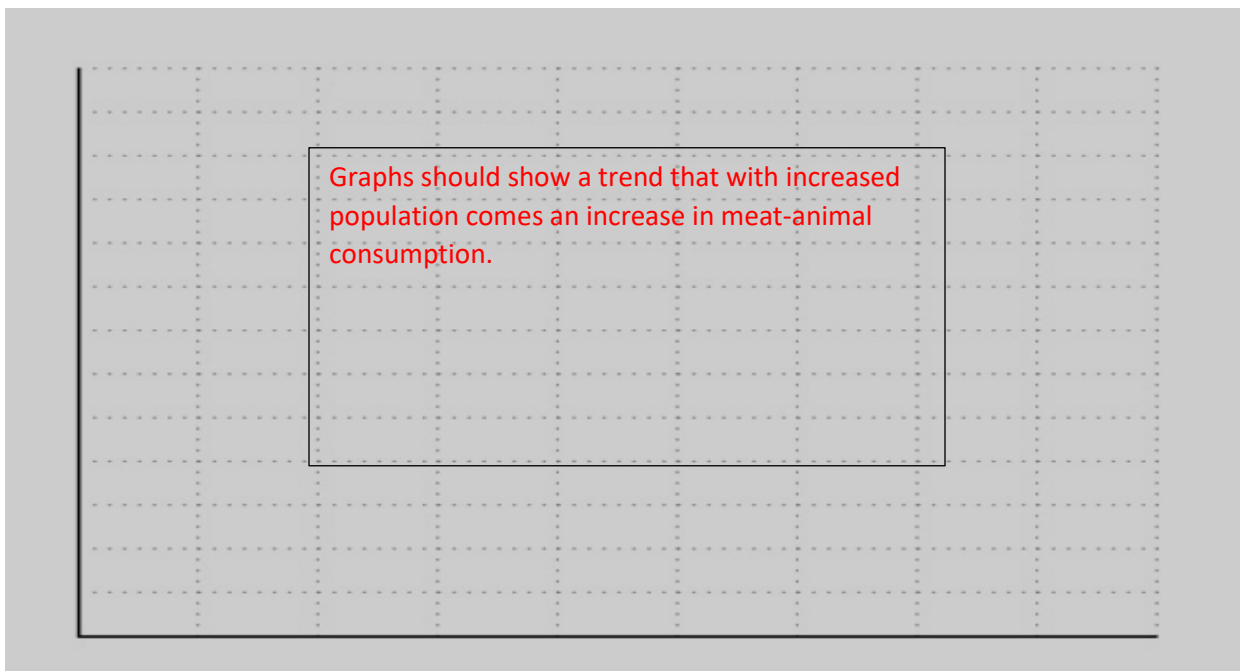
Directions: Utilizing the “ <https://ffa.app.box.com/file/985937535284>” publication, complete this activity to gain a better understanding of how the rendering industry protects our health and well-being.

Meat-animal diets generate a lot of waste. In the space below, draw what you believe are three items that generally would go to waste from the animal butchering process.

Examples: hooves, horns, blood, urine, connective tissue, hides, organs



Complete a line graph below to show the correlation of human population and meat-animal consumption. Label your x-axis and y-axis.



Which are potential problems that can result from the natural decomposition of animals? Shade the correct answer choices **ORANGE**.

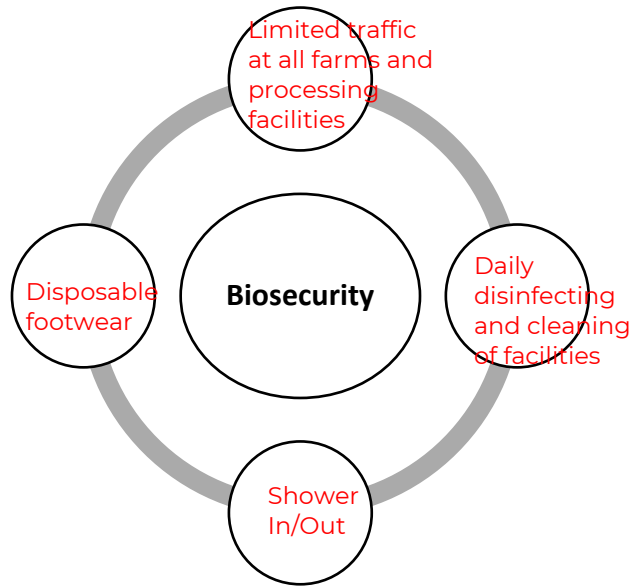
E. coli	Protozoa	Salmonella	Pneumonia
Warts	Pathogenic bacteria	Diarrhea	Viruses

Name: _____

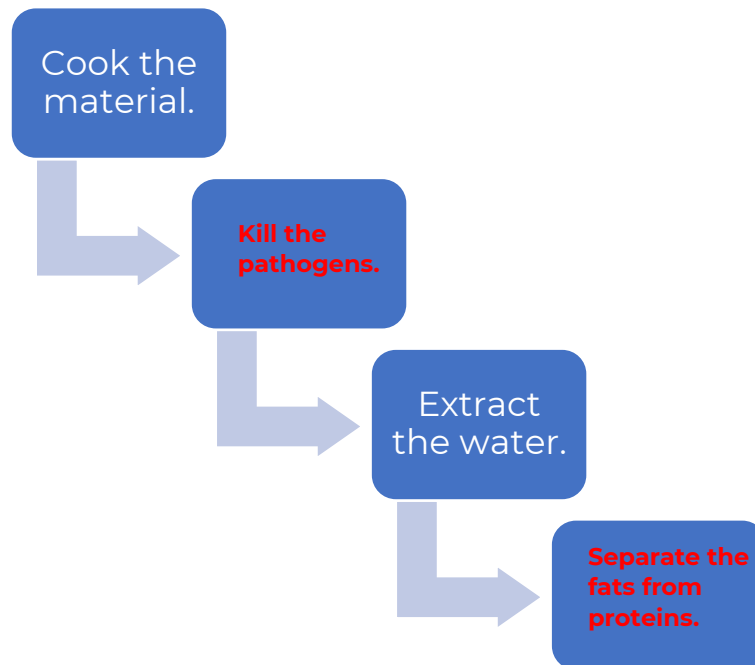


Complete the mind map below depicting what biosecurity represents in the food animal industry. (Example: using high heat to kill bacteria)

These are just a few ideas for students to think about. Many others are possible.



Complete the general steps of the rendering process below.



Rendering companies spend millions of dollars on equipment, analytical labs and monitoring instrumentation to meet federal, state and local standards and obtain operating permits for each rendering facility.

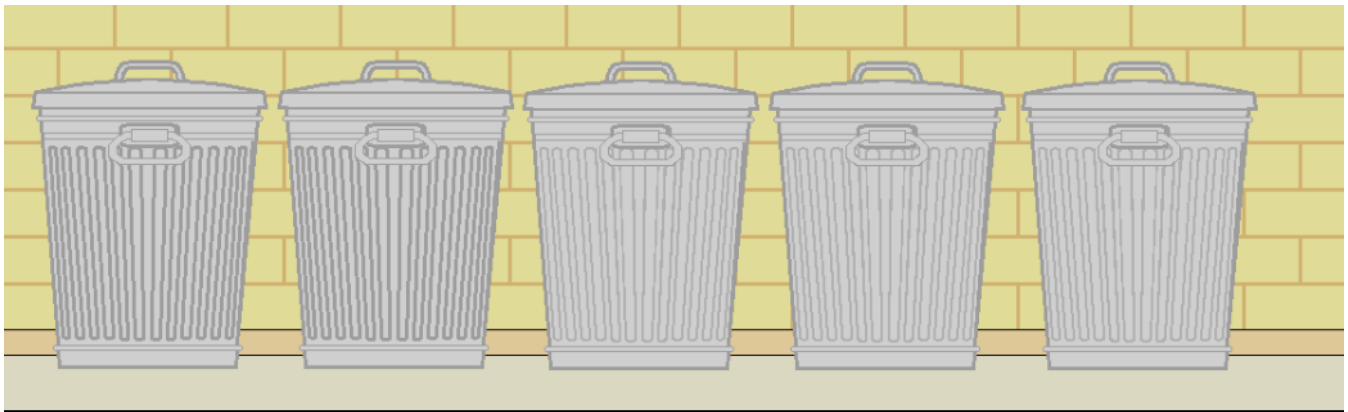
Name: _____

As of 2019, Darling owns and operates 52% of the industry-certified rendering facilities in the United States.

Rendering processes use high temperatures between 240 and 295 degrees F that destroy harmful pathogens and microorganisms within the first five minutes of processing.



On the trash cans below, identify the common disposal methods for animal mortalities or meat byproducts.



Identify at least three examples of why rendering is a more effective disposal method than landfills and composting.

Example 1	Example 2	Example 3
Reduces the spread of pathogens	Less time and energy needed Cost of running incinerators	Less animal and human exposure to bacteria and disease Less emission of greenhouse gases

Name: _____



Identify the four major government agencies that play an integral role in the regulation of the rendering industry and describe their roles.			
Agency: <u>EPA</u>	Agency: <u>FDA</u>	Agency: <u>USDA</u>	Agency: <u>OSHA</u>
Role: The EPA ensures that all processes affecting the air and water follow environmentally considerate practices.	Role: The FDA oversees regulation of animal feed and food for human consumption. This agency places an emphasis on identifying and developing limits for hazardous contaminants within feed and developing process controls with audited oversight to ensure compliance with regulations.	Role: The USDA plays a role in regulating dedicated edible rendering facilities (producing ingredients used in human food, such as gelatin, collagens, meat binders and texturizers) and has a tangential regulatory role over material intended for animal feed.	Role: OSHA takes on a role that focuses on the safety of both employees and consumers.



What are the three biggest takeaways from this publication from your viewpoint? In the space below, use words and pictures to describe them.

Answers will vary.