ND FFA Association

ADVANCED AGRICULTURAL TECHNOLOGY & MECHANICAL SYSTEMS

CDE Handbook

Purpose

The Advanced Agricultural Technology & Mechanical Systems CDE helps students develop their technical skills and knowledge and their ability to work with others to solve complex problems.

Objectives

This career development event selects and awards those students and teams that demonstrate:

1. Mastery of the subject matter and skills common to the systems areas;
2. Effective communication skills;
3. Superior problem-solving techniques;
4. An understanding of modern technology; and
5. The ability to function as individuals and as team members working together.

Rules

1. Each chapter may enter up to four members who have completed at least the 10th grade and have not been a participant in the national event;
2. The top three scores will be added for the team score;
3. An individual may only participate in one Agriculture Mechanics event each year;
4. The event will be held in cooperation with Agricultural Systems Management Department at North Dakota State University;
5. Each participant must compete in all phases of the event;
6. Each individual must furnish their own welding gloves, safety glasses and coveralls/shop coat;
7. Participant must wear official dress for awards presentations only;
8. Industrial standard eye protection and other safety precautions are a must during all phases of shop work. Appropriate clothing must be worn, must be in good repair and fit properly. Long sleeves are required for welding or cutting;
9. All tools, equipment and materials will be furnished. All written materials will be furnished, Individuals must provide their own clipboards and two sharpened number 2 lead pencils. The use of an electronic calculator is encouraged. Personal computers will be provided if needed to be used for problem solving activities;
10. All portions of this CDE will take place on ONE day. (The written test will not be held in the evening);
11. Teams will be pre-registered for three time slots—7:30 am, 10:00 am, and 1:30 pm. All team members must compete in the same time slot and are responsible to show up

on time for their assigned time slot or be disqualified. Team members participating in other CDEs/LDEs later in the day must register for the 7:30 am start time;

12. The order of events: 1. Team Problem Solving Activity, 2. Problem Solving/Skills Development Activities, and 3. Written Exam; and
13. Reference guide for technical information on themes and tool identification: Agricultural Technical Systems and Mechanics, 2nd Edition © 2019, ISBN: 978-0-8269-3680-6 and/or the 1st Edition.

Format

The state Advanced Agricultural Technology and Mechanical Systems CDE will be developed from the subject matter areas that are listed following each of the five systems associated with the agricultural mechanics industry:

1. Machinery and Equipment Systems: repair and maintenance, materials handling, processing, adjustments, metal fabrication;
2. Electrical Systems: AC/DC power, electrical safety, electrical standards, sensing devices, electrical wiring, controls, electronics, motors and other electrical loads, operating instructions, and manufacturer's recommendations;
3. Energy Systems: mechanical power, chemical power, wind power, solar power, hydraulic power, engine operation, maintenance, troubleshooting, repair;
4. Structural Systems: structures, storage, concrete, masonry, plumbing, electrical, fabrication, construction, building materials, ventilation, heating, air conditioning; and
5. Environmental and Natural Resource Systems: water quality, sustainable agricultural practices, soil and water conservation, biological waste handling.

Themes that will be used include:

1. 2023 - Processing Systems—Equipment: Combine;
2. 2024 - Plant Production Systems—Equipment: Planter; and
3. 2025 - Integrated Pest Management Systems—Equipment: Sprayer.

1. Written Exam
   a. A written exam consisting of multiple-choice questions will be developed from the five system areas;
   b. Participants will have 60 minutes to complete the exam; and
   c. The written exam will be worth 100 points.
2. Problem Solving/Skill Development Activities
   a. Each individual will perform skills associated with each of the five systems;

b. A total of 20 minutes will be allowed for each section. Each section is worth 30 points;
c. These individual performance activities will be developed from the skill competency/problem solving lists identified in the chart below; and
d. Total points for this section is 150 points.

3. Team Problem Solving Activity
   a. Participants will compete as a team to solve a "hands on" integrated problem associated with the theme selected with the event;
   b. A broad scenario will be presented to the team, the team will then have the freedom to use any and all information, organize themselves to solve the problem in their own way, and determine how they will put their solution together; and
   c. A total of 45 minutes per team to complete the activity. The team activity is worth 250 points.

Odd Years	
Practicums	Agricultural Equipment listed in the theme above. Questions may be based on actual equipment and/or operator's manual.
	Metal Fabrication (MIG or Arc) – View Rubric
	Electric Motors, controls, and sensing devices
	Engine systems (large or small engines)
	Concrete, Masonry, and plumbing
Team	Based on equipment listed in the theme above.

Even Years	
Practicums	Agricultural Equipment listed in the theme above. Questions may be based on actual equipment and/or operator's manual.
	Metal Fabrication (MIG or Arc) – View Rubric
	Electrical Circuits
	Engine systems (large or small engines)
	Building Construction
Team	Based on equipment listed in the theme above.

Scoring

Activity	Individual	Team
Written Test	100	300
Problem Solving (5 @ 30 pts.)	150	450
Team Activity		250
Maximum Points	250	1000

Awards

1. Individual
   a. Individual scores will be tabulated (and do not include the team activity) and broken into gold, silver, and bronze award areas;
   b. Individual ties will not be broken; and
   c. The high individual receives the "baby bison" trophy and a $250 stipend.
2. Team
   a. Team scores will be tabulated by adding the top three team member scores and the team activity. They will be broken into gold, silver, and bronze;
   b. The high team shall be eligible to represent North Dakota in the National Agricultural Technology & Mechanical Systems career development event. The high team receives the Traveling Trophy and travel stipends to participate in the National Event; and
   c. Team Tie Breakers will be determined by the following:
      i. Written Exam Score;
      ii. Total of Individual Performance Scores; and/or
      iii. Team Problem Solving Score.

Agriculture, Food and Natural Resources Content Standards

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
AS.05.01. Performance Indicator: Design animal housing, equipment and handling facilities for the major systems of animal production.		
AS.05.01.01.b. Critique designs for an animal facility and prescribe alternative layouts and adjustments for the safe, sustainable and efficient use of the facility.	Electricity Structures Team Event	AFNR Career Cluster – Animal Systems Pathway, Statement 2 STEM Career Cluster, Statement 4 STEM Career Cluster, Statement 5
AS.05.01.01.c. Design an animal facility focusing on animal requirements, economic efficiency, sustainability, safety and ease of handling.	Electricity Structures Team Event	AFNR Career Cluster – Animal Systems Pathway, Statement 2 STEM Career Cluster, Statement 4 STEM Career Cluster, Statement 5
AS.05.01.02.b. Analyze the use of modern equipment, technology and handling facility procedures and determine if they enhance the safe, economic and sustainable production of animals.	Electricity Structures Team Event Exam	AFNR Career Cluster – Animal Systems Pathway, Statement 2 STEM Career Cluster, Statement 4 STEM Career Cluster, Statement 5
AS.05.01.02.c. Select, use and evaluate equipment, technology and handling procedures to enhance sustainability and production efficiency.	Electricity Structures Team Event	AFNR Career Cluster – Animal Systems Pathway, Statement 2 STEM Career Cluster, Statement 4 STEM Career Cluster, Statement 5
AS.05.02. Performance Indicator: Comply with government regulations and safety standards for facilities used in animal production.		
AS.05.02.01.b. Analyze animal facilities to determine if standards have been met.	Structures Environmental and natural resources Team event Exam	CCSS.ELA-Literacy.W.9-10.9b CCSS.ELA-Literacy.W.11-12.9b
AS.05.02.01.c. Evaluate facility designs and make recommendations to ensure that it meets standards for the legal, safe, ethical, economical and efficient production of animals.	Structures Environmental and natural resources Team event Exam	CCSS.ELA-Literacy.W.9-10.9b CCSS.ELA-Literacy.W.11-12.9b
CS.01.02. Performance Indicator: Examine technologies and analyze their impact on AFNR systems.		
CS.01.02.01.b. Apply appropriate use of technologies in AFNR workplace scenarios.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	
CS.01.02.01.c. Solve problems in AFNR workplaces or scenarios using technology.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources	

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
	Team activity	
CS.01.02.02.b. Analyze how technology is used in AFNR systems to maximize productivity.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	
CS.01.02.02.c. Evaluate the importance of technology use and how it impacts AFNR systems.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	
CS.03.02. Performance Indicator: Develop a plan to maintain and improve health, safety and environmental compliance and performance.		
CS.03.02.01.b. Analyze health and safety performance plans of an AFNR business.	Entire event	AFNR Career Cluster, Statement 6
CS.03.02.01.c. Create a plan to improve safety, health and environmental management regulations in an AFNR business.	Entire event	AFNR Career Cluster, Statement 6
CS.03.02.02.b. Develop plans to improve environmental compliance and performance within an AFNR system.	Entire Event	AFNR Career Cluster, Statement 6
CS.03.02.02.c. Devise a strategy to educate employees on environmental compliance and performance in an AFNR business.	Entire event	AFNR Career Cluster, Statement 6
CS.03.03. Performance Indicator: Apply health and safety practices to AFNR worksites.		
CS.03.03.01.b. Analyze and summarize current health and safety practices of AFNR business.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	
CS.03.03.01.c. Create a health and safety policy plan for AFNR business.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	
CS.03.03.02.b. Assess various emergency response plan requirements for an AFNR worksite and/or facility.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
CS.03.03.02.c. Create a plan to communicate appropriate responses for health and safety situations within an AFNR business.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	
CS.03.03.03.b. Assess first aid knowledge and procedures relevant to AFNR worksites.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	
CS.03.03.03.c. Conduct a survey and evaluate results of AFNR businesses to identify structure of health and safety practices and number of employees certified in first aid training.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	
CS.03.03.04.b. Assess the safety priorities and appropriate responses for different levels of contamination or injury at an AFNR worksite.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	
CS.03.03.04.c. Create a plan to mitigate the level of contamination or injury identified as a risk in the workplace.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	
CS.03.04. Performance Indicator: Use appropriate protective equipment and demonstrate safe and proper use of AFNR tools and equipment.		
CS.03.04.01.b. Analyze and summarize protective equipment requirements on various AFNR tools and equipment.	Entire event	
C3.03.04.01.c. Design plans to ensure the use of appropriate protective equipment when using various AFNR tools and equipment.	Entire event	
CS.03.04.02.b. Complete the set up and adjustment for tools and equipment related to AFNR tasks	Entire event	
C3.06.04.02.c. Evaluate and select appropriate tools and equipment to complete AFNR tasks.	Entire event	

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
CS.03.04.03.b. Assess and demonstrate appropriate operation, storage and maintenance techniques for AFNR tools and equipment.	Entire event	
C3.06.04.03.c. Devise operation, storage and maintenance plans or schedules for AFNR tools and equipment.	Entire event	
CS.04.01. Performance Indicator: Identify and implement practices to steward natural resources in different AFNR systems.		
CS.04.01.01.b. Analyze available practices to steward natural resources in AFNR systems (e.g., wildlife and land conservation, soil and water practices, ecosystem management, etc.).	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	AFNR Career Cluster, Statement 2 AFNR Career Cluster, Statement 3
CS.04.01.01.c. Devise strategies for stewarding natural resources at home and within community.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	AFNR Career Cluster, Statement 2 AFNR Career Cluster, Statement 3
CS.04.01.02.b. Analyze and assess sustainability practices that can be applied in AFNR systems (e.g., energy efficiency, recycle/reuse/repurpose, green resources, etc.).	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	AFNR Career Cluster, Statement 2 AFNR Career Cluster, Statement 3
CS.04.01.02.c. Evaluate sustainability policies and plans and prepare summary of potential improvements for AFNR businesses or organizations.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	AFNR Career Cluster, Statement 2 AFNR Career Cluster, Statement 3
CRP.02.01. Performance Indicator: Use strategic thinking to connect and apply academic learning, knowledge and skills to solve problems in the workplace and community.		
CRP.02.01.01.b. Assess workplace problems and identify the most appropriate academic knowledge and skills to apply.	Entire event	
CRP.01.01.01.c. Evaluate past workplace and community situations and determine how personal responsibility positively or negatively impacted outcomes	Entire event	
CRP.02.01.02.b. Assess community problems and identify the most appropriate academic knowledge and skills to apply.	Entire event	

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
CRP.01.01.02.c. Model personal responsibility in workplace and community situations.	Entire event	
CRP.02.02. Performance Indicator: Use strategic thinking to connect and apply technical concepts to solve problems in the workplace and community.		
CRP.02.02.01.b. Assess workplace problems and distinguish the most appropriate technical concepts to apply.	Entire event	
CRP.02.02.01.c. Apply technical concepts to solve problems in the workplace and reflect upon the results achieved.	Entire event	
CRP.02.02.02.b. Assess community problems and identify the most appropriate technical concepts to apply.	Entire event	
CRP.02.02.02.c. Apply technical concepts to solve problems in the community and reflect upon results achieved.	Entire event	
CRP.04.01. Performance Indicator: Speak using strategies that ensure clarity, logic, purpose and professionalism in formal and informal settings.		
CRP.04.01.01.b. Analyze use of verbal and non-verbal communication strategies in workplace situations.	Team event	
CRP.04.01.01.c. Evaluate other's verbal and non-verbal communications (e.g., speeches, presentations, oral reports, etc.) and propose recommendations for improvement in clarity, logic, purpose and professionalism.	Team event	
CRP.04.02. Performance Indicator: Produce clear, reasoned and coherent written communication in formal and informal settings.		
CRP.04.02.02.b. Apply techniques for ensuring clarity, logic and coherence to edit written communications (e.g., emails, reports, presentations, technical documents, etc.).	Team event	
CRP.04.02.02.c. Compose clear and coherent written documents (e.g., agendas, audio-visuals, drafts, forms, etc.) for formal and informal settings.	Team event	
CRP.04.03. Performance Indicator: Model active listening strategies when interacting with others in formal and informal settings.		
CRP.04.03.01.b. Apply active listening strategies (e.g., be attentive, observe non-verbal cues, ask clarifying questions, etc.).	Team event	

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
CRP.06.03.02.b. Elicit and assimilate input and feedback from individuals and organizations about new ideas or innovations for the workplace or community.	Team event	
CRP.07.02.02.c. Create and defend proposals for new technologies, practices and ideas using valid and reliable data sources.	Team event	
CRP.08.01. Performance Indicator: Apply reason and logic to evaluate workplace and community situations from multiple perspectives.		
CRP.08.01.01.b. Apply steps for critical thinking to a variety of workplace and community situations.	Team event	
CRP.08.01.02.b. Assess solutions to workplace and community problems for evidence of reason, logic and consideration of multiple perspectives.	Team event	
CRP.08.01.02.c. Devise strategies to apply reason, logic and input from multiple perspectives to solve workplace and community problems.	Team event	
CRP.08.02. Performance Indicator: Investigate, prioritize and select solutions to solve problems in the workplace and community		
CRP.08.02.01.b. Assimilate and prioritize potential solutions to solve problems in the workplace and community.	Team event	
CRP.08.02.01.c. Devise strategies to evaluate the effectiveness of solutions for resolving workplace and community problems.	Team event	
CRP.08.02.02.b. Apply decision-making processes to generate possible solutions to solve workplace and community problems.	Team event	
CRP.08.02.02.c. Evaluate and select solutions with greatest potential for success to solve workplace and community problems.	Team event	
CRP.08.03. Performance Indicator: Establish plans to solve workplace and community problems and execute them with resiliency.		
CRP.08.03.01.b. Analyze and determine the best problem-solving model to apply to workplace and community problems.	Team event Exam	
CRP.08.03.01.c. Evaluate the effectiveness of different problem-solving models for reaching a solution to workplace and community issues.	Team event Exam	

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
CRP.08.03.02.b. Create plans to solve workplace and community problems.	Team event Exam	
CRP.08.03.02.c. Implement and evaluate plans to solve workplace and community problems.	Team event Exam	
CRP.11.01. Performance Indicator: Research, select and use new technologies, tools and applications to maximize productivity in the workplace and community.		
CRP.11.01.01.b. Analyze advantages and disadvantages of new technologies, tools and applications to maximize productivity in the workplace and community.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	
CRP.11.01.02.b. Select, apply and use new technologies, tools and applications in workplace and community situations to maximize productivity.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	
CRP.11.01.02.c. Evaluate effectiveness and make recommendations for using new technologies, tools and applications in the workplace and community.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	
CRP.12.01. Performance Indicator: Contribute to team-oriented projects and build consensus to accomplish results using cultural global competence in the workplace and community.		
CRP.12.01.01.b. Formulate action plans to complete team-oriented projects in the workplace and community, including plans for personal contributions.	Team activity	
CRP.12.01.01.c. Evaluate the effectiveness of team-oriented projects at work and in the community and make recommendations for future improvements	Team activity	
CRP.12.01.02.b. Apply consensus building techniques to accomplish results in team-oriented situations.	Team activity	
CRP.12.01.02.c. Devise and implement methods to obtain feedback from team members on their experiences after completing workplace and community projects.	Team activity	

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
CRP.12.02. Performance Indicator: Create and implement strategies to engage team members to work toward team and organizational goals in a variety of workplace and community situations (e.g., meetings, presentations, etc.).		
CRP.12.02.02.b. Select strategies to engage team members and apply in a variety of situations.	Team event	
CRP.12.02.01.c. Create novel strategies to engage team members based on the situation.	Team event	
ESS.01.01. Performance Indicator: Analyze and interpret laboratory and field samples in environmental service systems.		
ESS.01.01.01.b. Determine the appropriate sampling techniques needed to generate data.	Entire event	CCSS.ELA-LITERACY.SL.11-12.5 CCSS.ELA-LITERACY.RST.11-12.9 CCSS.MATH.CONTENT.HSN.Q.A.1 CCSS.MATH.CONTENT.HSN.Q.A.2 CCSS.MATH.CONTENT.HSN.Q.A.3 CCSS.MATH.CONTENT.HSS.ID.A.2 CCSS.MATH.CONTENT.HSS.ID.B.5 HS-ESS2-2
ESS.01.01.01.c. Collect and prepare sample measurements using appropriate data collection techniques.	Entire event	CCSS.ELA-LITERACY.SL.11-12.5 CCSS.ELA-LITERACY.RST.11-12.9 CCSS.MATH.CONTENT.HSN.Q.A.1 CCSS.MATH.CONTENT.HSN.Q.A.2 CCSS.MATH.CONTENT.HSN.Q.A.3 CCSS.MATH.CONTENT.HSS.ID.A.2 CCSS.MATH.CONTENT.HSS.ID.B.5 HS-ESS2-2
ESS.01.01.02.b. Summarize the purpose of statistical analysis methods commonly used in environmental service systems research and explain examples of their use in practice.	Entire event	CCSS.ELA-LITERACY.SL.11-12.5 CCSS.ELA-LITERACY.RST.11-12.9 CCSS.MATH.CONTENT.HSN.Q.A.1 CCSS.MATH.CONTENT.HSN.Q.A.2 CCSS.MATH.CONTENT.HSN.Q.A.3 CCSS.MATH.CONTENT.HSS.ID.A.2 CCSS.MATH.CONTENT.HSS.ID.B.5 HS-ESS2-2
ESS.01.01.02.c. Utilize data analysis to identify trends in a data sample and assess the confidence that can be drawn from those conclusions.	Entire event	CCSS.ELA-LITERACY.SL.11-12.5 CCSS.ELA-LITERACY.RST.11-12.9 CCSS.MATH.CONTENT.HSN.Q.A.1 CCSS.MATH.CONTENT.HSN.Q.A.2 CCSS.MATH.CONTENT.HSN.Q.A.3 CCSS.MATH.CONTENT.HSS.ID.A.2 CCSS.MATH.CONTENT.HSS.ID.B.5 HS-ESS2-2
ESS.01.02. Performance Indicator: Properly utilize scientific instruments in environmental monitoring situations (e.g., laboratory equipment, environmental monitoring instruments, etc.).		
ESS.01.02.01.b. Demonstrate the proper use and maintenance of basic laboratory equipment.	Machinery and equipment Electricity Compact equipment	

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
	Structures Environmental and natural resources Team activity	
ESS.01.02.01.c. Calibrate and use laboratory equipment according to standard operating procedures	Entire event	
ESS.01.02.02.b. Demonstrate the proper use and maintenance of environmental monitoring instruments.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	
ESS.01.02.02.c. Calibrate and use environmental monitoring instruments according to standard operating procedures.	Entire event	
ESS.03.01. Performance Indicator: Apply meteorology principles to environmental service systems.		
ESS.03.01.01.b. Differentiate how components of the atmosphere (e.g., weather systems and patterns, structure of the atmosphere, etc.) affect environmental service systems.	Entire event	CCSS.ELA-LITERACY.RST.11-12.1 CCSS.ELA-LITERACY.RST.11-12.2 CCSS.ELA-LITERACY.RST.11-12.7 CCSS.ELA-LITERACY.WHST.9-12.7 CCSS.MATH.CONTENT.HSN-Q.A.1 CCSS.MATH.CONTENT.HSN-Q.A.2 CCSS.MATH.CONTENT.HSN-Q.A.3 HS-ESS2-6 HS-ESS3-5
ESS.03.01.01.c. Utilize meteorological data to assess the impact of atmospheric conditions on environmental service systems.	Entire event	CCSS.ELA-LITERACY.RST.11-12.1 CCSS.ELA-LITERACY.RST.11-12.2 CCSS.ELA-LITERACY.RST.11-12.7 CCSS.ELA-LITERACY.WHST.9-12.7 CCSS.MATH.CONTENT.HSN-Q.A.1 CCSS.MATH.CONTENT.HSN-Q.A.2 CCSS.MATH.CONTENT.HSN-Q.A.3 HS-ESS2-6 HS-ESS3-5
ESS.03.02. Performance Indicator: Apply soil science and hydrology principles to environmental service systems.		
ESS.03.02.01.b. Use a soil survey to determine the land capability classes for different parcels of land in an area.	Entire event	CCSS.ELA-LITERACY.RST.11-12.1 CCSS.ELA-LITERACY.RST.11-12.2 CCSS.ELA-LITERACY.RST.11-12.7 CCSS.ELA-LITERACY.WHST.9-10.7 CCSS.ELA-LITERACY.WHST.11-12.7 CCSS.MATH.CONTENT.HSN-Q.A.1 CCSS.MATH.CONTENT.HSN-Q.A.2 CCSS.MATH.CONTENT.HSN-Q.A.3 HS-ESS2-5 HS-ESS2-6

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
ESS.03.02.01.c. Design a master land-use management plan for a given area that utilizes land capability classes in order to minimize erosion and flooding, maximize development and preservation of topsoil, etc.	Entire event	CCSS.ELA-LITERACY.RST.11-12.1 CCSS.ELA-LITERACY.RST.11-12.2 CCSS.ELA-LITERACY.RST.11-12.7 CCSS.ELA-LITERACY.WHST.9-10.7 CCSS.ELA-LITERACY.WHST.11-12.7 CCSS.MATH.CONTENT.HSN-Q.A.1 CCSS.MATH.CONTENT.HSN-Q.A.2 CCSS.MATH.CONTENT.HSN-Q.A.3 HS-ESS2-5 HS-ESS2-6
ESS.03.02.02.b. Differentiate rock types and relate the chemical composition of mineral matter in soils to the parent material.	Entire event	CCSS.ELA-LITERACY.RST.11-12.1 CCSS.ELA-LITERACY.RST.11-12.2 CCSS.ELA-LITERACY.RST.11-12.7 CCSS.ELA-LITERACY.WHST.9-10.7 CCSS.ELA-LITERACY.WHST.11-12.7 CCSS.MATH.CONTENT.HSN-Q.A.1 CCSS.MATH.CONTENT.HSN-Q.A.2 CCSS.MATH.CONTENT.HSN-Q.A.3 HS-ESS2-5 HS-ESS2-6
ESS.03.02.02.c. Evaluate the soil composition in order to predict the impact of that soil on environmental service systems.	Entire event	CCSS.ELA-LITERACY.RST.11-12.1 CCSS.ELA-LITERACY.RST.11-12.2 CCSS.ELA-LITERACY.RST.11-12.7 CCSS.ELA-LITERACY.WHST.9-10.7 CCSS.ELA-LITERACY.WHST.11-12.7 CCSS.MATH.CONTENT.HSN-Q.A.1 CCSS.MATH.CONTENT.HSN-Q.A.2 CCSS.MATH.CONTENT.HSN-Q.A.3 HS-ESS2-5 HS-ESS2-6
ESS.03.02.03.b. Assess the physical qualities of the soil that determine its potential for filtration of groundwater supplies and likelihood for flooding.	Entire event	CCSS.ELA-LITERACY.RST.11-12.1 CCSS.ELA-LITERACY.RST.11-12.2 CCSS.ELA-LITERACY.RST.11-12.7 CCSS.ELA-LITERACY.WHST.9-10.7 CCSS.ELA-LITERACY.WHST.11-12.7 CCSS.MATH.CONTENT.HSN-Q.A.1 CCSS.MATH.CONTENT.HSN-Q.A.2 CCSS.MATH.CONTENT.HSN-Q.A.3 HS-ESS2-5 HS-ESS2-6
ESS.03.02.03.c. Conduct tests of soil to determine its potential for filtration of groundwater supplies and likelihood for flooding.	Entire event	CCSS.ELA-LITERACY.RST.11-12.1 CCSS.ELA-LITERACY.RST.11-12.2 CCSS.ELA-LITERACY.RST.11-12.7 CCSS.ELA-LITERACY.WHST.9-10.7 CCSS.ELA-LITERACY.WHST.11-12.7 CCSS.MATH.CONTENT.HSN-Q.A.1 CCSS.MATH.CONTENT.HSN-Q.A.2 CCSS.MATH.CONTENT.HSN-Q.A.3 HS-ESS2-5 HS-ESS2-6

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
ESS.03.02.04.b. Assess precautions taken to prevent or reduce contamination of groundwater supplies.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	CCSS.ELA-LITERACY.RST.11-12.1 CCSS.ELA-LITERACY.RST.11-12.2 CCSS.ELA-LITERACY.RST.11-12.7 CCSS.ELA-LITERACY.WHST.9-10.7 CCSS.ELA-LITERACY.WHST.11-12.7 CCSS.MATH.CONTENT.HSN-Q.A.1 CCSS.MATH.CONTENT.HSN-Q.A.2 CCSS.MATH.CONTENT.HSN-Q.A.3 HS-ESS2-5 HS-ESS2-6
ESS.03.02.04.c. Evaluate the methods used in a given example to protect groundwater supplies.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	CCSS.ELA-LITERACY.RST.11-12.1 CCSS.ELA-LITERACY.RST.11-12.2 CCSS.ELA-LITERACY.RST.11-12.7 CCSS.ELA-LITERACY.WHST.9-10.7 CCSS.ELA-LITERACY.WHST.11-12.7 CCSS.MATH.CONTENT.HSN-Q.A.1 CCSS.MATH.CONTENT.HSN-Q.A.2 CCSS.MATH.CONTENT.HSN-Q.A.3 HS-ESS2-5 HS-ESS2-6
ESS.04.02. Performance Indicator: Manage safe disposal of all categories of solid waste in environmental service systems.		
ESS.04.02.01.b. Analyze environmental hazards created by different types of solid waste, solid waste accumulation and solid waste disposal.	Environmental and natural resources Team activity	HS-ETS1-2
ESS.04.02.01.c. Develop a plan for solid waste disposal for a given situation that considers the environmental hazards, economic realities and social concerns associated with this task.	Environmental and natural resources Team activity	HS-ETS1-2
ESS.04.02.02.b. Analyze and document basic sanitary landfill operating procedures and design.	Environmental and natural resources Team activity	HS-ETS1-2
ESS.04.02.02.c. Evaluate sanitary landfill procedures for environmental, economic and social sustainability.	Environmental and natural resources Team activity	HS-ETS1-2
ESS.04.02.03.b. Apply scientific principles to explain the benefits and processes of composting.	Environmental and natural resources Team activity	HS-ETS1-2
ESS.04.02.03.c. Evaluate the appropriateness of composting methods in different situations.	Environmental and natural resources Team activity	HS-ETS1-2
ESS.04.02.04.b. Analyze and document different recycling methods and classify materials that can be recycled.	Environmental and natural resources Team activity	HS-ETS1-2
ESS.04.02.04.c. Survey and evaluate recycling programs and procedures.	Environmental and natural resources Team activity	HS-ETS1-2

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
ESS.04.04. Performance Indicator: Compare and contrast the impact of conventional and alternative energy sources on the environment and operation of environmental service systems.		
ESS.04.04.02.b. Identify advantages and disadvantages of alternative energy sources as they pertain to environmental service systems.	Electricity Environmental and natural resources Team activity	CCSS.ELA-LITERACY.RST.11-12.1 CCSS.ELA-LITERACY.RST.11-12.8 CCSS.ELA-LITERACY.WHST.9-10.5 CCSS.ELA-LITERACY.WHST.11-12.5 CCSS.ELA-LITERACY.WHST.9-10.7 CCSS.ELA-LITERACY.WHST.11-12.7 CCSS.ELA-LITERACY.RST.11-12.2 CCSS.ELA-LITERACY.RST.11-12.9 CCSS.ELA-LITERACY.WHST 11-12.9 CCSS.MATH.CONTENT.HSN-Q.A.1 CCSS.MATH.CONTENT.HSN-Q.A.2 CCSS.MATH.CONTENT.HSN-Q.A.3 HS-ETS1-2 HS-ETS1-4
ESS.04.04.02.c. Evaluate the impact alternative energy sources have on environmental conditions.	Electricity Environmental and natural resources Team activity	CCSS.ELA-LITERACY.RST.11-12.1 CCSS.ELA-LITERACY.RST.11-12.8 CCSS.ELA-LITERACY.WHST.9-10.5 CCSS.ELA-LITERACY.WHST.11-12.5 CCSS.ELA-LITERACY.WHST.9-10.7 CCSS.ELA-LITERACY.WHST.11-12.7 CCSS.ELA-LITERACY.RST.11-12.2 CCSS.ELA-LITERACY.RST.11-12.9 CCSS.ELA-LITERACY.WHST 11-12.9 CCSS.MATH.CONTENT.HSN-Q.A.1 CCSS.MATH.CONTENT.HSN-Q.A.2 CCSS.MATH.CONTENT.HSN-Q.A.3 HS-ETS1-2 HS-ETS1-4
ESS.04.04.03.b. Analyze and document the main categories of energy consumption.	Entire event	CCSS.ELA-LITERACY.RST.11-12.1 CCSS.ELA-LITERACY.RST.11-12.8 CCSS.ELA-LITERACY.WHST.9-10.5 CCSS.ELA-LITERACY.WHST.11-12.5 CCSS.ELA-LITERACY.WHST.9-10.7 CCSS.ELA-LITERACY.WHST.11-12.7 CCSS.ELA-LITERACY.RST.11-12.2 CCSS.ELA-LITERACY.RST.11-12.9 CCSS.ELA-LITERACY.WHST 11-12.9 CCSS.MATH.CONTENT.HSN-Q.A.1 CCSS.MATH.CONTENT.HSN-Q.A.2 CCSS.MATH.CONTENT.HSN-Q.A.3 HS-ETS1-2 HS-ETS1-4
ESS.04.04.03.c. Evaluate strategies for reducing energy consumption to determine the most effective course of action based on the needs of environmental service systems.	Entire event	CCSS.ELA-LITERACY.RST.11-12.1 CCSS.ELA-LITERACY.RST.11-12.8 CCSS.ELA-LITERACY.WHST.9-10.5 CCSS.ELA-LITERACY.WHST.11-12.5 CCSS.ELA-LITERACY.WHST.9-10.7 CCSS.ELA-LITERACY.WHST.11-12.7 CCSS.ELA-LITERACY.RST.11-12.2

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
		CCSS.ELA-LITERACY.RST.11-12.9 CCSS.ELA-LITERACY.WHST 11-12.9 CCSS.MATH.CONTENT.HSN-Q.A.1 CCSS.MATH.CONTENT.HSN-Q.A.2 CCSS.MATH.CONTENT.HSN-Q.A.3 HS-ETS1-2 HS-ETS1-4
ESS.05.01. Performance Indicator: Use technological and mathematical tools to map land, facilities and infrastructure for environmental service systems.		
ESS.05.01.01.b. Apply surveying and mapping principles to a situation involving environmental service systems and identify and explain the use of equipment for surveying and mapping.	Entire event	HS-ETS1-4
ESS.05.01.01.c. Demonstrate surveying and cartographic skills to make site measurements in order to address concerns and needs within an environmental service systems situation.	Entire event	HS-ETS1-4
ESS.05.01.02.b. Apply GIS skills to a situation specific to environmental service systems.	Entire event	HS-ETS1-4
ESS.05.01.02.c. Interpret and evaluate GIS data to come to a conclusion about a scenario specific to environmental service systems.	Entire event	HS-ETS1-4
ESS.05.01.03.b. Analyze and document examples of utilization of breaking technology in environmental service systems.	Entire Event	HS-ETS1-4
ESS.05.01.03.c. Evaluate trends in technology and develop predictions about how these advancements will change environmental service systems	Entire event	HS-ETS1-4
ESS.05.02. Performance Indicator: Perform assessments of environmental conditions using equipment, machinery and technology.		
ESS.05.02.01.b. Assess different measurements of water quality to determine their effectiveness and limitations.	Environmental and natural resources Team activity	HS-ETS1-4 HS-ETS1-2
ESS.05.02.01.c. Evaluate a sample of water to determine its quality and if it has been contaminated.	Environmental and natural resources Team activity	HS-ETS1-4 HS-ETS1-2
ESS.05.02.02.b. Assess different measurements of soil quality (e.g., soil horizons, soil texture, organic matter, soil respiration, etc.) to determine their effectiveness and limitations.	Environmental and natural resources Team activity	HS-ETS1-4 HS-ETS1-2

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
ESS.05.02.02.c. Evaluate a sample of soil to determine its quality and if it has been contaminated.	Environmental and natural resources Team activity	HS-ETS1-4 HS-ETS1-2
ESS.05.02.03.b. Assess different measurements of air quality (e.g., ozone, carbon monoxide, particulate matter, etc.) to determine their effectiveness and limitations.	Environmental and natural resources Team activity	HS-ETS1-4 HS-ETS1-2
ESS.05.02.03.c. Perform an evaluation of air quality to determine and assess its impact of human and ecological populations.	Environmental and natural resources Team activity	HS-ETS1-4 HS-ETS1-2
ESS.05.02.04.b. Assess different measurements of assessing ecological health (e.g., quadrat biodiversity assessments, transect surveys, population counts, detection of disease and invasive species, etc.) to determine their effectiveness and limitations.	Environmental and natural resources Team activity	HS-ETS1-4 HS-ETS1-2
ESS.05.02.04.c. Evaluate a habitat to determine its ecological quality and if it is threatened.	Environmental and natural resources Team activity	HS-ETS1-4 HS-ETS1-2
FPP.01.01. Performance Indicator: Analyze and manage operational and safety procedures in food products and processing facilities.		
FPP.01.01.01.b. Analyze and document attributes and procedures of current safety programs in food products and processing facilities.	Electricity Compact equipment Structures Environmental and natural resources Team activity	AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 1 AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 2 AFNR Career Cluster, Statement 6 Manufacturing Career Cluster – Maintenance, Installation and Repair Pathway Statement 2 Manufacturing Career Cluster – Maintenance, Installation and Repair Pathway Statement 4 Manufacturing Career Cluster – Production Pathway 2 Manufacturing Career Cluster – Production Pathway 3
FPP.01.01.01.c. Construct plans that ensure implementation of safety programs for food products and processing facilities.	Electricity Compact equipment Structures Environmental and natural resources Team activity	AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 1 AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 2 AFNR Career Cluster, Statement 6 Manufacturing Career Cluster – Maintenance, Installation and Repair Pathway Statement 2 Manufacturing Career Cluster – Maintenance, Installation and Repair Pathway Statement 4

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
		Manufacturing Career Cluster – Production Pathway 2 Manufacturing Career Cluster – Production Pathway 3
FPP.01.01.02.b. Assess equipment and facility maintenance used in food products and processing systems (e.g., specifications for machines, sanitation procedures, repair protocol, etc.).	Electricity Compact equipment Structures Environmental and natural resources Team activity	AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 1 AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 2 AFNR Career Cluster, Statement 6 Manufacturing Career Cluster – Maintenance, Installation and Repair Pathway Statement 2 Manufacturing Career Cluster – Maintenance, Installation and Repair Pathway Statement 4 Manufacturing Career Cluster – Production Pathway 2 Manufacturing Career Cluster – Production Pathway 3
FPP.01.01.02.c. Devise strategies to maintain equipment and facilities for food products and processing systems.	Electricity Compact equipment Structures Environmental and natural resources Team activity	AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 1 AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 2 AFNR Career Cluster, Statement 6 Manufacturing Career Cluster – Maintenance, Installation and Repair Pathway Statement 2 Manufacturing Career Cluster – Maintenance, Installation and Repair Pathway Statement 4 Manufacturing Career Cluster – Production Pathway 2 Manufacturing Career Cluster – Production Pathway 3
FPP.01.02. Performance Indicator: Apply food safety and sanitation procedures in the handling and processing of food products to ensure food quality.		
FPP.01.02.01.b. Outline procedures to eliminate possible contamination hazards associated with food products and processing.	Electricity Compact equipment Structures Environmental and natural resources Team activity	AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 1 AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 2
FPP.01.02.01.c. Identify sources of contamination in food products and/or processing facilities and develop ways to eliminate contamination.	Electricity Compact equipment Structures Environmental and natural resources Team activity	AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 1 AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 2
FPP.01.02.02.b. Construct plans that ensure implementation of safe handling procedures on food products.	Electricity Compact equipment Structures Environmental and natural resources	AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 1 AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 2

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
	Team activity	
FPP.01.02.02.c. Examine, interpret and report outcomes from safe handling procedures and results from quality assurance tests.	Electricity Compact equipment Structures Environmental and natural resources Team activity	AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 1 AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 2
FPP.01.02.03.b. Design and construct experiments for quality assurance tests on food products.	Electricity Compact equipment Structures Environmental and natural resources Team activity	AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 1 AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 2
FPP.01.02.03.c. Interpret and evaluate results of quality assurance tests on food products and examine steps to implement corrective procedures.	Electricity Compact equipment Structures Environmental and natural resources Team activity	AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 1 AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 2
FPP.01.02.04.b. Assess the procedures of microbiological tests used to detect food-borne pathogens.	Electricity Compact equipment Structures Environmental and natural resources Team activity	AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 1 AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 2
FPP.01.02.04.c. Conduct and interpret microbiological tests for food-borne pathogens.	Electricity Compact equipment Structures Environmental and natural resources Team activity	AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 1 AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 2
NRS.01.04. Performance Indicator: Apply ecological concepts and principles to aquatic natural resource systems.		
NRS.01.04.02.b. Analyze how different classifications of ground and surface water affect ecosystem function.	Environmental and natural resources	
NRS.01.04.02.c. Devise strategies to manage, protect, enhance or improve sources of groundwater or surface water based on its properties.	Environmental and natural resources	
NRS.01.04.03.b. Assess techniques used in the creation, enhancement and management of riparian zones and riparian buffers.	Environmental and natural resources	
NRS.01.04.03.c. Devise strategies for the creation, enhancement and management of riparian zones and riparian buffers.	Environmental and natural resources	
NRS.01.05. Performance Indicator: Apply ecological concepts and principles to terrestrial natural resource systems.		
NRS.01.05.04.b. Analyze a plot of land in order to determine which soil management techniques would be most applicable.	Machinery and equipment Compact equipment Structures	

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
	Environmental and natural resources Team activity	
NRS.01.05.04.c. Devise a soil management plan to minimize erosion and maximize biodiversity, plant productivity, and the formation of topsoil.	Machinery and equipment Compact equipment Structures Environmental and natural resources Team activity	
NRS.02.04. Performance Indicator: Examine and explain how economics affects the use of natural resources.		
NRS.02.04.01.b. Assess whether economic value increases or decreases the conservation, protection, improvement and enhancement of natural resources.	Environmental and natural resources	
NRS.02.04.01.c. Devise a plan to improve the conservation, protection, improvement and enhancement of natural resources based on economic value and practices	Environmental and natural resources	
NRS.02.04.02.b. Assess the importance of the use of natural resources on local, state and national economies.	Environmental and natural resources	
NRS.02.04.02.c. Anticipate and predict how changes to the availability of natural resources because of human activity may impact a local, state and national economy.	Environmental and natural resources	
NRS.02.04.03.b. Analyze and document how the adoption of green technology and/or alternative energy affected a local, state or national economy.	Environmental and natural resources	
NRS.02.04.03.c. Anticipate and predict the economic impact of green technology and alternative energy.	Environmental and natural resources	
NRS.03.02. Performance Indicator: Demonstrate cartographic skills, tools and technologies to aid in developing, implementing and evaluating natural resource management plans.		
NRS.03.02.01.b. Apply cartographic skills and tools (e.g., land surveys, geographic coordinate systems, etc.) to locate natural resources.	Environmental and natural resources	AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 3
NRS.03.02.01.c. Evaluate the availability of and threats to natural resources using cartographic skills (e.g., spread of invasive species, movement of wildlife populations, changes to biodiversity of edge of habitat versus interior, etc.).	Environmental and natural resources	AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 3
NRS.03.02.02.b. Analyze how an area's natural resources could be assessed using GIS technology.	Environmental and natural resources	AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 3

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
NRS.03.02.02.c. Use GIS data for a given area to devise a management plan for the management, conservation, improvement, and enhancement of its natural resources.	Environmental and natural resources	AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 3
PS.01.03. Performance Indicator: Develop and implement a fertilization plan for specific plants or crops.		
PS.01.03.03.b. Interpret laboratory analyses of soil and tissue samples.	Machinery and equipment Compact equipment Environmental and natural resources Team activity	AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 3
PS.01.03.03.c. Prescribe fertilizer applications based on the results of a laboratory analysis of soil and plant tissue samples.	Machinery and equipment Compact equipment Environmental and natural resources Team activity	AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 3
PS.01.03.04.b. Calculate the amount of fertilizer to be applied based on nutrient recommendation and fertilizer analysis.	Machinery and equipment Compact equipment Environmental and natural resources Team activity	AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 3
PS.01.03.04.c. Calibrate application equipment to meet plant nutrient needs.	Machinery and equipment Compact equipment Environmental and natural resources Team activity	AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 3
PS.01.03.05.b. Assess production methods for their short- and long-term effects on soil.	Machinery and equipment Compact equipment Environmental and natural resources Team activity	AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 3
PS.01.03.05.c. Devise a plan for soil management for a selected production method.	Machinery and equipment Compact equipment Environmental and natural resources Team activity	AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 3
PS.01.03.06.b. Assess environmental factors on a crop.	Machinery and equipment Compact equipment Environmental and natural resources Team activity	AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 3
PS.01.03.06.c. Devise a plan to meet plant nutrient needs based on environmental factors present.	Machinery and equipment Compact equipment Environmental and natural resources Team activity	AFNR Career Cluster – Food Products and Processing Systems Pathway, Statement 3
PS.03.02. Performance Indicator: Develop and implement a management plan for plant production.		
PS.03.02.02.b. Prepare soil and growing media for planting with the addition of amendments.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	CCSS.ELA-Literacy.RI.9-10.1 CCSS.ELA-Literacy.RI.9-10.8 CCSS.ELA-Literacy.RST.9-10.3 CCSS.ELA-Literacy.WHST.9-10.2 CCSS.ELA-Literacy.WHST.9-10.4 CCSS.ELA-Literacy.WHST.9-10.9

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
PS.03.02.02.c. Analyze how mechanical planting equipment performs soil preparation and seed placement.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	CCSS.ELA-Literacy.RI.9-10.1 CCSS.ELA-Literacy.RI.9-10.8 CCSS.ELA-Literacy.RST.9-10.3 CCSS.ELA-Literacy.WHST.9-10.2 CCSS.ELA-Literacy.WHST.9-10.4 CCSS.ELA-Literacy.WHST.9-10.9
PS.03.02.03.b. Apply pre-plant treatments required of seeds and plants and evaluate the results.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	CCSS.ELA-Literacy.RI.9-10.1 CCSS.ELA-Literacy.RI.9-10.8 CCSS.ELA-Literacy.RST.9-10.3 CCSS.ELA-Literacy.WHST.9-10.2 CCSS.ELA-Literacy.WHST.9-10.4 CCSS.ELA-Literacy.WHST.9-10.9
PS.03.02.03.c. Adjust and calibrate mechanized seeding and/or planting equipment for desired seed application rate.	Entire event	CCSS.ELA-Literacy.RI.9-10.1 CCSS.ELA-Literacy.RI.9-10.8 CCSS.ELA-Literacy.RST.9-10.3 CCSS.ELA-Literacy.WHST.9-10.2 CCSS.ELA-Literacy.WHST.9-10.4 CCSS.ELA-Literacy.WHST.9-10.9
PS.03.02.04.b. Monitor the progress of plantings and determine the need to adjust environmental conditions.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	CCSS.ELA-Literacy.RI.9-10.1 CCSS.ELA-Literacy.RI.9-10.8 CCSS.ELA-Literacy.RST.9-10.3 CCSS.ELA-Literacy.WHST.9-10.2 CCSS.ELA-Literacy.WHST.9-10.4 CCSS.ELA-Literacy.WHST.9-10.9
PS.03.02.04.c. Prepare and implement a plant production schedule based on predicted environmental conditions and desired market target (e.g., having plants ready to market on a specific day such as Mother's Day, organic production, low maintenance landscape plants, etc.).	Machinery and equipment Electricity Compact equipment Structures Environment and natural resources Team activity	CCSS.ELA-Literacy.RI.9-10.1 CCSS.ELA-Literacy.RI.9-10.8 CCSS.ELA-Literacy.RST.9-10.3 CCSS.ELA-Literacy.WHST.9-10.2 CCSS.ELA-Literacy.WHST.9-10.4 CCSS.ELA-Literacy.WHST.9-10.9
PS.03.02.05.b. Demonstrate proper techniques to control and manage plant growth through mechanical, cultural or chemical means.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	CCSS.ELA-Literacy.RI.9-10.1 CCSS.ELA-Literacy.RI.9-10.8 CCSS.ELA-Literacy.RST.9-10.3 CCSS.ELA-Literacy.WHST.9-10.2 CCSS.ELA-Literacy.WHST.9-10.4 CCSS.ELA-Literacy.WHST.9-10.9
PS.03.02.05.c. Prepare plant production schedules utilizing plant growth knowledge to get plants to their optimal growth stage at a given time.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	CCSS.ELA-Literacy.RI.9-10.1 CCSS.ELA-Literacy.RI.9-10.8 CCSS.ELA-Literacy.RST.9-10.3 CCSS.ELA-Literacy.WHST.9-10.2 CCSS.ELA-Literacy.WHST.9-10.4 CCSS.ELA-Literacy.WHST.9-10.9
PS.03.02.06.b. Compare and contrast the types of technologies used for controlled atmosphere production.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	CCSS.ELA-Literacy.RI.9-10.1 CCSS.ELA-Literacy.RI.9-10.8 CCSS.ELA-Literacy.RST.9-10.3 CCSS.ELA-Literacy.WHST.9-10.2 CCSS.ELA-Literacy.WHST.9-10.4 CCSS.ELA-Literacy.WHST.9-10.9

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
PS.03.02.06.c. Research, select and defend technology for use in controlled atmosphere production.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	CCSS.ELA-Literacy.RI.9-10.1 CCSS.ELA-Literacy.RI.9-10.8 CCSS.ELA-Literacy.RST.9-10.3 CCSS.ELA-Literacy.WHST.9-10.2 CCSS.ELA-Literacy.WHST.9-10.4 CCSS.ELA-Literacy.WHST.9-10.9
PS.03.02.07.b. Compare and contrast the types of systems used in hydroponic and aquaponic plant production.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	CCSS.ELA-Literacy.RI.9-10.1 CCSS.ELA-Literacy.RI.9-10.8 CCSS.ELA-Literacy.RST.9-10.3 CCSS.ELA-Literacy.WHST.9-10.2 CCSS.ELA-Literacy.WHST.9-10.4 CCSS.ELA-Literacy.WHST.9-10.9
PS.03.02.07.c. Research, select and defend the use of a hydroponic or aquaponic plant system.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	CCSS.ELA-Literacy.RI.9-10.1 CCSS.ELA-Literacy.RI.9-10.8 CCSS.ELA-Literacy.RST.9-10.3 CCSS.ELA-Literacy.WHST.9-10.2 CCSS.ELA-Literacy.WHST.9-10.4 CCSS.ELA-Literacy.WHST.9-10.9
PS.03.05. Performance Indicator: Harvest, handle and store crops according to current industry standards.		
PS.03.05.01.b. Assess the stage of growth to determine crop maturity or marketability and demonstrate proper harvesting techniques	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	CCSS.ELA-Literacy.RST.9-10.3 CCSS.ELA-Literacy.RST.9-10.4 CCSS.ELA-Literacy.WHST.9-10.2a
PS.03.05.01.c. Analyze the processed used by mechanical harvesting equipment.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	CCSS.ELA-Literacy.RST.9-10.3 CCSS.ELA-Literacy.RST.9-10.4 CCSS.ELA-Literacy.WHST.9-10.2a
PS.03.05.02.b. Evaluate crop yield and loss data and make recommendations to reduce crop loss.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	CCSS.ELA-Literacy.RST.9-10.3 CCSS.ELA-Literacy.RST.9-10.4 CCSS.ELA-Literacy.WHST.9-10.2a
PS.03.05.02.c. Implement and evaluate the effectiveness of plants to reduce crop loss.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	CCSS.ELA-Literacy.RST.9-10.3 CCSS.ELA-Literacy.RST.9-10.4 CCSS.ELA-Literacy.WHST.9-10.2a
PS.03.05.03.b. Research and analyze practices used to maintain a safe product through harvest, processing, storage and shipment (e.g., Food Safety Modernization Act, Good Agricultural Practices, etc.).	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources	CCSS.ELA-Literacy.RST.9-10.3 CCSS.ELA-Literacy.RST.9-10.4 CCSS.ELA-Literacy.WHST.9-10.2a

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
	Team activity	
PS.03.05.03.c. Research laws and apply regulations to ensure the production of plants and plant products that are safe for distribution and use.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	CCSS.ELA-Literacy.RST.9-10.3 CCSS.ELA-Literacy.RST.9-10.4 CCSS.ELA-Literacy.WHST.9-10.2a
PS.03.05.04.b. Analyze the proper conditions required to maintain the quality of plants and plant products held in storage and during shipping.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	CCSS.ELA-Literacy.RST.9-10.3 CCSS.ELA-Literacy.RST.9-10.4 CCSS.ELA-Literacy.WHST.9-10.2a
PS.03.05.04.c. Monitor and evaluate environmental conditions in storage facilities for plants and plant products.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	CCSS.ELA-Literacy.RST.9-10.3 CCSS.ELA-Literacy.RST.9-10.4 CCSS.ELA-Literacy.WHST.9-10.2a
PST.01.02. Performance Indicator: Apply physical science and engineering principles to design, implement and improve safe and efficient mechanical systems in AFNR situations.		
PST.01.02.01.b Perform mathematical calculations to determine the mechanical advantage of simple machines in AFNR-related mechanical systems.	Entire event	HS-PS3-1 HS-PS3-3
PST.01.02.01.c. Apply the scientific method to devise strategies to improve the efficiency of operation of AFNR-related mechanical systems.	Team activity	HS-PS3-1 HS-PS3-3
PST.01.02.02.b. Calculate the maintenance and purchase cost of tools, machines and equipment used in AFNR.	Entire event	HS-PS3-1 HS-PS3-3
PST.01.02.02.c. Devise and document processes to safely implement and evaluate the safe use of AFNR-related tools, machinery and equipment.	Machinery and equipment Electricity Compact equipment Structures Team activity	HS-PS3-1 HS-PS3-3
PST.01.02.03.b. Select, maintain and demonstrate the proper use of tools, machines and equipment used in different AFNR-related mechanical systems.	Entire event	HS-PS3-1 HS-PS3-3
PST.01.02.03.c. Conduct a safety inspection of tools, machines and equipment used in different AFNR-related mechanical systems.	Machinery and equipment Electricity Compact equipment Structures Team activity	HS-PS3-1 HS-PS3-3

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
PST.01.03. Performance Indicator: Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).		
PST.01.03.01.b. Analyze the situation and determine the best welding and cutting process to be used in metal fabrication.	Machinery and equipment Compact equipment Structures Team activity	
PST.01.03.01.c. Evaluate the quality of metal fabrication procedures (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).	Machinery and equipment Compact equipment Structures Team activity	
PST.01.03.02.b. Assess and select the proper electrode for use in various shielded metal arc welding situations.	Machinery and equipment Compact equipment Structures Team activity	
PST.01.03.02.c. Construct and/or repair metal structures and equipment using metal-fabrication procedures.	Machinery and equipment Compact equipment Structures Team activity	
PST.02. Performance Element: Operate and maintain AFNR mechanical equipment and power systems.		
PST.02.01.01.b. Develop a preventative maintenance schedule for equipment, machinery and power units used in AFNR power, structural and technical systems.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	
PST.02.01.01.c. Devise a strategy to communicate to different audiences, preventative maintenance and service schedule for equipment, machinery and power units used in AFNR power, structural and technical systems.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	
PST.02.01.02.b. Service filtration systems and maintain fluid levels on equipment, machinery and power units in accordance with operator's manuals.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	
PST.02.01.02.c. Assess and adjust equipment (e.g., belts and drives, chains, sprockets, etc.) and maintain fluid conveyance components (e.g., hoses, lines, nozzles, etc.) to ensure proper functioning.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
PST.02.02. Performance Indicator: Operate machinery and equipment while observing all safety precautions in AFNR settings.		
PST.02.02.01.b. Analyze and calculate the cost of using equipment, machinery, and power units for AFNR power, structural and technical systems.	Entire event	
PST.02.02.01.c. Perform pre-operation inspections, start-up & shut-down procedures on equipment, machinery and power units as specified in owner's manuals.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	
PST.02.02.02.b. Apply safety principles and applicable regulations to operate equipment, machinery and power units used in AFNR power, structural and technical systems.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	
PST.02.02.02.c. Adjust equipment, machinery and power units for safe and efficient operation in AFNR power, structural and technical systems.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	
PST.03.01. Performance Indicator: Troubleshoot, service and repair components of internal combustion engines using manufacturers' guidelines.		
PST.03.01.01.b. Analyze and explain how the components of internal combustion engines interrelate during operation.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	
PST.03.01.01.c. Evaluate service and repair needs for internal combustion engines using a variety of performance tests (e.g., manuals, computer-based diagnostics, etc.).	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	
PST.03.01.02.b. Utilize technical manuals and diagnostic tools to determine service and repair needs of spark-and-compression internal combustion engines used in AFNR power, structural and technical systems.	Entire event	
PST.03.01.02.c. Inspect, analyze and repair spark-and-compression internal combustion engines used in AFNR power, structural and technical systems.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources	

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
	Team activity	
PST.03.02. Performance Indicator: Service electrical systems and components of mechanical equipment and power systems using a variety of troubleshooting and/or diagnostic methods.		
PST.03.02.01.b. Assess the tools used to measure the basic units of electrical circuits in AFNR power, structural and technical systems, and perform the measurements.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	
PST.03.02.01.c. Analyze and design electrical circuits for AFNR power, structural and technical systems using knowledge of the basic units of electricity.	Electricity Compact equipment Structures Environmental and natural resources Team activity	
PST.03.02.02.b. Analyze and interpret electrical system symbols and diagrams.	Entire event	
PST.03.02.02.c. Conduct testing procedures to evaluate and repair malfunctioning electrical components and systems used in AFNR power, structural and technical systems.	Machinery and equipment Electricity Compact equipment Structures Environmental and natural resources Team activity	
PST.03.02.03.b. Distinguish and select materials and tools used in electrical control circuit installation.	Electricity Structures Environmental and natural resources Team activity	
PST.03.02.03.c. Plan and install electrical control circuits and/or circuit boards to assure proper operation within AFNR power, structural and technical systems.	Electricity Structures Environmental and natural resources Team activity	
PST.03.03. Performance Indicator: Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment and power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.).		
PST.03.03.01.b. Analyze and interpret hydraulic and pneumatic system symbols and diagrams used in AFNR power, structural and technical systems.	Machinery and equipment Compact equipment Structures Team activity	
PST.03.03.01.c. Inspect, analyze and repair hydraulic and pneumatic system components used in AFNR power, structural and technical systems	Machinery and equipment Compact equipment Structures Team activity	
PST.03.03.02.b. Utilize speed, torque and power measurements to calculate efficiency in power transmission systems used in AFNR power, structural and technical systems.	Machinery and equipment Compact equipment Structures Team activity	

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
PST.03.03.02.c. Inspect, analyze and repair the components of power transmission systems used in AFNR power, structural and technical systems.	Machinery and equipment Compact equipment Structures Team activity	
PST.03.03.03.b. Assess and analyze vehicle and machinery performance related to suspension and steering systems used in AFNR power, structural and technical systems.	Machinery and equipment Compact equipment Structures Team activity Exam	
PST.03.03.03.c. Inspect, analyze and repair vehicle suspension and steering systems used in AFNR power, structural and technical systems.	Machinery and equipment Compact equipment Team activity	
PST.04.01. Performance Indicator: Create sketches and plans for AFNR structures.		
PST.04.01.01.b. Apply scale measurement and dimension to develop sketches of agricultural structures.	Structures Team activity Exam	
PST.04.01.01.c. Create sketches of an agricultural structure by applying principles of design.	Structures Team Activity	
PST.04.01.02.c. Evaluate, plan and design functional and efficient facilities for use in AFNR power, structural and technical systems.	Structures Team activity Exam	
PST.04.02. Performance Indicator: Determine structural requirements, specifications and estimate costs for AFNR structures		
PST.04.02.01.b. Analyze a project plan to prepare a bill of materials and an estimate of material costs.	Team activity Exam	
PST.04.02.01.c. Create a project cost estimate, including materials, labor and management for an AFNR structure.	Team activity Exam	
PST.04.02.02.b. Assess and analyze local building code requirements for agriculture structures.	Electricity Structures Team Activity	
PST.04.02.02.c. Design and conduct a building functionality and safety assessment on an agricultural structure using knowledge of industry standards and local code requirements.	Electricity Structures Team Activity	

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
PST.04.03. Performance Indicator: Follow architectural and mechanical plans to construct, maintain and/or repair AFNR structures (e.g., material selection, site preparation and/or layout, plumbing, concrete/masonry, etc.).		
PST.04.03.01.b. Analyze and assess samples of materials or products for quality and efficiency of workmanship.	Structures Team Event	
PST.04.03.01.c. Select materials for a project based upon an analysis of the project and the quality of the materials.	Structures Team Event	
PST.04.03.02.b. Complete a building site analysis checklist to select an ideal building site.	Structures Team Event	
PST.04.03.02.c. Assess site characteristics, identify adjustments, and demonstrate procedures for preparing a building site.	Structures Team Event	
PST.04.03.03.b. Calculate costs associated with the repair and replacement of wood and/or metal components in an AFNR structure.	Structures Team Event Exam	
PST.04.03.03.c. Construct AFNR structures using wood and/or metal materials.	Structures Team Event	
PST.04.03.04.b. Calculate the cost of a water system in an AFNR structure (e.g., copper, PVC, etc.).	Structures Team Event Exam	
PST.04.03.04.c. Install and/or repair pipes and plumbing equipment and fixtures in AFNR structures.	Structures Team Event	
PST.04.03.05.b. Measure and calculate the cost of fencing materials.	Structures Team Event Exam	
PST.04.03.05.c. Construct, maintain, and/or repair fencing, including wood, static wire, electrical wire and other fencing materials.	Structures Team Event	
PST.04.03.06.b. Calculate volume for concrete projects.	Structures Team Event Exam	
PST.04.03.06.c. Construct, maintain and/or repair AFNR structures with concrete, brick, stone or masonry.	Structures Team Event	
PST.04.03.07.b Calculate BTU loss in an AFNR structure.	Structures Team Event Exam	
PST.04.03.07.c. Insulate a structure and estimate reduced BTU loss.	Structures Team Event	

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
PST.04.04. Performance Indicator: Apply electrical wiring principles in AFNR structures.		
PST.04.04.01.b. Assess and analyze the electrical requirements of an AFNR structure.	Electricity Structures Team Event	HS-PS3-5
PST.04.04.01.c. Install and/or repair fixtures following appropriate codes and standards.	Electricity Structures Team Event	HS-PS3-5
PST.04.04.02.b. Calculate the cost of operating an electrical motor.	Electricity Structures Team Event Exam	HS-PS3-5
PST.04.04.02.c. Plan and wire electrical circuits (i.e., single pole switch, three-way switch, duplex outlet, etc.).	Electricity Structures Team Event	HS-PS3-5
PST.05.02. Performance Indicator: Prepare and/or use electrical drawings to design, install and troubleshoot electronic control systems in AFNR settings.		
PST.05.02.01.b. Analyze schematic drawings for electrical control systems used in AFNR systems.	Machinery and equipment Team event Exam	
PST.05.02.02.c. Troubleshoot electrical control system performance problems found in AFNR power, structural and technical systems.	Electricity Team event	
PST.05.02.03.c. Develop and implement AFNR power, structural and technical control systems using programmable logic controllers (PLC) and/or other computer-based systems.	Electricity Compact equipment Team event	
PST.05.03. Performance Indicator: Apply geospatial technologies to solve problems and increase the efficiency of AFNR systems.		
PST.05.03.01.b. Assess and analyze data collected utilizing geospatial technologies.	Machinery and equipment Compact equipment Environmental and natural resources Team activity Exam	HS-ESS3-4 HS-ETS1-3 HS-ESS3-2
PST.05.03.01.c. Collect data and create maps utilizing geospatial technologies.	Machinery and equipment Compact equipment Environmental and natural resources Team activity	HS-ESS3-4 HS-ETS1-3 HS-ESS3-2
PST.05.03.02.b. Analyze and calculate the economic impact of utilizing precision technologies (e.g., GPS/GIS) in AFNR systems.	Machinery and equipment Compact equipment Environmental and natural resources Team activity Exam	HS-ESS3-4 HS-ETS1-3 HS-ESS3-2

Measurements Assessed	Event Activities Addressing Measurements	Related Academic Standards
PST.05.03.02.c. Install, maintain and service instrumentation and equipment used for precision technologies (i.e., GPS receivers, yield monitors, remote sensors, etc.) used in AFNR systems.	Machinery and equipment Compact equipment Environmental and natural resources Team activity	HS-ESS3-4 HS-ETS1-3 HS-ESS3-2