PATHWAY: Food Products and Processing Systems

Pathway Topic: Food Products and Processing Systems Topics

Pathway KS Statement: Apply principles of food processing to the food industry.

Performance Element: Develop management plans to maintain equipment and facilities.

Measurement Criteria: Develop and maintain a Standard Sanitation Operating Procedure (SSOP).

Measurement Criteria: Explain and demonstrate Good Manufacturing Practices (GMP), including employee safety.

Performance Element: Interpret and follow, develop and implement Hazard Analysis Critical Control Point (HACCP) procedures to establish operating parameters.

Measurement Criteria: Conduct a hazard analysis.

Measurement Criteria: Identify Critical Control Points (CCP).

Measurement Criteria: Establish critical limits for each Critical Control Point (CCP).

Measurement Criteria: Establish monitoring procedures.

Measurement Criteria: Establish corrective actions.

Measurement Criteria: Establish verification procedures.

Pathway KS Statement: Apply principles of food science to the food industry.

Performance Element: Apply food science principles to enhance product development.

Measurement Criteria: Conduct research.

Measurement Criteria: Apply the use of chemistry.

Measurement Criteria: Comply and apply USDA/FDA standards.

Measurement Criteria: Use product development (e.g., consumer opinion, taste testing).

Measurement Criteria: Conduct nutritional analysis (e.g., biochemistry).

Measurement Criteria: Compare and contrast the nutritive value of food groups.

Measurement Criteria: Identify and compare various food constituents.

Pathway KS Statement: Plan, implement, manage, and/or provide services for the preservation and packaging of food and food products.

Performance Element: Analyze product preparation options to prepare products for distribution.

Measurement Criteria: Conduct micro-test.

Measurement Criteria: Interpret and perform quality assurance tests (e.g., fat, moisture, protein).

Measurement Criteria: Demonstrate approved product handling techniques.

Measurement Criteria: Use weights and measures (e.g., US, metric) to formulate product.

Measurement Criteria: Demonstrate documentation techniques.

Measurement Criteria: Package products.

Measurement Criteria: Store products.

Performance Element: Compare and select food preservation methods to develop food preservation programs.
Agriculture, Food and Natural Resources

Pathway Topic: Food Products and Processing Systems Topics

Measurement Criteria: Calculate and inventory parts per million (ppm) of restricted ingredients (e.g., milk).

Measurement Criteria: Explain methods of chemical preservation (e.g., pH, salt, water activity [aw], additives).

Measurement Criteria: Explain the impact of temperature in food preservation.

Measurement Criteria: Compare and contrast packaging preservation (e.g., film, plastic, can).

Measurement Criteria: Compare and contrast process preservation (e.g., irradiation, pasteurization, sterilization).

Pathway KS Statement: Identify processing, handling, and storage factors to show how they impact product quality and safety.

Performance Element: Develop a “quality factors program” to comply with local, national, governmental, and international standards.

Measurement Criteria: Perform and interpret quality check of food products per industry standards.

Measurement Criteria: Explain methods of food storage to assure product quality.

Measurement Criteria: Interpret and follow industry/government standards.

Performance Element: Develop slaughter/inspection techniques to process food products and analyze food product options.

Measurement Criteria: Demonstrate approved techniques for preparing ready-to-eat food products.

Measurement Criteria: Compare and contrast slaughter techniques (e.g., zero tolerance).

Measurement Criteria: Conduct pre-mortem and post-mortem inspections.


Measurement Criteria: Select raw materials for processing.
PATHWAY: Plant Systems

Pathway Topic: Plant Systems Topic

Pathway KS Statement: Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.

Performance Element: Analyze and evaluate nutritional requirements and environmental conditions to develop and implement a fertilization plan.

Measurement Criteria:
- Describe nutrient sources.
- Determine plant nutrient requirements for optimum growth.
- Identify function of plant nutrients in plants.
- Determine the environmental factors that influence and optimize plant growth.
- Apply nutrients to plants for economic growth.
- Describe nutrient application methods and appropriate practices.

Performance Element: Test appropriate materials or examine data to evaluate and manage soil/media nutrients.

Measurement Criteria:
- Collect and test soil/media and/or plant tissue.
- Interpret tests of soil/media and/or plant tissue.
- Identify soil slope, structure and type.
- Evaluate soil/media permeability and water-holding capacity.
- Determine the chemical properties of soil/media.
- Determine land use capability.
- Determine the biological functions of microorganisms of soil/media.

Performance Element: Explain and use basic methods for reproducing and propagating plants.

Measurement Criteria:
- Determine the role of genetics in plants.
- Describe the components and functions of plant reproductive parts.
- Identify and practice methods of asexual/sexual plant propagation.
- Describe the principles of plant micro-propagation.
- Apply principles and practices of biotechnology to plant propagation.

Performance Element: Develop and use a plan for integrated pest management.

Measurement Criteria:
- Identify plant pests (e.g., insects, diseases, weeds, rodents).
- Determine pest management safety practices.
- Determine pest management methods.
- Develop pest management plans based on pest life cycles.
- Implement pest control plan with appropriate treatments.
- Evaluate pest control plan.
- Prevent, identify and manage pest resistance.

Pathway KS Statement: Address taxonomic or other classifications to explain basic plant anatomy and physiology.
Pathway Topic: Plant Systems Topic

Performance Element: Examine unique plant properties to identify/describe functional differences in plant structures including roots, stems, flowers, leaves and fruit.

Measurement Criteria: Identify plant structures (e.g., seeds).
Measurement Criteria: Describe physiological functions of plants.
Measurement Criteria: Describe germination process and conditions.

Performance Element: Classify plants based on physiology for taxonomic or other classifications.

Measurement Criteria: Classify plants as monocots or dicots.
Measurement Criteria: Classify plants as annuals, biennials or perennials.
Measurement Criteria: Classify plants according to growth habit.
Measurement Criteria: Classify plants by type.
Measurement Criteria: Classify plants by economic value.

Pathway KS Statement: Apply fundamentals of production and harvesting to produce plants.

Performance Element: Apply fundamentals of plant management to develop a production plan.

Measurement Criteria: Identify and select seeds and plants.
Measurement Criteria: Manipulate and evaluate environmental conditions (e.g., irrigation, mulch, shading) to foster plant germination, growth and development.
Measurement Criteria: Evaluate and demonstrate planting practices (e.g., population rate, germination/seed vigor, inoculation, seed and plant treatments).
Measurement Criteria: Evaluate and demonstrate transplanting practices.
Measurement Criteria: Prepare soil/media for planting.
Measurement Criteria: Control plant growth (e.g., pruning, pinching, disbudding, topping, detasseling, staking, cabling, shearing, shaping).
Measurement Criteria: Prepare plants and plant products for distribution.

Performance Element: Apply fundamentals of plant management to harvest, handle and store crops.

Measurement Criteria: Determine crop maturity.
Measurement Criteria: Identify harvesting practices and equipment.
Measurement Criteria: Demonstrate common harvesting techniques.
Measurement Criteria: Calculate yield and loss.
Measurement Criteria: Identify options for crop storage.
Measurement Criteria: Maintain quality of plant products in storage.
Measurement Criteria: Prepare plants and plant products for distribution.

Pathway KS Statement: Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, farm).

Performance Element: Apply basic design elements and principles to create a design using plants.

Measurement Criteria: Conduct a site evaluation for physical condition and design
Pathway Topic: Plant Systems Topic

Measurement Criteria: Apply elements of design (e.g., line, form, texture, color).
Measurement Criteria: Incorporate principles of design (e.g., space, scale, proportion, order).
Measurement Criteria: Use landscape design drawing tools including Computer Aided Design (CAD) and industry-specific software.
Measurement Criteria: Select hard goods, supplies and tools used in design.
Measurement Criteria: Select plant(s) for design.
PATHWAY: Animal Systems

Pathway Topic: Animal Systems Topic

**Pathway KS Statement:** Apply knowledge of anatomy and physiology to produce and/or manage animals in a domesticated or natural environment.

**Performance Element:** Use classification systems to explain basic functions of animal anatomy and physiology.

**Measurement Criteria:** Describe functional differences in animal structures and body systems.

**Measurement Criteria:** Classify animals according to anatomy and physiology.

**Performance Element:** Recognize the anatomy of animal species to understand how the body structures interact and affect animal health.

**Measurement Criteria:** Identify selected animal parts from a diagram or on a real animal.

**Measurement Criteria:** Identify ways that an animal’s health can be affected by anatomy/physiology problems.

**Performance Element:** Analyze a subject animal to determine the nature of its health status.

**Measurement Criteria:** Perform simple procedures in evaluating an animal’s health status.

**Measurement Criteria:** Identify symptoms of diseases, illnesses, parasites, and other health-related problems.

**Measurement Criteria:** Diagnose animal ailments.

**Measurement Criteria:** Implement disease prevention and health improvement program.

**Measurement Criteria:** Identify and implement (i.e., treat) treatment options.

**Pathway KS Statement:** Recognize animal behaviors to facilitate working with animals safely.

**Performance Element:** Develop a safety plan for working with a specific animal.

**Measurement Criteria:** Explain factors which serve to stimulate or discourage given types of animal behavior.

**Measurement Criteria:** Recognize the normality curve of animal behavior.

**Measurement Criteria:** Perform safe handling procedures when working with animals.

**Measurement Criteria:** Identify strengths and weaknesses of an animal safety handling plan.

**Measurement Criteria:** Operate animal facilities to insure safety of animals.

**Pathway KS Statement:** Provide proper nutrition to maintain animal performance.

**Performance Element:** Examine animal developmental stages to comprehend why nutrient requirements are different throughout an animal’s life cycle.

**Measurement Criteria:** Recognize the different phases of an animal’s life cycle.

**Measurement Criteria:** Select diets which provide the appropriate quantity of nutrients for each animal developmental stage.

**Performance Element:** Analyze a feed ration to determine whether or not it fulfills a given animal’s nutrient requirements.
Agriculture, Food and Natural Resources

Pathway Topic:  Animal Systems Topic

Measurement Criteria:  Identify the differences between good and poor quality feedstuffs.

Measurement Criteria:  Create a balanced ration for a given animal.

Performance Element:  Record and compare feed variations to assess whether the nutritional requirements of a given animal are being met.

Measurement Criteria:  Use different types of feedstuffs (e.g., roughage, concentrates) to create a feed ration containing the appropriate amounts of required nutrients.

Measurement Criteria:  Use different forms of feedstuffs (e.g., pellets, cracked, rolled, ground) to create a diet that meets the needs of a specific animal.

Pathway KS Statement:  Know the factors that influence an animal’s reproductive cycle to explain species response.

Performance Element:  Analyze elements in the reproductive cycle to explain differences between male and female reproductive systems.

Measurement Criteria:  Identify the parts of male and female reproductive tracts on example animals.

Measurement Criteria:  Analyze the reproductive cycle of a given animal.

Measurement Criteria:  Evaluate animal readiness for breeding.

Performance Element:  Discuss reproductive cycles to show how they differ from species to species.

Measurement Criteria:  Discuss the pros and cons of breeding through natural cover and artificial insemination.

Measurement Criteria:  Discuss the implications of genetic variation.

Measurement Criteria:  Describe techniques of artificial insemination.

Measurement Criteria:  Identify reproduction management practices (e.g., male to female ratios, age and weight for breeding, fertility and soundness for breeding, heat synchronization, flushing).

Performance Element:  Evaluate an animal to determine its breeding soundness.

Measurement Criteria:  Describe the procedure for determining an animal’s breeding readiness.

Measurement Criteria:  Identify and prevent problems associated with reproduction.

Measurement Criteria:  Select animals based on breeding soundness.

Pathway KS Statement:  Identify environmental factors that affect an animal’s performance.

Performance Element:  Recognize optimum performance for a given animal species.

Measurement Criteria:  Identify good performance for a given animal species.

Measurement Criteria:  Identify reasons why some animals perform better than others.

Performance Element:  Create a program to develop an animal to its highest potential performance.

Measurement Criteria:  Identify factors that can be manipulated to control a given animal’s performance.

Measurement Criteria:  Generate ways to increase an animal’s performance.

Performance Element:  Assess an animal to determine if it has reached its optimum
Pathway Topic: Animal Systems Topic

Performance level.

**Measurement Criteria:** Make appropriate changes in an animal’s environment in order to achieve optimum performance.

**Measurement Criteria:** Use appropriate tools in manipulating animal performance.

Performance Element: Develop efficient procedures to produce consistently high-quality animals, well-suited for their intended purpose.

**Measurement Criteria:** Identify a given species’ desirable production numbers (e.g., birth weight, rate of gain, age of maturity, age of sexual maturity).

**Measurement Criteria:** Evaluate desired traits (e.g., production) of animals.

**Measurement Criteria:** Evaluate the role that economics plays in animal production.

**Measurement Criteria:** Design facilities appropriate for the production of a given species of animal.

**Measurement Criteria:** Make decisions on using new techniques and methods in the production facility so that both profit and animal safety are maximized.
PATHWAY: Power, Structural & Technical Systems

Pathway Topic: Science

Pathway KS Statement: Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.

Performance Element: Relate power generation to energy sources.

Measurement Criteria: Identify petroleum sources (e.g., gasoline, diesel).

Measurement Criteria: Identify alternative sources (e.g., ethanol, biodiesel, air, wood, geothermal, solar).

Measurement Criteria: Compare environmental impact of energy sources.

Measurement Criteria: Compare efficiency of energy source.

Measurement Criteria: Compare characteristics of energy sources.

Measurement Criteria: Discuss efficiency of systems (e.g., fuel cells, chemical, wind, hydro, nuclear, electric, mechanical, solar, biological).

Performance Element: Apply principles of lubricants to sort and classify lubricants.

Measurement Criteria: Classify lubricants and determine applications.

Measurement Criteria: Identify viscosity and strengths of lubricants.

Measurement Criteria: Describe properties of lubricants.

Pathway Topic: Power

Pathway KS Statement: Apply principles of operation and maintenance to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.

Performance Element: Perform scheduled service routines to maintain machinery and equipment.

Measurement Criteria: Lubricate machinery and equipment.

Measurement Criteria: Ensure presence and function of safety systems and hardware.

Measurement Criteria: Service electrical systems.

Measurement Criteria: Perform machine adjustments (e.g., belts, drive chains).

Measurement Criteria: Service filtration systems.

Measurement Criteria: Maintain fluid levels.

Measurement Criteria: Maintain vehicle, machinery and equipment cleanliness and appearance.

Measurement Criteria: Maintain fluid conveyance components, (e.g., hoses and lines, valves, nozzles).

Measurement Criteria: Design a preventive maintenance schedule.

Measurement Criteria: Identify causes of malfunctions and failures.

Measurement Criteria: Calibrate metering, monitoring, and sensing equipment.

Performance Element: Observe rules of the road to operate machinery and equipment.

Measurement Criteria: Describe function of machine controls and instrumentation.

Measurement Criteria: Perform appropriate start-up procedures.

Measurement Criteria: Select proper machine(s) for specific task(s).

Measurement Criteria: Safely operate equipment.
Pathway Topic: Power

**Measurement Criteria:** Perform pre-operation inspection.

**Measurement Criteria:** List applicable laws for on- and off-highway operation.

Pathway KS Statement: Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.

Performance Element: Troubleshoot problems and evaluate performance to service and repair the components of internal combustion engines.

**Measurement Criteria:** Describe principles of operation.

**Measurement Criteria:** Identify engine systems and components.

**Measurement Criteria:** Analyze and troubleshoot engine.

**Measurement Criteria:** Perform overhaul procedures.

**Measurement Criteria:** Evaluate engine performance through post-rebuild testing.

Performance Element: Follow manufacturers’ guidelines to service and repair power transmission systems.

**Measurement Criteria:** Describe features, benefits, and applications of various power transmission systems.

**Measurement Criteria:** Describe principles of operation of various power transmission systems.

**Measurement Criteria:** Perform calculations involving speed, torque and power relationships.

**Measurement Criteria:** Describe features, benefits, and applications of mechanical transmission components (e.g., belts, chains, gears, bearings, seals, universals).

**Measurement Criteria:** Inspect, analyze, and repair hydrostatic transmissions.

**Measurement Criteria:** Inspect, analyze, and repair differentials and final drives.

**Measurement Criteria:** Inspect, analyze, and repair clutches and brakes.

**Measurement Criteria:** Inspect, analyze, and repair gear-type transmissions including power shift.

**Measurement Criteria:** Inspect, analyze, and repair auxiliary drives.

Performance Element: Evaluate performance and check maintenance manuals to service and repair hydraulic systems.

**Measurement Criteria:** Describe features, benefits, and applications of types of hydraulic systems.

**Measurement Criteria:** Describe physical principles of operation.

**Measurement Criteria:** Interpret symbols and schematic drawings.

**Measurement Criteria:** Describe the application and operation of major components.

**Measurement Criteria:** Inspect, analyze, and repair hydraulic components (e.g., pumps, valves).

**Measurement Criteria:** Inspect, analyze, and repair fluid conveyance components (e.g., hoses, lines).

**Measurement Criteria:** Evaluate system cleanliness.

**Measurement Criteria:** Identify hydraulic fittings and ports.

Performance Element: Troubleshoot from schematics to service vehicle electrical systems.
Pathway Topic: Power

**Measurement Criteria:** Describe features and applications of electrical systems.

**Measurement Criteria:** Interpret symbols and wiring diagrams.

**Measurement Criteria:** Test and troubleshoot electrical systems and components (e.g., battery, charging, starting, lighting, instrumentation, accessories).

**Measurement Criteria:** Troubleshoot and install instrumentation and data acquisition system (e.g., Global Positioning System (GPS), spraying, planting, harvesting monitors).

**Measurement Criteria:** Diagnose and repair control systems and sensors (e.g., engine, transmission, implement).

Performance Element: Use company diagrams and schematics to service vehicle heating and air conditioning systems.

**Measurement Criteria:** Describe physical principles of operation.

**Measurement Criteria:** Interpret symbols and diagrams.

**Measurement Criteria:** Test, troubleshoot, and replace heating and air-conditioning components (e.g., compressor, expansion valve, receiver dryer, pump, hoses).

**Measurement Criteria:** Evacuate and charge air conditioning systems.

Performance Element: Check performance parameters to service and repair steering, suspension, traction, and vehicle performance systems.

**Measurement Criteria:** Evaluate traction, ballasting, and weight transfer.

**Measurement Criteria:** Evaluate vehicle stability.

**Measurement Criteria:** Determine optimum vehicle performance, e.g., horsepower management, fuel efficiency.

**Measurement Criteria:** Troubleshoot, adjust, and repair suspension systems.

**Measurement Criteria:** Inspect and repair steering systems.

Performance Element: Use tools in the workplace to demonstrate safe use and proper skills with construction/fabrication hand tools.

**Measurement Criteria:** Demonstrate proper use of measurement and layout tools.

**Measurement Criteria:** Apply proper use of measurement and layout tools in construction/fabrication of an actual project.

**Measurement Criteria:** Demonstrate safe and proper techniques in using hand and power tools in construction/fabrication.

**Measurement Criteria:** Demonstrate hand and power tool use to construct/fabricate an actual project according to blueprints or plans.

**Measurement Criteria:** Identify and demonstrate proper hand and power tool maintenance procedures.

Pathway Topic: Structural Systems

**Pathway KS Statement:** Exercise basic skills in blueprint and design development to create sketches, drawings and plans.

Performance Element: Use computer skills to develop simple sketches and plans.

**Measurement Criteria:** Use current technology to develop simple plans and sketches.

**Measurement Criteria:** Identify symbols and drawing techniques used to develop simple plans and sketches.
Pathway Topic: Structural Systems

Measurement Criteria: Use scale measurement and dimension to develop simple plans and sketches.

Pathway KS Statement: Read and relate structural plans to specifications and building codes.

Performance Element: Examine blueprints and local codes to develop a logical construction plan.

Measurement Criteria: Identify parts of a plan or blueprint.
Measurement Criteria: Identify criteria for different views of a plan or blueprint.
Measurement Criteria: Locate elements of a construction plan and develop a construction plan.
Measurement Criteria: Identify local code enforcement agencies and procedures.
Measurement Criteria: Read and interpret local code information.
Measurement Criteria: Complete permit applications.

Pathway KS Statement: Examine structural requirements to estimate project costs.

Performance Element: Use bids and billing information to develop a complete materials list and project cost estimate.

Measurement Criteria: Identify materials used in agricultural construction/fabrication.
Measurement Criteria: Explain proper criteria for material use.
Measurement Criteria: Identify elements of project cost estimate (materials, labor, administrative, etc.).
Measurement Criteria: Explain selection process of all construction materials.
Measurement Criteria: Estimate and select type and quantities of material and other costs associated with a specified project plan.
Measurement Criteria: Prepare a bid package for a planned project.

Pathway KS Statement: Develop skills required to use construction/fabrication equipment and tools.

Performance Element: Use tools in the workplace to demonstrate safe use and proper skills with construction/fabrication hand tools.

Measurement Criteria: Demonstrate proper use of measurement and layout tools.
Measurement Criteria: Apply proper use of measurement and layout tools in construction/fabrication of an actual project.
Measurement Criteria: Demonstrate safe and proper techniques in using hand and power tools in construction/fabrication.
Measurement Criteria: Demonstrate hand and power tool use to construct/fabricate an actual project according to blueprints or plans.
Measurement Criteria: Identify and demonstrate proper hand and power tool maintenance procedures.

Pathway KS Statement: Plan, implement, manage, and/or provide support services to facility design and construction; equipment design, manufacture, repair, and service; and agricultural technology.

Performance Element: Design machinery and equipment including vehicles, implements, building, and facilities (e.g., feeding, feed storage).

Measurement Criteria: Analyze site/equipment/permit requirements.
Pathway Topic:  Structural Systems

**Measurement Criteria:** Develop drawings.
**Measurement Criteria:** Estimate material needs and costs.
**Measurement Criteria:** Operate Computer Aided Drafting Design (CADD) Software.

**Performance Element:** Follow architectural and mechanical plans to construct buildings and facilities.

**Measurement Criteria:** Identify and select appropriate building materials.
**Measurement Criteria:** Install plumbing equipment and fixtures.
**Measurement Criteria:** Construct with wood and metal.
**Measurement Criteria:** Install electrical wiring components and fixtures.
**Measurement Criteria:** Paint or protect with coatings.
**Measurement Criteria:** Insulate facility.
**Measurement Criteria:** Install fencing.
**Measurement Criteria:** Install glass, ridged plastic panels and/or film plastic.
**Measurement Criteria:** Construct with concrete, stone, and brick.

Pathway Topic:  Technical Systems

**Pathway KS Statement:** Use the variety of tools available in computer systems to accomplish fast, accurate production in the workplace.

**Performance Element:** Identify and explain various types of hardware systems to show their applications potential.

**Measurement Criteria:** Identify and describe individual components of each system.
**Measurement Criteria:** Discuss various types of diagnostic equipment.
**Measurement Criteria:** Be able to show aptitude in use of various equipment.
**Measurement Criteria:** Demonstrate competency on cable through put and set up.

**Pathway KS Statement:** Use available power sources to plan and apply control systems.

**Performance Element:** Measure with selected instruments to demonstrate knowledge of basic electricity.

**Measurement Criteria:** Show proficiency in use of various meters.
**Measurement Criteria:** Discuss importance of and techniques for grounding.
**Measurement Criteria:** Show understanding of codes and regulations.
**Measurement Criteria:** Discuss various energy sources.

**Performance Element:** Reference electrical drawings to design, install, and troubleshoot control systems.

**Measurement Criteria:** Develop and read schematic drawings for a control system.
**Measurement Criteria:** Identify and describe uses of various components of control systems; i.e., transistors, relays, HVAC, logic controllers.
**Measurement Criteria:** Discuss the importance of maintenance schedules.
**Measurement Criteria:** Identify system performance problems and apply troubleshooting techniques.

**Pathway KS Statement:** Explain geospatial technology to demonstrate its applications.

**Performance Element:** Employ appropriate techniques to demonstrate application of GIS/GPS systems principles.
Pathway Topic: Technical Systems

Measurement Criteria: Explain the concept and principles.
Measurement Criteria: Describe equipment.
Measurement Criteria: List techniques used.
Measurement Criteria: Explain the application of GIS/GPS systems with map development output.

Performance Element: Use computer applications to produce maps that reflect surveying and mapping principles.

Measurement Criteria: Understand and use various equipment.
Measurement Criteria: Perform survey and produce map using computer techniques.

Performance Element: Select an area of personal expertise to demonstrate knowledge of end applications.

Measurement Criteria: Apply knowledge and experience to a specific application or project to show competency; i.e., calibration, volumetric controlling, electrical design.
PATHWAY: Natural Resources Systems

Pathway Topic: Natural Resource Systems Topics

Pathway KS Statement: Recognize importance of resource and human interrelations to conduct management activities in natural habitats.

Performance Element: Identify resource management components to establish relationships in natural resource systems.

Measurement Criteria: Identify natural resources.
Measurement Criteria: Identify organizations and agencies involved in resource management.
Measurement Criteria: Identify impacts by humans on natural resources.
Measurement Criteria: Describe ecosystem relationships.
Measurement Criteria: Create habitat management plan.

Performance Element: Apply cartographic skills to natural resource activities.

Measurement Criteria: Describe different types of maps.
Measurement Criteria: Interpret map features and legend.
Measurement Criteria: Determine map scale and actual distance.
Measurement Criteria: Determine direction from map.
Measurement Criteria: Determine elevation and terrain features from topographic maps.
Measurement Criteria: Use directional tools with map to locate position.
Measurement Criteria: Use land survey and coordinate system.
Measurement Criteria: Use Geographic Information System to interface geospatial data.
Measurement Criteria: Interpret photos and images.

Performance Element: Monitor natural resource status to obtain planning data.

Measurement Criteria: Conduct resource inventory and population studies.
Measurement Criteria: Establish sample plots and points.
Measurement Criteria: Locate and identify resources.
Measurement Criteria: Collect data concerning resource availability and health.
Measurement Criteria: Maintain databases of resource data.
Measurement Criteria: Use a Geographic Information System to analyze resource data.
Measurement Criteria: Prepare a technical report.
Measurement Criteria: Describe the relationship of harvest levels to long-term availability of resources.

Performance Element: Employ environmental and wildlife knowledge to demonstrate natural resource enhancement techniques.

Measurement Criteria: Demonstrate stream enhancement techniques.
Measurement Criteria: Demonstrate forest stand improvement techniques.
Measurement Criteria: Demonstrate wildlife habitat enhancement techniques.
Measurement Criteria: Demonstrate range enhancement techniques.
Measurement Criteria: Demonstrate recreation area enhancement techniques.

Performance Element: Examine weather and other criteria to recognize dangers related to work in an outdoor environment.
Pathway Topic: Natural Resource Systems Topics

Measurement Criteria: Recognize weather-related dangers.
Measurement Criteria: Recognize hazards as they relate to terrain.
Measurement Criteria: Recognize poisonous plants and animals.
Measurement Criteria: Recognize hazardous situations at the work location.

Performance Element: Learn applicable rules or laws to demonstrate natural resource mitigation techniques.
Measurement Criteria: Demonstrate mitigation techniques.

Pathway KS Statement: Use effective venues to communicate natural phenomena to the public.

Performance Element: Communicate natural resource information to the general public.
Measurement Criteria: Set up and staff a display booth that communicates a natural resource topic during a community event.
Measurement Criteria: Develop a public use area to explain natural resources.
Measurement Criteria: Participate as a facilitator during a public meeting concerning natural resource management.
Measurement Criteria: Lead a group habitat conservation project.
Measurement Criteria: Volunteer in a natural resource area.

Performance Element: Personally interpret natural resource phenomena to natural resource users.
Measurement Criteria: Lead a group hike to interpret a natural area.
Measurement Criteria: Conduct a workshop, activity or program to interpret an example of natural resource conservation.
Measurement Criteria: Develop an interpretive trail to describe a natural resource area.
Measurement Criteria: Produce printed material that interprets a natural resource area or phenomenon.
Measurement Criteria: Produce natural resource curriculum materials.
Measurement Criteria: Develop a sign to communicate a natural resource area or phenomenon.
Measurement Criteria: Create a multi-media/video presentation that interprets a natural resource topic, area or phenomenon.
Measurement Criteria: Create a web page to present and interpret a natural resource topic, area or phenomenon.

Pathway KS Statement: Apply scientific principles to natural resource management activities.

Performance Element: Use science concepts, processes, and research techniques to examine natural resource topics.
Measurement Criteria: Develop a research/monitoring plan to inquire about a natural resource topic.
Measurement Criteria: Conduct a research/monitoring activity for a natural resource topic.
Measurement Criteria: Evaluate the results of a natural resource-related inquiry.
Measurement Criteria: Produce a technical report of results/findings.
Pathway Topic: Natural Resource Systems Topics

Performance Element: Examine biological and physical characteristics to identify and classify natural resources.

Measurement Criteria: Identify tree species and other woody vegetation.
Measurement Criteria: Identify grass and forb species.
Measurement Criteria: Identify wildlife species.
Measurement Criteria: Identify fish species.
Measurement Criteria: Identify rocks, minerals and soil types.

Performance Element: Examine natural cycles and related phenomena to describe ecologic concepts and principles.

Measurement Criteria: Describe the hydrologic cycle.
Measurement Criteria: Describe the nitrogen cycle.
Measurement Criteria: Describe the carbon cycle.
Measurement Criteria: Describe nutrient cycles.
Measurement Criteria: Describe succession.
Measurement Criteria: Describe population dynamics.
Measurement Criteria: Describe primary and secondary producers.
Measurement Criteria: Describe predator-prey relationships.
Measurement Criteria: Identify potential pollution sources.
Measurement Criteria: Define watershed boundaries.
Measurement Criteria: Use stream classification system.
Measurement Criteria: Describe the influence of weather and climatic factors.

Pathway KS Statement: Employ knowledge of natural resource industries to describe production practices and processing procedures.

Performance Element: Prepare presentations to describe how natural resource products are produced, harvested, processed and used.

Measurement Criteria: Describe forest harvest techniques and procedures.
Measurement Criteria: Describe wildlife harvest techniques and procedures.
Measurement Criteria: Describe fish harvest techniques and procedures.
Measurement Criteria: Describe how minerals and ores are extracted and processed.
Measurement Criteria: Describe how oil is extracted and processed.
Measurement Criteria: Describe hydroelectric generation techniques and procedures.
Measurement Criteria: Describe how public recreation use is a product.

Pathway KS Statement: Practice responsible conduct to protect natural resources.

Performance Element: Employ techniques and equipment needed to prevent wildfire.

Measurement Criteria: Demonstrate personal fire prevention precautions while working in natural environments.
Measurement Criteria: Participate in wildfire prevention community service project.

Performance Element: Use wildfire suppression techniques to demonstrate abilities in firefighting and control.

Measurement Criteria: Meet industry standards for fire suppression training (e.g., National Wildfire Coordinating Group Firefighter Certification Standards).
Pathway Topic: Natural Resource Systems Topics

Performance Element: Recognize symptoms of animal and plant diseases and use appropriate techniques to prevent their spread.

- **Measurement Criteria:** Identify observable diseases impacting plants and animals.
- **Measurement Criteria:** Describe how to report observance of disease infestations.
- **Measurement Criteria:** Use appropriate techniques and equipment when working with bio-hazards.

Performance Element: Recognize insect types and available controls to prevent insect infestation.

- **Measurement Criteria:** Identify and classify insects.
- **Measurement Criteria:** Identify insect damage signs.
- **Measurement Criteria:** Describe how to report observance of insect infestation.

Performance Element: Use acceptable pesticides to treat insect infestation.

- **Measurement Criteria:** Obtain appropriate pesticide applicators’ license.
- **Measurement Criteria:** Apply materials to treat for insect infestation.

Performance Element: Know law enforcement procedures to manage public gatherings and to gain entry into secure, closed or restricted areas.

- **Measurement Criteria:** Demonstrate precautions to use when interfacing with the public concerning regulations and law enforcement.
- **Measurement Criteria:** Describe security issues for closed and restricted areas.
- **Measurement Criteria:** Describe solutions to issues concerning public protection.
- **Measurement Criteria:** Recognize potential threat situations for the public and other resource users.
- **Measurement Criteria:** Identify the appropriate law enforcement authority.
PATHWAY: Environmental Service Systems
Pathway Topic: Environmental Service Systems Topics
Pathway KS Statement: Use analysis procedures to plan and evaluate environmental service impacts.

Performance Element: Use instrumentation to monitor samples.

Measurement Criteria: Operate basic laboratory equipment and environment monitoring instruments (e.g., pH meter/ISE meter, compound microscope/dissecting microscope, sound level measuring devices, turbidimeter, conductivity meter, chlorine meter OVA, HNMU).

Measurement Criteria: Perform chemical laboratory sample preparation.
Measurement Criteria: Perform analytical separation techniques.
Measurement Criteria: Perform spectroscopic analysis using instruments such as: spectrophotometer/auto spectrophotometer, AA/graphite furnace, ICP, GC/MS, oxygen meter, IC, IR, FTIR X-ray diffraction nitrogen analyzer, mercury analyzer, FID/PID analyzer, and RAD meter.

Measurement Criteria: Operate advanced laboratory and field equipment and instruments (e.g., HPLC, GC, bomb calorimeter, geiger mueller counter, explosimeters specific gas meters, carbon analyzer, microwave).
Measurement Criteria: Use computers to interface with chemical analytical instruments.
Measurement Criteria: Perform instrumental analysis (e.g., mass spectrometers, chromatographs, electron microscopes).

Performance Element: Calibrate and service instruments on a timely schedule to maintain environmental instrumentation.

Measurement Criteria: Maintain instruments using gas systems.
Measurement Criteria: Calibrate chemical analytical instruments.
Measurement Criteria: Operate and maintain flow instrument systems.
Measurement Criteria: Operate and maintain pressure test instruments (e.g., manometers, vacuum pumps, pressure and vacuum gages).
Measurement Criteria: Service thermal measuring instruments.
Measurement Criteria: Service physical property (e.g., sample control) measuring instruments.
Measurement Criteria: Service chemical property measuring instruments (e.g., O2 meter, spectrophotometer, atomic absorption spectrophotometer, inductively coupled plasma, ion chromatography, infrared).

Performance Element: Apply statistics, charts, and scattergrams to measure and monitor operations.

Measurement Criteria: Apply basic statistics concepts.
Measurement Criteria: Interpret scattergrams.
Measurement Criteria: Analyze probability theories.
Measurement Criteria: Determine control limits.
Measurement Criteria: Determine process capability.
Pathway Topic: Environmental Service Systems Topics

Measurement Criteria: Prepare and evaluate charts.
Measurement Criteria: Conduct process improvement studies.
Measurement Criteria: Interpret quantitative and graphic output from chemical analysis instruments.

Pathway KS Statement: Identify public policies and regulations impacting environmental services to determine their effect on facility operation.

Performance Element: Consult reliable resources or training to identify the major laws impacting environmental services.

Measurement Criteria: Identify requirements of Superfund Amendment Reauthorization Act (SARA).
Measurement Criteria: Identify requirements of waste and material transportation.
Measurement Criteria: Describe job-related activities subject to the Occupational Safety and Health Administration (OSHA).
Measurement Criteria: Explain requirements of Safe Drinking Water Act (SDWA).
Measurement Criteria: Explain requirements of Clean Air Act.
Measurement Criteria: Identify key components of (_____ISO 14000).

Pathway KS Statement: Apply scientific principles to environmental services.

Performance Element: Apply meteorological knowledge to recognize weather systems and weather patterns.

Measurement Criteria: Identify the components of the earth’s atmosphere.
Measurement Criteria: Explain basic meteorology principles.

Performance Element: Describe soil compositions and properties to demonstrate knowledge of soil science.

Measurement Criteria: Describe soil geology.
Measurement Criteria: Describe composition of soil.
Measurement Criteria: Describe the biological properties of soil.
Measurement Criteria: Identify the physical properties of soil.
Measurement Criteria: Describe the chemical properties of soil.
Measurement Criteria: Test soil samples to determine characteristics.
Measurement Criteria: Explain classification of soil water.
Measurement Criteria: Explain the relationship between soil classifications and land use.

Performance Element: Explain well design and groundwater supplies to demonstrate knowledge of hydrology.

Measurement Criteria: Explain hydrology.
Measurement Criteria: Explain geological and meteorological principles affecting groundwater supply.
Pathway Topic: Environmental Service Systems Topics

Measurement Criteria: Conduct channel flow analysis.
Measurement Criteria: Identify basic criteria for water well design.
Measurement Criteria: Identify differences in groundwater potential.
Measurement Criteria: Identify environmental hazards associated with groundwater supplies.

Performance Element: Discuss properties, classifications and functions in order to understand wetland principles.

Measurement Criteria: Explain wetlands classification.
Measurement Criteria: Explain the function of wetlands.
Measurement Criteria: Describe the living components of wetland habitats.
Measurement Criteria: Delineate wetlands.
Measurement Criteria: Identify techniques used in wetland management, enhancement and restoration programs.

Measurement Criteria: Identify principles used in wetland mitigation and restoration.

Performance Element: Discuss properties, classifications and functions in order to understand watershed principles.

Measurement Criteria: Identify properties of watersheds.
Measurement Criteria: Explain watershed management.
Measurement Criteria: Delineate watersheds.
Measurement Criteria: Assess source water.

Performance Element: Use chemical analysis to conduct tests.

Measurement Criteria: Explain basic chemistry principles (e.g., elements, compounds).
Measurement Criteria: Apply chemical laboratory skills.

Performance Element: Perform common microbiology procedures to examine cell types and conduct tests.

Measurement Criteria: Conduct bioassay tests.
Measurement Criteria: Identify groups of microorganisms.
Measurement Criteria: Analyze factors affecting microbial growth.

Performance Element: Apply sampling techniques and other assessments to demonstrate background knowledge of microbiology.

Measurement Criteria: Apply microbiological principles and procedures.
Measurement Criteria: Explain immunological procedures.
Measurement Criteria: Describe roles of microorganisms in the environment.
Measurement Criteria: Explain microbial growth.
Measurement Criteria: Describe influence of environmental factors on microbes.
Measurement Criteria: Demonstrate the use of fundamental statistics in sampling practices.

Pathway KS Statement: Operate environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management, and energy) to manage a facility environment.

Performance Element: Use pollution control measures to maintain a safe facility environment.

Measurement Criteria: Identify types of pollution (e.g., ground, surface water, air,
Pathway Topic: Environmental Service Systems Topics

Measurement Criteria: Identify presence of pollution.
Measurement Criteria: Describe environmental impact from industrial and non-industrial processes.
Measurement Criteria: Quantify extent of pollution.
Measurement Criteria: Locate and monitor sources of pollution.
Measurement Criteria: Conduct remediation activities.
Measurement Criteria: Monitor remediation activities.
Measurement Criteria: Establish pollution management and prevention program.

Performance Element: Apply principles of solid waste management (landfill) to manage safe disposal of all categories of waste.

Measurement Criteria: Collect solid waste materials.
Measurement Criteria: Treat solid waste materials.
Measurement Criteria: Manage solid waste systems.
Measurement Criteria: Identify the risks associated with solid waste accumulation and disposal.
Measurement Criteria: Describe methods of site identification and acceptance.
Measurement Criteria: Explain sanitary landfill operating procedures.
Measurement Criteria: Monitor sanitary landfill procedures.
Measurement Criteria: Describe methods to operate a composting facility.
Measurement Criteria: Describe methods to incinerate solid waste.
Measurement Criteria: Describe recycling methods.

Performance Element: Apply drinking water treatment operations principles to assure safe water at a facility.

Measurement Criteria: Describe the demineralization processes in water treatment.

Performance Element: Apply wastewater treatment operations principles to manage wastewater disposal in keeping with rules and regulations.
Pathway Topic: Environmental Service Systems Topics

Measurement Criteria: Sample wastewater.
Measurement Criteria: Describe wastewater collection systems.
Measurement Criteria: Analyze the constituents of wastewater entering wastewater treatment facility.
Measurement Criteria: Describe the treatment train, effluent disposal, and biosolids management in wastewater.
Measurement Criteria: Analyze treatment process control for the treatment train, effluent disposal, and biosolids management in wastewater.
Measurement Criteria: Inspect and maintain equipment for the treatment train, effluent disposal, and biosolids management in wastewater.
Measurement Criteria: Describe common facility operational problems.
Measurement Criteria: Identify methods for cross-connection and backflow prevention.

Performance Element: Apply hazardous materials management principles to assure a safe facility and to comply with applicable regulations.

Measurement Criteria: Describe risks related to hazardous materials.
Measurement Criteria: Describe health and safety practices to reduce risks from hazardous materials.
Measurement Criteria: Demonstrate appropriate responses for major types of hazardous materials disasters (e.g., chemical, fire and explosion, general safety hazards) (FRA, FRO, HMT, HMS).
Measurement Criteria: Describe appropriate use of Personal Protective Equipment (PPE).
Measurement Criteria: Explain hazardous substance regulations.
Measurement Criteria: Demonstrate ability to obtain and use information addressing hazardous substance release.
Measurement Criteria: Demonstrate safe handling procedures for hazardous materials and hazardous waste.
Measurement Criteria: Evaluate laboratory results.
Measurement Criteria: Demonstrate methods for identifying hazardous material.
Measurement Criteria: Detect hazardous materials.
Measurement Criteria: Perform site evaluation for hazardous material risk.
Measurement Criteria: Retrieve and evaluate hazardous materials and hazardous waste sample data.
Measurement Criteria: Respond to mock hazardous materials emergency situations.
Measurement Criteria: Describe use of equipment related to hazardous materials and hazardous-waste operations.
Measurement Criteria: Prepare hazardous materials for transportation and storage in accordance with regulations.
Measurement Criteria: Demonstrate ability to operate treatment and disposal systems.
Pathway Topic:  Environmental Service Systems Topics

Measurement Criteria: Maintain required documents for hazardous-materials and hazardous-waste management activities.

Measurement Criteria: Audit regulatory compliance.

Performance Element: Explore conventional and alternative supplies to define energy sources.

Measurement Criteria: Identify conventional energy sources and their environmental impact.

Measurement Criteria: Identify alternate energy sources and their environmental impact.

Pathway KS Statement:  Use tools, equipment, machinery and technology to accomplish tasks in environmental services.

Performance Element: Use technological tools to map land, facilities, and infrastructure.

Measurement Criteria: Apply surveying and mapping principles to make site measurements and map facility accesses and infrastructure.

Measurement Criteria: Apply basic drafting skills to create working drawings.

Measurement Criteria: Use CADD fundamentals to create specialized documents.

Measurement Criteria: Apply cartographic skills.

Measurement Criteria: Apply surveying skills.

Measurement Criteria: Use geo-spatial analysis processes for an environmental services application.
PATHWAY: Agribusiness Systems

Pathway Topic: Agribusiness Systems Topic

**Pathway KS Statement:** Employ leadership skills to accomplish goals and objectives in an AFNR business environment.

**Performance Element:** Develop a mission statement to guide business activities effectively.

- **Measurement Criteria:** Identify planning approaches for preparing mission statement.
- **Measurement Criteria:** Write a mission statement.
- **Measurement Criteria:** Establish short- and long-term goals.
- **Measurement Criteria:** Ask for feedback from stakeholders to test the impact of the mission statement.
- **Measurement Criteria:** Disseminate mission statement to inform fellow employees and gain in-house support.

**Performance Element:** Apply leadership skills to accomplish general business activities from production to public relations.

- **Measurement Criteria:** Identify leadership styles.
- **Measurement Criteria:** Conduct a business meeting using proper parliamentary procedures/consensus techniques.
- **Measurement Criteria:** Work in teams to access a variety of expertise.
- **Measurement Criteria:** Extend a pat on the back for jobs well done.

**Performance Element:** Apply management skills to accomplish general business activities from production to public relations.

- **Measurement Criteria:** Identify management types.
- **Measurement Criteria:** Identify organizational structures.
- **Measurement Criteria:** Identify time management techniques.
- **Measurement Criteria:** Make business agreements.
- **Measurement Criteria:** Follow local, state, and federal regulations and appreciate the consequences of not following them.
- **Measurement Criteria:** Recruit, train and evaluate human resources.
- **Measurement Criteria:** Make business presentations.

**Pathway KS Statement:** Practice good record keeping to accomplish AFNR business objectives.

**Performance Element:** Prepare and maintain all files as needed to accomplish effective record keeping.

- **Measurement Criteria:** Identify information management systems.
- **Measurement Criteria:** Develop record keeping techniques and practices.
- **Measurement Criteria:** Keep production and agribusiness records.
- **Measurement Criteria:** Make records analysis.

**Pathway KS Statement:** Apply generally accepted accounting principles and skills to manage budget, credit, and optimal application of AFNR business assets.
Pathway Topic: Agribusiness Systems Topic

Performance Element: Use key accounting fundamentals to accomplish dependable bookkeeping and associated files.

**Measurement Criteria:**
- Budget resources (e.g., capital, human, financial, time).
- Manage assets for optimum utilization.
- Manage risk of liabilities.
- Evaluate credit uses and options.
- Prepare and interpret financial statements (e.g., balance sheet, profit/loss statement, cash flow statement).
- Prepare tax forms (e.g., W-4, I9, Depreciation, 1099, Workers Compensation).
- Determine cost of doing business.
- Compare and examine advantages and disadvantages of banking procedures (e.g., bank reconciliation).
- Analyze investment options (e.g., buy, lease, finance, risk).

Pathway KS Statement: Employ AFNR industry concepts and practices to manage inventory.

Performance Element: Monitor inventory levels to accomplish practical inventory control.

**Measurement Criteria:**
- Maintain optimum inventory levels.
- Apply just-in-time concepts.
- Calculate costs of carrying inventory.
- Perform logistics management.

Pathway KS Statement: Utilize technology to accomplish AFNR business objectives.

Performance Element: Use technology and information technology strategies for business improvement.

**Measurement Criteria:**
- Utilize leading technology; e.g., Global Positioning System (GPS), Geographical Information System (GIS), Personal Data Application (PDA), cellular.
- Create and use documents using word processors, spreadsheets, databases and electronic mail.
- Conduct research using the Internet.
- Conduct oral/visual presentation using presentation software.

Pathway KS Statement: Use sales and marketing principles to accomplish an AFNR business objective.

Performance Element: Conduct market research.

**Measurement Criteria:**
- Evaluate methods of marketing products and services.
- Apply economic principles to marketing (e.g., supply and demand).
- Research products and service design(s).

Performance Element: Develop a marketing plan.

**Measurement Criteria:**
- Identify and develop value-added products.
- Develop public relations campaigns.
Pathway Topic:  Agribusiness Systems Topic

Measurement Criteria:  Develop sales goals and incentive programs.
Performance Element:  Implement a marketing plan.

Measurement Criteria:  Promote products and services.
Measurement Criteria:  Advertise products and services.
Performance Element:  Merchandise products and services.

Measurement Criteria:  Identify key components to organize a sale.
Measurement Criteria:  Build and develop customer relationships.
Measurement Criteria:  Conduct sales presentation.
Measurement Criteria:  Provide post-sale service.
Measurement Criteria:  Handle customer complaints.
Measurement Criteria:  Locate prospective new customers.