

***POWER GENERATION
SKILL STANDARDS***

Plant Electricians

FOR MORE INFORMATION

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Focus Group Participants

The focus groups consisted of front-line workers, first line supervisors and professionals in the power generation industry within the Pacific Northwest power grid region. They determined the critical work functions and key activities performed by power plant electricians. They then listed the performance indicators, technical knowledge, skills and abilities, and employability skills required to succeed in this field. Their insights were an invaluable contribution to this work.

Pat McCarty- Tacoma Power
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Special Thanks

The Power Generation Skill Standards project was launched at the Grant County PUD SeaTac conference room where industry training supervisors, plant managers and labor representatives determined the scope of the power generation skills project. Based on that input, a two day focus group session for power plant electricians was hosted by Tacoma Power at their Cowlitz River Project facility. This intense meeting generated impressive results. The investment by industry in this project was high, but the results provide a detailed knowledge capture of the skilled crafts that will serve industry, labor and educational needs well. The standards represent a collaborative, high-quality benchmark for the power generation workforce that will contribute to the future success of the energy industry and its employees. We sincerely thank our industry and labor partners for supporting this work.

The Power Generation Skill Standards Project Outcomes

The following are the outcomes of *Power Generation Skill Standards*, as determined by the partnership:

- Skill standards needed for power generation careers consistent with the current and future needs of the public and business
- Verification of worker input by written survey
- A report for power generation employers, labor unions and educators showing the standards and the data that supported those standards

The Next Steps

The completion of the skill standards represents phase one of this endeavor. The next step is to provide oversight to the development of curriculum based on the skill standards. This is a cooperative and collaborative project with power generation industry, labor unions, high schools, and colleges throughout the state. Additionally, the skills standards will serve as a foundation for Credit for Prior Learning and industry human resource job requirements.

Table of Contents

OVERVIEW

Introduction

The State of the Industry

NATIONAL CONTEXT

A National Context for Skill Standards

 What Are Skill Standards?

 Why Are Skill Standards Important?

 The Benefits and Uses of Skill Standards

Skill Standards to Curriculum: A Continuous Development Process

Pyramid of Competencies

POWER GENERATION SKILL STANDARDS PROJECT

Project Goals, Guiding Principals and Methodologies

Employability Skills: SCANS Profile

Definition of Terms

RESULTS: Skill Standards for Plant Electrician

Typical Job Description

Scenarios: Routine, Crisis and Long Term

SCANS Survey Results

Summary of Critical Work Functions and Key Activities

Theories and Concepts

Verification Survey Results

Skill Standards

INTEGRATION

Assessment and Certification: A Vital Connection

Assessment Strategies

Assessment Design

APPENDICES

References

Ordering Information

OVERVIEW

Introduction

The State of the Industry

OVERVIEW

Introduction

The Power Generation Skill Standards is the result of a collaborative project led by the Centralia College Center of Excellence for Energy Technology. The initial work on Energy Industry Distribution Skill Standards for Electricians, Lineman, Instrument/Control/ Relay/Meter Technician and Millwright was conducted in 2003 by Walla Walla Community College.

The Power Generation and Power Distribution Skill Standards serve as companion documents to create a standard for curriculum development, skills training and human resource needs for energy production and distribution. Bonneville Power Administration (BPA) has developed skill standards for craft, supervisory and engineering occupations that will serve the transmission needs of the Pacific Northwest power grid. Collectively, the skill standards will continue to be expanded by position to standardize the knowledge management processes for power generation, transmission and distribution.



Skill Standards Message from Industry

By Pat McCarty

Generation Manager, Tacoma Power and
Chair, Advisory Board, Center of Excellence for Energy Technology

Most energy jobs have changed a lot over the last 20 years, due in part to the many technological advances that have occurred; the changes to the power plant electrician's job have been nothing short of dramatic.

For starters, power plant electrician's duties were much less complex than they are today. In the past, those tasks included installing the occasional conduit or cable tray run, changing light bulbs, doing annual maintenance on generators, and troubleshooting. Troubleshooting was much easier back then because most all relays, governors and excitation systems were electrical/mechanical or mostly mechanical. These were fairly straightforward systems, and as a result, electrical problems were easier to identify.

That all changed with the introduction of electronics and computers, which rendered the design of electrical systems and equipment far more complex. New systems and equipment such as solid-state protection relays, smart relays, programmable logic controllers, computerized plant control systems, electronic governors and static excitation systems are more advanced. Today these systems are increasingly integrated and used in combination with each other.

The introduction of new and integrated systems and equipment also called for the development of higher-level skills among electricians. Electricians were now required to use computers as an everyday tool for installation and troubleshooting. Education and training programs were modified to teach to the new systems, including the technology tools and skills they required. Foundational skills such as problem solving, critical thinking and basic communications also became more critical.

As electrician work has become more complex, it is increasingly difficult to recruit qualified personnel. Filling vacancies by recruiting from other industry sectors provided an effective supple-

ment to fill vacancies, but presented another set of challenges. For example, while commercial and residential electricians often install a lot of the equipment used in the power industry, very few ever troubleshoot these systems.

Industry declines in pulp and paper, aluminum and other manufacturing sectors has further made it difficult to recruit qualified people from sectors where electricians are familiar with the equipment used in the power industry. Those industries employ electricians who are trained on similar equipment, and they can readily make the transition into power generation careers.

With those industries shrinking or leaving the region, however, it has become harder to attract qualified electricians.

Labor shortages and new skill requirements have led many employers, colleges and other training providers to develop skill standards for power generation occupations, both to define what skills are required now, and to provide training benchmarks for the future.

The primary benefit of having power plant electrician skills standards in place is that it gives us an assurance that future applicants will have the foundational knowledge, skills and abilities needed to succeed in the industry. The standards provide a practical, detailed roadmap for colleges and other training programs to follow as they establish or modify relevant electrician programs.

The standards also provide a specific tool for communicating with students, incumbent workers and experienced electricians from other industry sectors what will be expected of them in the electric power industry.

Finally, the skill standards also provide power generation employers with a systematic way to identify the core work of our employees, and a measure for assessing how new technologies and a changing workplace will alter the skill requirements for power plant electricians in the future.



Skill Standards Message from Labor

by Bob Guenther

Bob Guenther, President, Thurston, Lewis, Mason, Central Labor Council, Vice President, 3rd District Washington State Labor Council AFL/CIO, Chair, Regional Education and Training Center, Satsop Campus, Lobbyist, IBEW Local 77.

Skill Standards enable predictive thinking on future industrial needs.

Establishment of skill standards offers continuous improvement for current business needs and at the same time provides oppor-

tunities for workers to bring skills to the workplace that ensures quality training to make business profitable. The attainment of the goals of skill standards also provides an opportunity for labor to negotiate in good faith the wages that their expertise has earned.

Further, history has shown that industrial accident frequency continues to decline through good workforce training. Skill standards provide the foundation for providing a safe and skilled workforce for Washington State, the region and our nation as a whole.

I am proud of Organized Labor's participation in the skill standards process.

NATIONAL CONTEXT

A National Context for Skill Standards

What Are Skill Standards?

Why Are Skill Standards Important?

The Benefits and Uses of Skill Standards

Skill Standards to Curriculum: A Continuous Development Process

Pyramid of Competencies

National Context for Skill Standards

The National Skill Standards Board was established by Congress in 1994 to encourage the creation and adoption of a national system of voluntary skill standards that would enhance the ability of the U.S. to compete effectively in a global economy. By the time the NSSB sunset in 2003, several national voluntary skill standards projects were developed by various industries in full partnership with education, labor and community-based organizations. The intent was to have voluntary skill standards that are flexible, portable, and continuously updated and improved. Washington State has provided significant leadership in the development and use of industry-defined skill standards.

What Are Skill Standards?

Skill standards are performance specifications that identify the knowledge, skills and abilities an individual needs to succeed in the workplace. They are critical to improving workforce skills, raising living standards and improving the competitiveness of the U.S. economy. To be effective, skill standards must reflect the consensus of power generation professionals.

Skill standards provide measurable benchmarks of skill and performance achievement. They answer two critical questions: What do workers need to know and be able to do to succeed in today's workplace? And, how do we know when workers are performing well? Without this fundamental information, employers do not know whom to hire or where to focus their limited training dollars; employees and new entrants to the workforce do not know what they need to do to improve their performance; educators do not know how to prepare students for the challenge of the workplace.

Why Are Skill Standards Important?

In today's workplaces, the only constant is change. Jobs that once were relatively simple now require high performance work processes and enhanced skills. Because skill standards reflect changing workplace realities, they are a tool that can be used by applicants and employees to access greater career opportunities.

National recognition of skill standards in career fields provides a common basis for certifying achievement against those standards, thereby allowing for the portability of skills across geographic areas, companies and careers.

Updating skills and knowledge is now a lifelong endeavor, causing many employers and employees to spend more effort, time and money on education and training. Skill standards provide benchmarks for making education and training decisions, shaping curricula and directing funds toward highest value education and training investments.

The Benefits and Uses of Skill Standards

Skill standards benefit all the stakeholders—business, labor, educators, government, and the community. The success of a skill standards development project and its usefulness to the community is dependent on the full participation and commitment of all stakeholders. These benefits can be used as a benchmark for evaluating the effectiveness of collaborative efforts.

How Skill Standards Benefit Employers

Employers can use skill standards to establish personnel qualification requirements. Interviews, performance reviews and productivity can be evaluated and assessed to a higher degree of accuracy and efficacy. Employers are also able to identify core competencies and workers' abilities to demonstrate competencies. By matching competencies to critical work functions and key activities, employers can significantly improve efficiencies and productivity. Performance-based skill standards also provide a vehicle for varying degrees of job certainty and the structure for establishing competency-based pay scales. In addition, employers use skill standards to:

- Align personnel qualification requirements with nationally adopted certificates of competence.
- Modify employee training.
- Simplify measurement of employee training effectiveness.
- Assess employee skill levels based on industry standards.
- Match employee skills to the work needed.
- More easily document employee skills, training needs and performance criteria.
- Improve consumer satisfaction and confidence through better developed evaluation skills for customer contact personnel.
- Improve employee satisfaction and morale by clarifying expectations.
- Improve quality, productivity, time-to-market and competitiveness.
- Achieve business goals.
- Partner with education and labor in developing school-to-work initiatives.

How Skill Standards Benefit Educators

Educators can identify core competencies and assessments based on the skill standards and implement them in their curricula. Students can then be required to demonstrate competency throughout their coursework. Academia and industry can build a cohesive relationship through a like-minded expectation of student competencies and work readiness. This enhances an instructor's ability to teach information consistent with industry's entry level expectations and needs. In addition, educators use skill standards to:

- Partner with business and labor in developing school-to-work initiatives.

- Provide effective, targeted instruction.
- Develop benchmarks for certificates of competence earned by students.
- Communicate what companies expect of employees.
- Develop new and evaluate existing curriculum and programs based on industry needs.
- Develop assessments to evaluate skills, knowledge, and abilities in classrooms and internships.
- Develop a common language on workforce preparation with business and labor.
- Improve relationships with local businesses, labor unions, other educators and agencies.
- Provide students with relevant career education and counseling.

How Skill Standards Benefit Labor Unions

Labor unions can use skill standards to gain support for company-sponsored worker training programs and to identify career paths for workers within companies and industries. Unions can provide this information to union members and develop strategies to improve career mobility and stability. Skill standards help unions to:

- Improve member value to the company.
- Provide a greater worker voice in the company.
- Link skill standards to increased training and upward career mobility for union members.
- Assist employers to match employee skills to the work needed.
- Develop skills-based training and certification initiatives that complement union apprenticeship programs.
- Communicate effectively with employers about worker training and retraining needs.
- Cooperate with education and industry in developing school-to-work initiatives.

How Skill Standards Benefit Students and Workers

Skill standards assist students in making career choices by providing industry expectations for success in the workplace. In addition, standards-based curriculum and assessments provide students with credentials that certify work-readiness. Work-ready students can anticipate being hired at higher rates of pay and can experience faster advancement in their chosen fields. Workers can accurately assess their skills against those required for career advancement and plan effectively for their career pathways. They can determine the skills and abilities needed for advancement or transfer within industries, and determine the continuous learning and training they need to upgrade their skills. In addition, students and workers can use skill standards to:

- Achieve clarity regarding what they are expected to learn and how to prepare for work.
- Enter and reenter the workforce with better control of their choices of high paying jobs requiring high skills.

- Accurately assess business expectations of the skills needed for positions and careers of their choice.
- Improve mobility and portability of their credentials.
- Obtain certification of competence of the skills they gain through experience, school, training, or self-study.
- Enhance their performance and achievement by self-evaluation against known standards.
- Be active contributors to the activities that make their organizations successful.

How Skill Standards Benefit Government

Government can provide information that will ensure a better skill match between workers and employers and initiate education reform to better educate future members of the workforce. Skill standards better enable agencies to provide options for career and job mobility and link learning to the needs of the workplace. In addition, government can use skill standards to:

- Assist in the development of a highly skilled and competitive workforce.
- Evaluate the effectiveness of publicly funded education and training.
- Increase opportunities for under-represented populations by making public the information that defines the skills required for success and by facilitating the national adoption of those definitions and their use.
- Support the creation of high performance organizations where they improve living standards for all members of the population.
- Facilitate collaboration between educators and industry.
- Communicate the need and basis for education reform to business, education, labor, and the community-at-large on both local and national levels.

Skill Standards to Curriculum: A Continuous Development Process

The skill standards generated in this project are designed to be used by participating education partners to develop or modify curriculum at the high school and community college level. By providing the necessary input from industry, this skill standards document is a first step in curriculum development to serve the power generation industry in particular, and to demonstrate what can be done across industries.

In order to keep current with a rapidly changing workplace, standards need to be reevaluated and updated on a regular basis, with full partner participation at each step. New technological developments impact the ways that workers organize and apply their skills, including time management and interpersonal relationships. Increased technological complexity may simplify some of the job tasks but make others more intricate. Today's successful power generation workers are challenged to acquire a broader range of decision making and customer service skills as well as keep current with emerging technologies. Ongoing changes like these must be reflected in curriculum in order to meet the needs of industry, where expectations for workers are evolving.

A model of continuous improvement for economic development: Using Skill Standards

Step 1: Skill Standards Identification

- Compile and research existing standards in related jobs and careers.
- Conduct focus groups to identify critical work functions and key activities, define key activity performance indicators and identify technical knowledge, foundation skills and personal qualities.
- Conduct a survey of current workers to determine level of SCANS skills required for each job.
- Develop work-related scenarios to place the skill standards in the context of the work environment.
- Verify the data gathered from focus groups.
- Disseminate skill standards information to involved parties from industry, education and labor for their review and editing.

Step 2: Assessment

- Develop assessments through the collaboration of industry and education to reflect competent performance as defined by the skill standards.
- Collect evidence of a person's ability to perform at the levels determined by the skill standards.
- Determine present skill level through direct and indirect evidence by assessing a student, trainee, apprentice, prospective worker or worker seeking additional training.
- Use products and items produced by the person being assessed as direct evidence.
- Gather supporting information to use as indirect evidence.
- Assess results using the criteria of validity, currency, authenticity and sufficiency.
- Demonstrate validity using tangible item or record of action.

- Demonstrate authenticity by having the individual being assessed produce the item or specific piece of a team-effort.
- Demonstrate sufficiency by providing enough evidence to match key tasks and performance criteria of the skill standards.

Step 3: Curriculum Development

- Identify necessary competencies based on the skill standards information and assessments.
- Develop program outcomes for specific academic and training programs, including Tech Prep, 2-year, and apprenticeship programs.
- Perform gap analysis to determine changes or additions to be made to curriculum.
- Revise existing curriculum to better meet the current and future needs of the industry.
- Develop new curriculum and establish new programs based on these competencies.

Step 4: Articulation

- Develop models to support the articulation of program outcomes and competencies between academic and training systems.
- Establish articulation agreements between existing programs to ensure portability of skills.
- Connect competencies and Certificates of Competence with benchmark documentation to build national portability systems.

A Continuous Updating Process

A continuous exercise is necessary: all partners must revise and verify skill standards on a regular basis. For national economic development success, curriculum and current training methods must be updated to meet workplace standards.

Individual workers must have access to clearly stated competency goals and direct access to skill development assistance. With cooperative effort on local and national levels, we can begin to resolve the workforce shortages in the power generation industry that face us today.

Pyramid of Competencies

The Pyramid of competencies is a depiction of skill standards in three broad skill categories.

Tier I

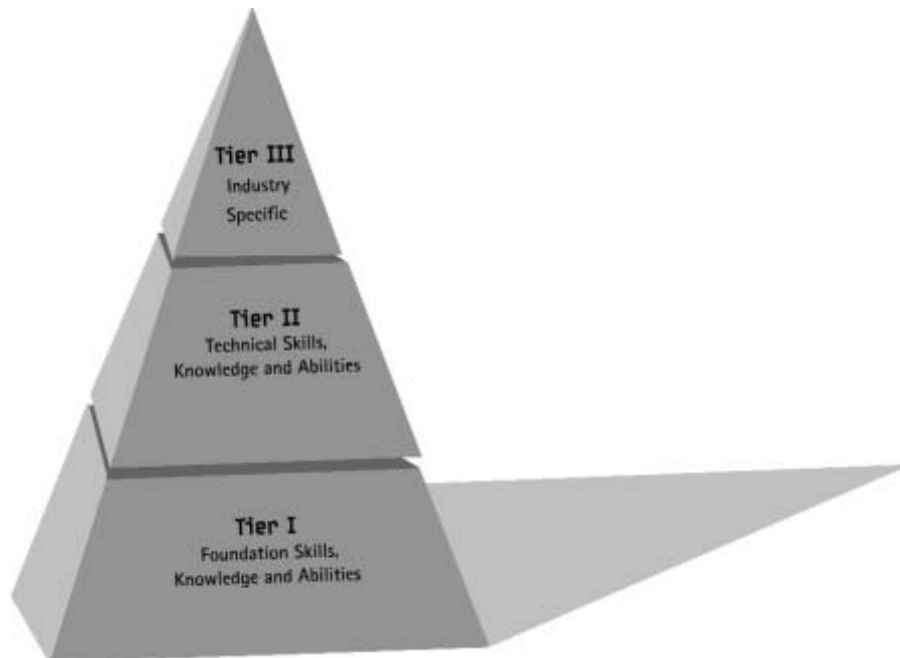
Tier I represents the broadest level of competencies, and is the set of employability (SCANS) skills, knowledge, abilities and personal qualities required of all workers to be successful in today's workplace. These are the universal skills that are needed to apply technical knowledge and tools effectively.

Tier II

Tier II represents technical skills, knowledge and abilities common to a cluster of jobs within a cluster across all an industries or industry sectors. For workers in power generation, for example, knowledge of applicable federal, state and local laws would be applicable across all sectors.

Tier III

Tier III represents industry-specific technical skills, knowledge and abilities that are unique to individual jobs or clusters and are the most prone to rapid change. For example, many workers need to upgrade their skills based on sudden market shifts.



POWER GENERATION SKILL STANDARDS PROJECT

Project Goals, Guiding Principals and Methodology

Employability Skills: SCANS Profile

Definition of Terms

Project Goals, Guiding Principle and Methodology

Goals

- Identify voluntary skill standards for the power generation industry. The standards will serve as benchmarks for entry into power generation careers at the technical level.
- Disseminate the results and support the use of skill standards by educators, businesses, unions, students, workers and government agencies.

Guiding Principles

- Experienced workers are the experts in their career field and are best able to identify the work performed and the skills, knowledge and abilities required to be successful.
- Business, labor and education must work as partners to ensure the creation of a link between the work expectations and the curriculum.
- The standards must be consistent with existing civil rights laws and practices.
- Standards must be flexible, portable and should be updated continuously.
- Skill standards describe the major functions and key activities, as well as the performance indicators, technical knowledge and skills, employability skills and personal attributes needed to succeed in the workplace.
- Integrated skill standards define work duties and the skills required to perform them in the context of work settings.

The experience of the partners involved in this project holds that the success of any skill standards project is critically linked to the full participation and commitment of all partners.

Identification of Skill Standards: Methodology

Background

These industry-defined skill standards were developed using specific research-based processes. The project followed the process required by the Washington State Board for

Community and Technical Colleges (SBCTC) as described in *Skill Standards Guidebook I*, Washington State Board for Community and Technical Colleges, 1996 and the process developed by the National Skill Standards Board (NSSB). In particular, the protocols used for the ICT (Information Communications Technology) skill standards were applied to this project.

The Center of Excellence for Energy Technology was formed in 2003 in response to the desire of industry to address the ever-widening shortfall of skilled workers in the power generation industry. The Center represents the education and training needs of the Energy industry through its partnership with employers, labor and educators. In 2006, funds were granted this project by the Washington State Workforce Training and Education Coordinating Board to conduct a skill standard study.

Dr. Alan Hardcastle of the WSU Extension Energy Program and Terryll Bailey of The Allison Group, conducted extensive secondary research to identify trends, current jobs and existing skill standards in the power generation sector including data from the SBCTC Skill Standards Web site and the NSSB. Researchers met with industry representatives to determine the goals and research design of the skill standards project, to obtain their input on the research to date and to finalize the clusters to be covered in the study.

A focus group session was conducted with Senior Experts from industry to review the preliminary research and advise the research process. These employers and labor leaders established the project direction and timeline, and identified an initial list of critical work functions and key activities. This initial list was subsequently reviewed by panels of subject matter experts; primarily current workers who perform those jobs.

Focus Groups

In the focus group, a structured process was used to guide the panel through the development of the critical work functions and key activities. The process included the following elements.

- Panelists were facilitated by a professional skill standards focus group leader.
- Panelists receive an orientation to skill standards. Examples were provided.
- Panelists from diverse areas of the power generation industry arrived at consensus regarding the components of the skill standards.
- Panelists clarified the organization and structure of the critical work functions and key activities, filled in gaps, and confirmed the accuracy of the critical work functions and key activities.
- Panelists identified Performance Indicators for each key activity.

- Panelists identified occupational technical knowledge and skills for each key activity.
- Panelists brainstormed the topics that need to be covered in training and education programs to prepare people to enter the work.
- Panelists completed survey to level SCANS.

After a thorough orientation to skill standards, panelists were asked to brainstorm critical work functions for their cluster. After composing their own critical work functions, they were then provided with the draft critical work functions identified by the Senior Experts and through research. Panelists were asked to compare the critical work functions from the Senior Experts with those they brainstormed as a group and to consider the following criteria:

- Is the function a broad responsibility?
- Does it take a significant amount of time to achieve?
- Are there groupings of Key Activities associated with it?

Participants were asked to review the key activities for each critical work function and to posit appropriate changes wherever necessary. The criteria used for this purpose were:

- Does the activity describe what you have to do to achieve this function?
- Is it a major area of task responsibility?
- Is it concrete and specific?
- Does it have relatively equal importance to the other Key Activities?
- Does each Key Activity require distinct, definable skills?

Once the critical work functions and key activities were finalized, performance indicators were developed for each key activity. Panelists were asked how they know when a task is performed well and what elements need to be in place so they would be ensured that this key activity is performed competently. The following criteria were provided regarding performance indicators:

Performance Indicators should...

- Describe competent performances.
- Be directly observable, concrete and measurable.
- Capture the essential aspects of performance.
- Be as precise and explicit as possible but still apply across the industry cluster.
- Reflect what the individual can control.

Panelists brainstormed performance indicators and then arrived at consensus with respect to the final list. The group was assisted in putting the content into appropriate language format.

Panelists next moved to identify the occupational technical knowledge and skills for each key activity. They brainstormed occupational technical knowledge and skills, and then arrived at the final list through consensus. Panelists were asked what a person needs to know and be able to do to accomplish the key activities at the level defined by the performance indicators.

In each focus group an informal discussion was held to identify the subjects and topics most important for new entrants to the industry.

Surveys

A survey was conducted to level SCANS skills and personal qualities for the cluster. SCANS (Secretary's Commission on Achieving Necessary skills) are foundation abilities required of workers in all occupations at varying levels specific to their jobs, ranging from basic academic skills to problem solving, working in teams and the use of technology. Surveys were distributed to panelists in the focus groups and to workers across the State of Washington. Complete survey data from 33 Power Plant Electricians was collected and analyzed. The SCANS survey results are presented in a separate section of this document.

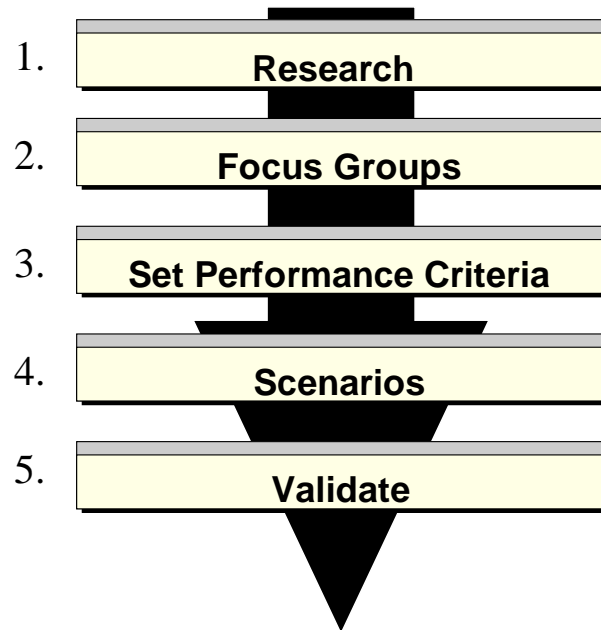
Senior Expert Review

Senior Experts from the energy generation sector reviewed the critical work functions, key activities and performance indicators produced by the focus group panels. The Senior Experts provided a few minor edits and answered some follow up questions from the research team. All of the Senior Experts confirmed the content of the skill standards.

Industry-wide Review

The preliminary skill standard was reviewed and verified in the early part of 2009 by a survey of the energy industry. Survey respondents were asked to comment on the standards, and to rank the relative importance of the functions and tasks identified by the focus groups. Complete survey data from 33 Power Plant Electricians was collected and analyzed. The Verification Survey Results are presented in a separate section of this document.

Process: Building Skill Standards



Employability Skills: SCANS Profile

During the data-gathering process of this project, employability skills for power generation careers were identified. Employability (or workplace) skills are basic academic and foundation skills needed to build more advanced competencies. The foundation skills are based on broad workplace categories, known as SCANS (Secretary’s Commission on Achieving Necessary Skills, U.S. Department of Labor). This federal report issued in 1991 identifies 37 foundation and workplace competencies required for work readiness.

SCANS are comprised of a three-part foundation of skills and personal qualities and five workplace competencies needed for successful job performance in today’s workforce. Professionals currently working in the field were asked to identify the level of difficulty for each of the 37 SCANS skills most required for successful workplace performance in each cluster. The information in the charts on the following pages was compiled by taking a weighted average of the responses across the cluster. This summary information provides a general view of the key workplace skills deemed relevant and necessary for the front line worker in power generation as well as providing the foundation for the employability skills within the skill standards.

Basic skills	Thinking skills	Personal qualities	Workplace Competencies
Reading	Creative Thinking	Responsibility	Utilizing Resources
Writing	Decision Making	Self-worth	Interpersonal Skills
Arithmetic	Problem Solving	Sociability	Utilizing Information
Listening	Visualization	Self-management	Using Systems
Speaking	Knows/Learns Reasoning	Integrity/Honesty	Using Technology

The ADVANCE™ *Workplace Standards Skill Inventory* from Advanced Educational Spectrums, Inc. was used to capture industry views on foundation skills for power generation workers. Industry professionals ranked the SCANS skill levels required. The chart on the following pages contains information created by taking the average of the profiles across the clusters. This summary information provides a general view of the key foundation skills deemed relevant and necessary for the entry-level power generation worker.

<i>Applies creative thinking</i>	Level I <input type="checkbox"/> • Makes connections between old & new • Recognizes patterns/relationships	Level II <input type="checkbox"/> • Paraphrases/summarizes previous existing ideas • Documents creative thinking process while problem solving • Utilizes brainstorming techniques	Level III <input checked="" type="checkbox"/> • Develops creative solutions • Applies creative solutions in new situations	Level IV <input type="checkbox"/> • Generates unique solutions • Formulates new ideas/plans/approaches • Organizes new processes/procedures	Level V <input type="checkbox"/> • Judges/validates creative expressions • Actively pursues creative expressions
<i>Applies decision making strategies</i>	Level I <input type="checkbox"/> • Understands decision making process • Recalls basic rules/principles • Identifies goals and constraints	Level II <input type="checkbox"/> • Applies rules/principles to situation • Gathers information	Level III <input checked="" type="checkbox"/> • Analyzes situation/information • Considers risks/implications • Compiles multiple viewpoints	Level IV <input type="checkbox"/> • Generates alternative solutions • Evaluates alternative solutions • Formulates plan of action	Level V <input type="checkbox"/> • Judges consequences/pros/cons • Justifies purpose/results • Sets decision making parameters
<i>Recognizes and solves problems</i>	Level I <input type="checkbox"/> • Identifies the problem	Level II <input type="checkbox"/> • Understands the complaint/discrepancy • Appropriately offers complaint/discrepancy	Level III <input checked="" type="checkbox"/> • Examines informational data • Considers risks/implications • Compiles multiple viewpoints	Level IV <input type="checkbox"/> • Generates/evaluates solutions • Devises/implements plan of action	Level V <input type="checkbox"/> • Evaluates/adjusts plan of action

Sample survey questions from the Advance Workplace Standards Skill Inventory

Definition of terms

Each chart in the following skill standards templates contains the following components:

Clusters

Clusters describe the major areas of work carried out across an industry cluster. They apply across specific industry segments (e.g. automobile manufacturing, furniture manufacturing, airplane manufacturing, etc.) and often cover families of related job titles. Plant electricians are an example of a cluster within power generation.

Critical Work Functions

Critical work functions represent the general areas of responsibility for the front-line worker in power generation. The functions tell us what must be done to achieve the key purpose of an occupation cluster.

Employability Skills

Employability skills are basic academic and personal skills that are needed to build more advance competencies. They are competencies required by all workers in order to obtain meaningful work and participate in the modern workforce.

Key Activities

Key activities are the tasks related to the functional area of the career cluster and performed by workers in a given occupation. They are made up of work activities which are measurable and observable, and which result in a decision, product or service.

Level of Importance

Professionals who are actively working in this occupation rated the level of importance for each critical work function and key activity, ranging from not important to critical. All critical work functions were rated and verified as being important, very important or critical.

Performance Indicators

Performance indicators are specific behavioral evidence of a worker's achievement of skills, knowledge and task completion. The question answered is: "How do we know when this key activity is performed well?" Performance indicators provide the standard of performance required to produce the necessary outcomes of key activities.

Technical Skills, Knowledge, Abilities and Tools

Technical skills, knowledge and abilities are those areas of expertise which workers must have in order to perform a given occupational task with excellence. A collection of skills, knowledge, abilities and tools make up competencies.

Skills refer to proficiency in an applied activity. This activity could be physical, mental or interpersonal in nature.

Knowledge is a particular set of information.

Abilities are broad human characteristics that result from natural talent, training or experience.

Tools are materials, equipment and implements a worker must be able to use competently to meet the requirements of the job.

RESULTS: Skill Standards for Plant Electricians

Typical Job Description

Scenarios: Routine, Crisis and Long Term

SCANS Survey Results

Summary of Critical Work Functions and Key Activities

Theories and Concepts

Verification Survey Results

Skill Standards

Typical Job Description

Plant Electrician

Job Description:

PRIMARY PURPOSE:

Perform skilled journey-level work in the construction, maintenance and repair of electrical and electronic equipment, apparatus and fixtures used at power generation plants.

RESPONSIBILITIES/ ACCOUTABILITIES:

May be responsible to perform a combination of the following duties based upon job assignment:

- Inspect, maintain repair and overhaul electromechanical and solid state electrical equipment, using a variety of electrical test equipment, meters, powered and non-powered tools and equipment.
- Install new electrical and electronic equipment and electrical wiring according to the National Electrical Code and company electrical standards.
- Maintain and repair electrical and electronic systems for Project facilities and equipment.
- Perform high voltage switching and operate generators in support of operations.
- Work safely and cooperatively with co-workers and the public.
- Cut and remove trees, branched and brush in close proximity to energized power lines.
- Lead a work party in performing maintenance or repair work.
- Other related incidental work as needed.
- Comply with and practice proper equipment clearance procedures.
- Perform all work in compliance with applicable codes, standards, safety and environment regulations.
- Responsible for station lockout/tagout procedures as mandated by company policy.

General Qualifications

SKILLS/ COMPETENCIES:

- Methods, equipment and materials used in the electrical trade.
- General knowledge of health, safety and environmental regulations.
- Applicable laws, codes, regulations, policies and procedures.
- Basic First Aid procedures.
- Principles of electronic theory as applied to electrical and electronic circuits, wiring and electrical equipment used in power generation.

- Theory of operation and use of Programmable Logic Control (PLC) units and other computer based equipment.
- Proficient written and verbal communication skills.
- Analyze situations accurately and adopt an effective course of action.
- Work from blueprints, shop drawings and sketches.
- Work independently with little direction.
- Establish and maintain cooperative and effective working relationships with others.
- Install, including programming, and troubleshooting PLC based equipment.

DEGREES/ CERTIFICATES/ LICENSE/ EXPERIENCE:

Required:

- High School diploma or equivalent.
- Completion of a recognized vocational education program in electrical or industrial electrical or industrial training –OR- completion of a recognized Electrical Apprenticeship Program and three out of the last five years’ journey-level experience as an electrician in the industrial maintenance field
- Possession and maintenance of valid drivers’ license.
- First Aid, CPR and forklift certification required prior to the completion of probation with maintenance thereafter.

PHYSICAL REQUIREMENTS/WORKING CONDITIONS:

- Requires climbing, standing, bending and lifting heavy objects in awkward and confined spaces using proper lifting and rigging techniques.
- Subject to exposure to fumes, dust and high levels of vibration.
- Subject to exposure to high noise levels required ear protection.
- Subject to working near moving parts of heavy machinery and high voltage equipment where the use of appropriate protective/safety equipment is required.
- Subject to working at heights and in adverse weather conditions.
- Work includes indoor and outdoor environment.
- May be subject to after duty call-outs.

Scenarios: Routine, Crisis and Long Term

Routine Scenario:

As January comes to an end, thoughts of spring come to mind. The thoughts are of snow melt, and 24/7 operations with spill. This year's snow data suggest that it is about an average water year during the runoff period. It is time to complete the pre-runoff maintenance lists to ensure the units will be ready for the runoff and spill. All last minute inspections and cleaning are scheduled and crews are working hard. The Electrician Constructors are working through the list and are on Excitation equipment.

While cleaning the excitation equipment, requests are made to perform megger test of the exciter rotor. After the unit had been thoroughly blown out with compressed air, all brushes on the slip rings are removed from their brush holders and positioned in a non contact area as per the request and the GE manual. The unit is tested with a meg-ohm meter for 60 seconds and left at rest with this charge for 60 seconds. The meter used is the hand crank 500V unit.

Readings:	During testing 60-sec.	3-100M
	Next 60 seconds	3.5M

The readings look good and there are no further actions noted after the megger test. It is time to move to the next item on the maintenance schedule.

Primary Tasks and Functions Involved in this Scenario

Critical Work Functions	Key Activities								
A. Maintain a Safe and Productive Work Environment	A1	A2	A3	A4	A5	A6	A7	A8 <i>Prioritize and schedule work</i>	A9
B. Maintain and Repair Equipment	<i>B1 Perform preventive maintenance</i>	<i>B2 Gather materials, tools and equipment</i>	B3	<i>B4 Perform repairs</i>	<i>B5 Document equipment maintenance & repair</i>	<i>B6 Perform housekeeping</i>	<i>B7 Monitor equipment indicators to ensure it is operating correctly</i>	<i>B8 Maintain and obtain proficiency in current and new technologies</i>	
C. Install / Retrofit Systems	C1	C2	C3	C4	C5	C6	C7	C8	C9
D. Communicate with Co-Workers and Management	<i>D1 Prepare maintenance and repair logs</i>	<i>D2 Participate in meetings and problem solving groups</i>	<i>D3 Communicate safety and job-specific needs</i>	D4	<i>D5 Provide consultation to coworkers and management</i>				

Critical Work Functions	Key Activities								
E. Maintain Tools, Test Equipment and Supplies	<i>E1</i>	<i>E2</i>	<i>E3</i>						
F. Operate Equipment	<i>F1 Inspect equipment</i>	<i>F2 Monitor equipment indicators to ensure it is operating correctly</i>	<i>F3</i>	<i>F4</i>	<i>F5</i>	<i>F6</i>			
G. Control Power Generating Equipment and Monitor Alarms	<i>G1</i>	<i>G2</i>	<i>G3</i>						
H. Maintain Environmental Quality	<i>H1</i>	<i>H2</i>	<i>H3</i>	<i>H4</i>					

Crisis Scenario:

The sleeping silence of the early morning is broken by the sound of a phone. The voice on the other end starts with the famous Hydro Operator quote "Sorry to have called so early, I hope I didn't wake you" even though it is before 4:00 in the morning, and the sun is not yet up." The Operator then goes on to say, "Unit 51 will not start and lake level is near the top. We would rather generate this water out and not spill it. Dispatch would also like the unit as soon as possible. Could you come in early? We think it is an 86U electrical issue."

Question to the Operator: What alarms are locked in?

Answer: Turbine bearing low oil alarm and we checked the containment, there is no oil in it and the level appears to be ok.

After hanging up the phone and grabbing the bare necessities it is time for the drive to work. Upon arrival, the operator is interviewed to get a better idea of the issue with unit 51. The operator reports, "The unit is filled with water, but the 86U will not clear and we are unable to clear the low oil alarm to allow the unit to start." After pulling the prints to find a good place to test the oil level sensors and the locations of all of the wire, preparations for a lockout tagout are made in case needed and the test equipment is staged. A visual inspection is performed on the wires and connections to the sensor. A loose electrical plug is identified. After adding lock-tite and tightening the plug, you hear the operator report over the radio that the alarm is clear and the unit is ready for a start.

Dispatch is notified and requests a unit 51 start and that preparations be made to dispatch unit 51 at 160 MWs. The Generation Electrician than walks into the break room to participate in the morning meeting and start a normal day.

Primary Tasks and Functions Involved in this Scenario

Critical Work Functions	Key Activities								
A. Maintain a Safe and Productive Work Environment	A1	A2	A3	A4	A5	A6	A7	A8	A9 <i>Perform lockout tagout and wear PPE (personal protective equipment)</i>
B. Maintain and Repair Equipment	B1	B2 <i>Gather materials, tools and equipment</i>	B3 <i>Perform troubleshooting</i>	B4 <i>Perform repairs</i>	B5 <i>Document equipment maintenance & repair</i>	B6	B7 <i>Monitor equipment indicators to ensure it is operating correctly</i>	B8	
C. Install / Retrofit Systems	C1	C2	C3	C4	C5 <i>Locate equipment & materials on work site</i>	C6	C7 <i>Monitor equipment indicators to ensure it is operating correctly</i>	C8	C9
D. Communicate with Co-Workers and Management	D1 <i>Prepare maintenance and repair logs</i>	D2 <i>Participate in meetings and problem solving groups</i>	D3 <i>Communicate safety and job-specific needs</i>	D4	D5 <i>Provide consultation to coworkers and management</i>				

Critical Work Functions	Key Activities								
E. Maintain Tools, Test Equipment and Supplies	<i>E1 Maintain, inspect and repair electrical hand tools and test equipment</i>	<i>E2</i>	<i>E3</i>						
F. Operate Equipment	<i>F1 Inspect equipment</i>	<i>F2 Monitor equipment indicators to ensure it is operating correctly</i>	<i>F3</i>	<i>F4</i>	<i>F5 Operate switches and circuit breakers</i>	<i>F6</i>			
G. Control Power Generating Equipment and Monitor Alarms	<i>G1</i>	<i>G2</i>	<i>G3 Troubleshoot the controls</i>						
H. Maintain Environmental Quality	<i>H1</i>	<i>H2</i>	<i>H3</i>	<i>H4</i>					

Long-Term Scenario:

During the morning start-up of the generating units, the operator discovered a fire in the automatic voltage regulator cubical of Unit 54. A plant electrician is called to assess the damage.

The fire appeared to have started in a three phase transformer “A4T” which provides power to the voltage regulator amplifier card. Closer inspection reveals that 3 diodes within the three phase rectification circuit were shorted. The fire also caused damage to three (3) meters, a control switch and some plastic wiring trays located directly above the failed transformer.

Generating Unit 54 was secured and power to the cubical was locked out to insure the repair work could be performed safely. Upon inspection, three wires within the wiring tray were also found with minimal insulation damage. It was determined that temporary repairs could be made to return the unit to service. The operators and plant management were informed of the damage and the plans made for temporary repairs.

Temporary repairs:

1. Transformer “A4T” and the 3 diodes on the voltage regulator amplifier card were replaced.
2. Volt meter 1M was removed and its wire leads taped off.
3. Ammeter 8M was removed and its wiring connected together.
4. Case on Ammeter 2M was warped but found to be operational and kept in-service.
5. The three wires with damaged insulation (approx. 1/2” each) were wrapped with electrical tape to re-establish quality insulation.
6. Auto Manual switch was removed and associated wiring connected to establish Automatic operation.

Long term plans:

1. Contact engineering for support funding and redesign based on investigation and discussion of fault.
2. Discuss outage timing for permanent repairs with Marketing to ensure reserves and obligations are met with minimal financial impact.
3. Access and acquire parts needing replacement prior to scheduling work.
4. Schedule crew time.
5. Plan for proper safety, equipment, parts and time allotment.
6. Use appropriate funding sources and fair purchasing practices.

Primary Tasks and Functions Involved in this Scenario

Critical Work Functions	Key Activities								
A. Maintain a Safe and Productive Work Environment	A1	A2	A3 <i>Identify and report unsafe conditions and take corrective action</i>	A4	A5	A6	A7	A8 <i>Prioritize and schedule work</i>	A9 <i>Perform lockout tagout and wear PPE (personal protective equipment)</i>
B. Maintain and Repair Equipment	B1	B2 <i>Gather materials, tools and equipment</i>	B3 <i>Perform troubleshooting</i>	B4 <i>Perform repairs</i>	B5 <i>Document equipment maintenance & repair</i>	B6	B7 <i>Monitor equipment indicators to ensure it is operating correctly</i>	B8	
C. Install / Retrofit Systems	C1 <i>Install, move or remove equipment</i>	C2 <i>Test to ensure proper function after installation / retrofit</i>	C3	C4 <i>Document the installation / retrofit</i>	C5 <i>Locate equipment & materials on work site</i>	C6	C7 <i>Monitor equipment indicators to ensure it is operating correctly</i>	C8	C9 <i>Provide input to planning process</i>
D. Communicate with Co-Workers and Management	D1 <i>Prepare maintenance and repair logs</i>	D2 <i>Participate in meetings and problem solving groups</i>	D3 <i>Communicate safety and job-specific needs</i>	D4 <i>Suggest ways (new ideas) to prevent future equipment malfunction or improve equipment performance</i>	D5 <i>Provide consultation to coworkers and management</i>				

Critical Work Functions	Key Activities								
E. Maintain Tools, Test Equipment and Supplies	<i>E1 Maintain, inspect and repair electrical hand tools and test equipment</i>	<i>E2 Maintain working stock</i>	<i>E3 Maintain inventory control</i>						
F. Operate Equipment	<i>F1 Inspect equipment</i>	<i>F2 Monitor equipment indicators to ensure it is operating correctly</i>	<i>F3</i>	<i>F4</i>	<i>F5 Operate switches and circuit breakers</i>	<i>F6</i>			
G. Control Power Generating Equipment and Monitor Alarms	<i>G1</i>	<i>G2</i>	<i>G3</i>						
H. Maintain Environmental Quality	<i>H1</i>	<i>H2</i>	<i>H3</i>	<i>H4</i>					

SCANS Survey Results: **Plant Electricians**

Foundation Skills and Personal Qualities	0	1	2	3	4	5	Critical Competencies
Basic Skills							
Demonstrates Effective Reading Strategies							<i>Identifies relevant details, facts and specifications; follows a set of instructions; analyzes, interprets and synthesizes information.</i>
Demonstrates Effective Writing Strategies							<i>Prepares messages; summarizes and paraphrases information; composes and edits original documents; synthesizes information</i>
Applies Arithmetic Processes							<i>Collects, records and interprets numerical data; predicts arithmetic results.</i>
Applies Mathematics Processes							<i>Uses mathematical techniques, formulas, processes; records and summarizes mathematical data; translates and interprets data.</i>
Demonstrates Effective Listening Skills							<i>Clarifies and interprets communication; influences communication; compares multiple viewpoints; relates intent to desired results.</i>
Demonstrates Effective Speaking Skills							<i>Presents basic ideas and information; explain concepts; actively participates in discussions; poses critical questions.</i>
Thinking Skills							
Applies Creative Thinking/ Generates Ideas							<i>Demonstrates creative thinking process while problem solving; develops/applies creative solutions to new situations; generates unique solutions.</i>
Applies Decision Making Strategies							<i>Gathers and analyzes situation and information; considers risks, implications; Generates and evaluates alternative solutions.</i>
Recognizes and Solves Problems							<i>Identifies problem; analyzes possible causes and reasons; generates and evaluates solutions; devises and implements plan of action.</i>
Demonstrates Visualization							<i>Applies appropriate principles, laws, theories to situations; interprets charts, graphs, symbols; generates operation plan/building plan.</i>
Knows How to Learn							<i>Interprets and applies new knowledge and experience; interprets symbols, diagrams and schematics; investigates use of new learning methods, tools.</i>
Applies Reasoning Skills							<i>Identifies problem and applies rules, principles to process or procedure; uses logic to draw conclusions; analyzes logic/rule/principle.</i>
Personal Qualities							
Demonstrates Responsibility							<i>Follows rules, policies, procedures; works with minimal supervision; monitors performance standards; follows up on assigned tasks.</i>
Demonstrates Belief in Self Worth							<i>Identifies own skills/abilities; accepts constructive criticism; accepts responsibility for personal behavior; understands impact on others.</i>
Demonstrates Sociability in Groups							<i>Establishes rapport with co-workers and customers; shows understanding/empathy for others; encourages cooperation, negotiation.</i>
Demonstrates Self-Management							<i>Maintains self-control; sets well defined/realistic goals; applies self-management skills; appropriately modifies goals.</i>
Demonstrates Integrity/ Honesty							<i>Demonstrates honesty and trustworthiness; analyzes personal/societal implications of decision; formulates ethical course of action.</i>

Foundation Skills and Personal Qualities	0	1	2	3	4	5	Critical Competencies
Management of Time/ Resources Manages Time							<i>Efficiently manages time; adjust schedule as required by supervisor; monitors/adjusts task sequence; recommends timeline changes.</i>
Manages Money							<i>Performs routine recordkeeping (non-financial)</i>
Manages Materials/Facilities							<i>Uses materials in a safe and efficient manner; maintains job-specific supplies and equipment; identifies future material needs.</i>
Manages Human Resources							<i>Recognizes job tasks; analyzes work assignments.</i>
Management / Use of Information Acquires/Evaluates Information							<i>Identifies need for data/information; integrates and analyzes multiple items of data; predicts outcomes.</i>
Organizes/Maintains Information							<i>Interprets information; analyzes organization of information; transfers information between formats.</i>
Interprets/Communicates Information							<i>Recognizes accuracy of information; prepares basic reports; summarizes/integrates information.</i>
Uses Computers to Process Information							<i>Understands computer operation; retrieves stored information, data; manipulates/ interprets data.</i>
Interpersonal Skills Participates as Team Member							<i>Actively participates in team activities; works to improve team skills; encourages, supports team members; demonstrates commitment.</i>
Teaches Others							<i>Models proper performance, attitudes; identifies training needs; provides constructive feedback, reinforcement.</i>
Serves Customers							<i>Recognizes customer needs; responds to customer needs; demonstrates commitment to customer.</i>
Exhibits Leadership							<i>Understands/adheres to standards; demonstrates commitment to excellence; leads by example; displays enthusiasm, positive attitudes.</i>
Negotiates Agreements							<i>Understands negotiations process; demonstrates composure; distinguishes between facts and inferences; detects underlying issues.</i>
Works with Diversity							<i>Respects rights of others; recognizes the value of diversity; encourages/supports a correct course of action.</i>
Understand/Manage of Systems Understands System							<i>Understands system organization, hierarchy; follows processes and procedures; recognizes system strengths, limitations.</i>
Monitors/Corrects System Performance							<i>Collects data; monitors system performance; troubleshoots system malfunction, failure.</i>
Improves/Designs Systems							<i>Identifies and suggests system modifications, improvements; examines proposed modifications, improvements.</i>
Use of Technology Selects Appropriate technology							<i>Understands requirements of the task; analyzes task/ technology relationship; proposes simple technological solutions.</i>
Applies Technology to Task							<i>Follows proper procedures; manipulates technology for desired result; analyzes technology output.</i>
Maintains/Troubleshoots Technology							<i>Identifies and corrects malfunctions; analyzes failures; evaluates performance of technology.</i>

Summary of Critical Work Functions and Key Activities

Energy Industry: Power Generation Skill Standards

Cluster: **Plant Electricians**

Critical Work Functions	Key Activities								
A. Maintain a Safe and Productive Work Environment	A1 <i>Participate in safety meetings</i>	A2 <i>Perform emergency drills and participate in emergency response teams</i>	A3 <i>Identify and report unsafe conditions and take corrective action</i>	A4 <i>Obtain and maintain licenses and certifications</i>	A5 <i>Perform safety inspections</i>	A6 <i>Provide safety and skill training for other employees</i>	A7 <i>Perform housekeeping</i>	A8 <i>Prioritize and schedule work</i>	A9 <i>Perform lockout tagout and wear PPE (personal protective equipment)</i>
B. Maintain and Repair Equipment	B1 <i>Perform preventive maintenance</i>	B2 <i>Gather materials, tools and equipment</i>	B3 <i>Perform troubleshooting</i>	B4 <i>Perform repairs</i>	B5 <i>Document equipment maintenance & repair</i>	B6 <i>Perform housekeeping</i>	B7 <i>Monitor equipment indicators to ensure it is operating correctly</i>	B8 <i>Maintain and obtain proficiency in current and new technologies</i>	
C. Install / Retrofit Systems	C1 <i>Install, move or remove equipment</i>	C2 <i>Test to ensure proper function after installation / retrofit</i>	C3 <i>Develop operating procedures</i>	C4 <i>Document the installation / retrofit</i>	C5 <i>Locate equipment & materials on work site</i>	C6 <i>Perform housekeeping</i>	C7 <i>Monitor equipment indicators to ensure it is operating correctly</i>	C8 <i>Maintain and obtain proficiency in current and new technologies</i>	C9 <i>Provide input to planning process</i>
D. Communicate with Co-Workers and Management	D1 <i>Prepare maintenance and repair logs</i>	D2 <i>Participate in meetings and problem solving groups</i>	D3 <i>Communicate safety and job-specific needs</i>	D4 <i>Suggest ways (new ideas) to prevent future equipment malfunction or improve equipment performance</i>	D5 <i>Provide consultation to coworkers and management</i>				

Critical Work Functions	Key Activities								
E. Maintain Tools, Test Equipment and Supplies	<i>E1 Maintain, inspect and repair electrical hand tools and test equipment</i>	<i>E2 Maintain working stock</i>	<i>E3 Maintain inventory control</i>						
F. Operate Equipment	<i>F1 Inspect equipment</i>	<i>F2 Monitor equipment indicators to ensure it is operating correctly</i>	<i>F3 Operate rolling / mobile equipment</i>	<i>F4 Operate heavy lifting equipment</i>	<i>F5 Operate switches and circuit breakers</i>	<i>F6 Operate generation equipment</i>			
G. Control Power Generating Equipment and Monitor Alarms	<i>G1 Operate PLC (Programmable Logic Controller) and DCS (Distributed Control System)</i>	<i>G2 Program PLC (Programmable Logic Controller) and DCS (Distributed Control System)</i>	<i>G3 Troubleshoot the controls</i>						
H. Maintain Environmental Quality	<i>H1 Perform compliance activities</i>	<i>H2 Maintain water quality and quantity</i>	<i>H3 Maintain air quality</i>	<i>H4 Perform environmental inspections</i>					

Theories and Concepts

Cluster: Plant Electricians

Knowledge of foundational science and engineering concepts and theories is essential in order to perform functions required of Electricians. These are listed below, and are important supplements to the technical knowledge and skills listed with each key activity.

SCIENCE AND ENGINEERING THEORIES AND CONCEPTS

- Physics of dams
- Behavior of matter
- Pressure and Chemistry of steam/water, boiler water, air and oil
- Gasses and liquids
- Mechanical energy
- Introductory mechanical engineering concepts
- Levers, pulleys, machines
- Hydraulics, pneumatics
- Renewable en processes and industries
- Basic system design and components: hydraulics, pneumatics, terminology, symbols, functions, etc
- Water treatment and purification control systems
- Basic electricity
- Environmental stewardship; CEM (continuous emissions monitoring control system)
- Machines, friction and bearings
- Lubrication and cooling
- Hydrologic life cycles (hydro fuel delivery/source)
- Overview of power generation delivery grid system from generation to end user
- WAC 296-45: High voltage electrical safety standards; OSHA 1910-333, NFPA 70-E

MATH FOR ELECTRICIANS

- Working knowledge of: measurement, layout, computation, formulae, functions
- Basic logic
- Algebra
- Solid geometry
- Computational technology
- Principles of alignment
- Torque
- Properties and behavior of motion
- Trigonometry (sin/cosine)

THERMAL CONCEPTS

- Number and type of systems
- Sources of fuel: quality, composition, chemistry
- Processing fuel
- Fuel storage
- Generation process (speed)
- Use of more diverse fuels
- Co-Gen (combined cycle steam plants)

Demand and stability of the industry
Industry is an interdependent system, not just individual companies operating autonomously; tied to a market system.
Fuel supply logic

EQUIPMENT

Breakers (station service, air blast, vacuum, oil and field)
Metal clad switchgear
Electrical controls
Generators & PMGs (permanent magnet generator)
Shop machinery
Electrical hand tools
Cranes
Battery Chargers & inverters; Station and auxiliary battery banks
Stator
Rotors
DC Exciters / solid state excitation
Fractional horsepower motors
AC and DC motors
Annunciators / alarms
Auxiliary Equipment
Station service transformers
Distribution panels
Transformers (current, potential, distribution)
Auxiliary generating equipment & auxiliary generator controls
Isolated phase busses
Governors and governor cabinet controls
Oil pump motors, starters and controls
Relays
Neutral ground devices
Switch boards, panels
Spill gate drive systems; Spillway gate controls
Switching and grounding equipment
Distribution circuits
UPS power supplies
Transfer switches
Voltage regulators
Motor starters and circuits
Relay circuits
Field rheostats
PLCs and PLC programs (programmable logic controller)
Emission control systems, to include scrubbers; Electrostatic precipitators
Diesel generators
Cathodic protection equipment
Lightning arrestors
Emergency lighting
Motor operated valves (Linitorque/Crane Teledyne/Auma)
LVDT (Linear Variable Differential Transformer) and proximity position sensing and

indication
Instrumentation systems and devices
SF6 Breakers

PLANT ENVIRONMENT

Outdoor lighting circuits
Indoor lighting circuits
Ventilation systems
Conduits, wire, cable
Overhead and underground wiring, including triplex
Remote control circuitry
RTU
Security systems
Heating and ventilation controls HVAC
Emergency lighting
Head gate controls
Life safety systems and equipment
Air conditioners and heat pumps
High voltage cables and terminations
Cable trays
Ground Fault Interrupters (GFI)
Grounding and bonding systems
Communication systems
Branch circuit panels and feeders and over current devices
Power utilization circuits, devices and equipment

TOOLS, METERS AND MONITORING INSTRUMENTS

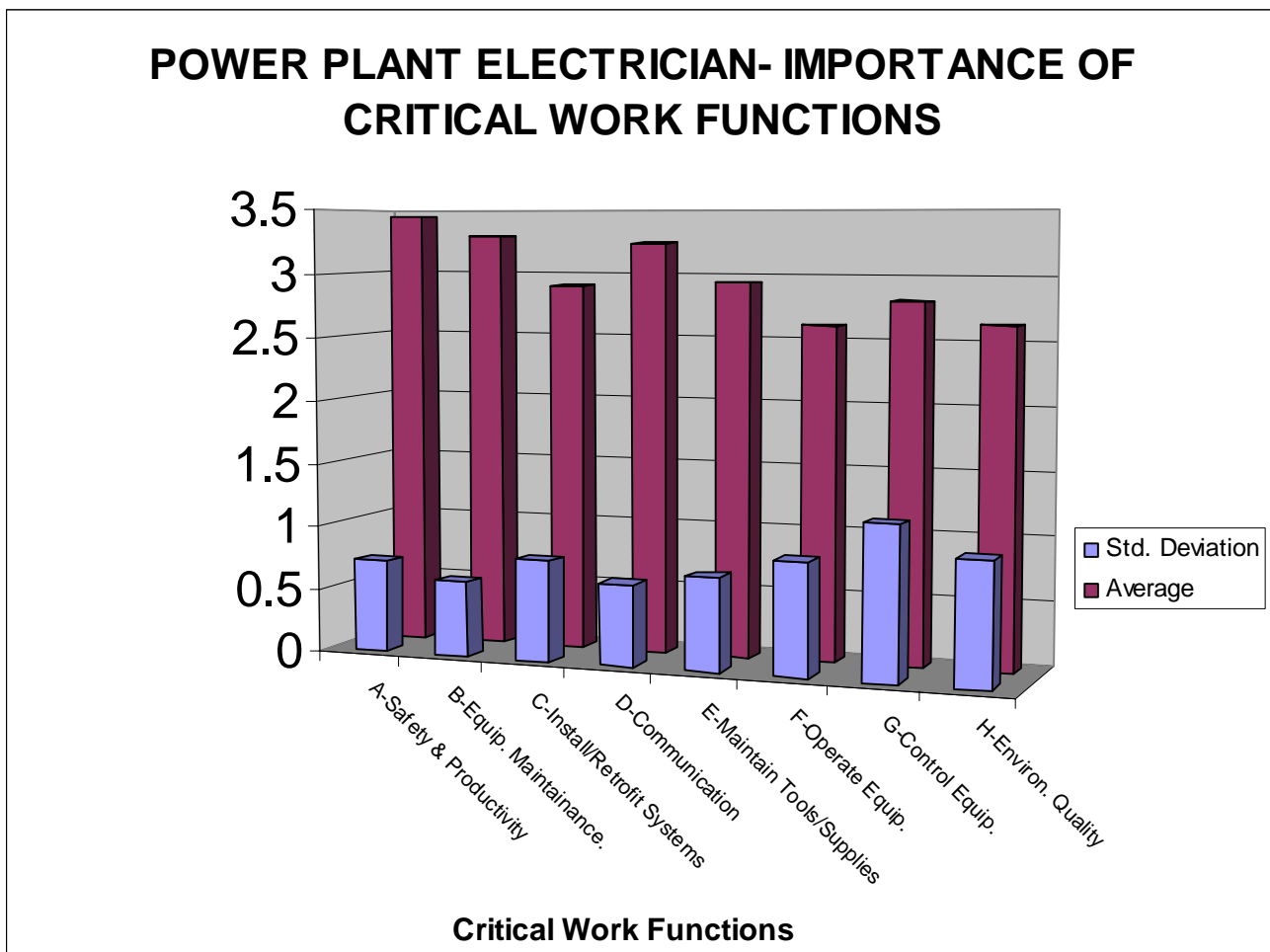
Volt Ohm meter
Ammeter
Megger
Phase rotation meter
Capacitor tester
Oscilloscope
Calibrator
Machine shop tools
High voltage tester
Hand tools
Benders, threaders
Electric hand tools
Micro-Ohm Meter/ductor
Hot work tools
High pot tester
Insulation oil tester
Recording equipment/data acquisition equipment

Knowledge of NEC, NESC, ANCI and IEEE or organizational construction electrical standards as required.

Verification Survey Results

Verification surveys were administered to determine if the critical work functions and tasks identified by the power plant electrician professionals would be verified by a broader sample of power plant electricians and subject-matter experts. Figure 1 shows the average importance and standard deviation of each function, rated on a scale from 0 to 4. These results generally verify that the critical work functions included in the skill standards document are relevant to the industry at large. The results show that Safety and Productivity (Critical Function A- Maintaining a Safe and Productive Work Environment) was rated highest as an important work function to the Power Plant Electrician, followed by Equipment Maintenance (Critical Function B- Maintain and Repair Equipment), and Communication (Critical Function D- Communication with Co-Workers and Management), with somewhat lower scores attributed to the remaining work functions. The largest variation in responses was for Control Equipment (Critical Function G- Control Power Generating Equipment and Monitor Alarms) which deals mostly with PLCs (Program Logic Controls) and DCSs (Distributed Control Systems). This value, expressed as a standard deviation, is just slightly above the average for all items.

Figure 1- Verification finding for Power Plant Electrician



Skill Standards

Cluster: *Plant Electrician*

Critical Work Function: *A. Maintain a Safe and Productive Work Environment*

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
<p>A1 Participate in safety meetings</p>	<ul style="list-style-type: none"> • Open agenda items are contributed when appropriate. • Unsafe work practices are noted and communicated in a clear and effective manner. • All communications in meetings are respectful. • Electrical safety items, powerhouse electrical hazards and near misses are communicated to ensure awareness. • Action items are properly assigned and completed. • All required job task safety meetings are conducted in accordance with applicable laws, regulations and organization policies and procedures. 	<ul style="list-style-type: none"> • Knowledge of safety policies and procedures. • Knowledge of safe work practices. • Knowledge of the safety organization structure, roles and responsibilities. • Knowledge of electrical safety items, powerhouse electrical hazards and near misses. • Knowledge of laws, regulations and organization policies and procedures regarding job task safety meeting requirements. • Knowledge of safe working clearances for various system voltages. • Knowledge of the physical address of the safety meeting. • Knowledge of meeting protocols in accordance with organizational policies and procedures. 	<ul style="list-style-type: none"> • Confirms information and interprets, clarifies and influences communication. • Establishes rapport with co-workers and customers; modifies behavior to environment; shows understanding for others and encourages cooperation and negotiation. • Communicates appropriate verbal/non-verbal messages, actively participates in discussion and presents complex ideas and information. • Assists and encourages team members, actively participates, works to improve team skills and demonstrates commitment. • Identifies relevant details, facts, specifications, follows set of instructions and qualifies/analyzes information.

KEY ACTIVITY	Performance Indicators • <i>How do we know when the task is performed well?</i>	Technical Knowledge • <i>Skills, Abilities, Tools</i>	Employability Skills • <i>SCANS Skills and Foundational Abilities</i>
A2 Perform emergency drills and participate in emergency response teams	<ul style="list-style-type: none"> • Training and certification on relevant emergency, first aid and CPR (cardio pulmonary resuscitation) procedures are complete and up to date. • Emergency response complies with company and regulatory policies and procedures. • Scenario drills on electrically isolating the plant and plant components is conducted on a regular basis. 	<ul style="list-style-type: none"> • Ability to obtain certifications. • Knowledge of emergency policies and procedures. • Knowledge of site-specific emergency responses. • Knowledge of emergency phone numbers and address/locations within facilities. • Knowledge of isolation procedures for the plant and plant components. • Knowledge of safety equipment at facilities. 	<ul style="list-style-type: none"> • Assists and encourages team members, actively participates, works to improve team skills and demonstrates commitment. • Analyzes work assignments, delegates responsibilities and assesses individual knowledge and skills. • Confirms information and interprets, clarifies and influences communication. • Prepares basic summaries and integrates information. • Interprets information and transfers information between formats.
A3. Identify and report unsafe conditions and take corrective action	<ul style="list-style-type: none"> • Conditions that present a threat to health, safety and the environment are identified, reported, and documented promptly. • Corrective actions are identified, and documentation is completed once corrective actions are taken. • Appropriate parties are consulted about corrective actions. • Corrective actions such as lockout tagout and isolating with danger tape are taken promptly according to company procedures. • Follow-up procedures are followed. 	<ul style="list-style-type: none"> • Ability to identify an unsafe condition. • Knowledge of the components, conditions and procedures utilized in a safe working and operating environment. • Knowledge of the consequences of safety situations such as systems under pressure and stored energy systems vs. low risk maintenance items. • Knowledge of documentation procedures. • Knowledge of procedures for taking corrective actions. • Knowledge of lockout tagout and electrical isolation procedures. • Knowledge of the electrical systems and their implications for safety. 	<ul style="list-style-type: none"> • Records information accurately, completes forms and writes simple documents. • Communicates appropriate verbal/non-verbal messages, actively participates in discussion and presents complex ideas and information. • Adheres to standards, demonstrates commitment to excellence and leads by example. • Analyzes possible causes, generates and evaluates solutions and generates and evaluates solutions. • Suggests system modifications/improvements and determines system components to be improved.

KEY ACTIVITY	<i>Performance Indicators</i>	<i>Technical Knowledge</i>	<i>Employability Skills</i>
A4 Obtain and maintain licenses and certifications	<ul style="list-style-type: none"> • How do we know when the task is performed well? • Mandatory trainings are attended as required. • CEU (Continuing education units) are accumulated as required. • CDL (commercial driver's license) physicals and drug tests are taken as required. 	<ul style="list-style-type: none"> • Skills, Abilities, Tools • Knowledge of safety manual. • Knowledge of first aid and ability to maintain first aid, CPR (cardio pulmonary resuscitation) and AED (automatic external defibrillator) certification. • Knowledge of requirements for electrical certifications. • Ability to pass the CDL (commercial driver's license) physical and drug tests. • Ability to access information about electrical training provided inside and outside the organization. 	<ul style="list-style-type: none"> • SCANS Skills and Foundational Abilities • Interprets and applies new knowledge and experience and analyzes application of learning tools. • Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks. • Understands technology applications, flows proper procedures and manipulates technology of desired results. • Assists and encourages team members, actively participates, works to improve team skills and demonstrates commitment. • Identifies relevant details, facts, specifications, follows set of instructions and qualifies/analyzes information.

<p>A5. Perform safety inspections</p>	<ul style="list-style-type: none"> • Inspections are thorough and complete. • Reference is made to technical manuals during the course of inspections. • Checklists and procedures are followed. • The environment is scanned for hazardous conditions. • Documentation is complete and accurate and submitted to appropriate personnel in a timely manner. • PPE (personal protective equipment) is worn as required and PPE is tested to ensure there are no leaks and test dates and intervals are current. • Minimum electrical equipment clearances are inspected and equipment is relocated as required. • Hazard and near-miss cards are properly filled out and submitted. • Security gates and access and clearances to switch yards, substations and electrical equipment rooms are properly controlled. 	<ul style="list-style-type: none"> • Knowledge of location of equipment instruction manuals and how to use them. • Knowledge of uses of PPE (personal protective equipment) and ability to test and inspect it. • Knowledge of requirements for minimum electrical equipment clearances. • Knowledge of hazard and near-miss cards procedures and uses. • Knowledge of security gate operation and access requirements and procedures. • Knowledge of applicable codes and standards: NEC (National Electrical Code), NESC (National Electrical Safety Code) and NFPA 70-E (National Fire Protective Association) and the ability to apply them to inspection issues. 	<ul style="list-style-type: none"> • Utilizes previous training and experience to predict outcomes; visually analyzes relationship between parts/whole and process/procedure and interprets charts, graphs and symbols. • Identifies relevant details, facts, specifications, follows set of instructions and qualifies/analyzes information. • Demonstrates honesty and trustworthiness, accepts responsibility for own behavior and analyzes implications of decisions. • Establishes rapport with co-workers and customers; modifies behavior to environment; shows understanding for others and encourages cooperation and negotiation. • Records information accurately, completes forms and writes simple documents.
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KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
A6. Provide safety and skill training for other employees	<ul style="list-style-type: none"> • Training covers all topics and procedures needed to facilitate employee safety. • Training makes clear the processes and need for employees to raise safety concerns, ask questions, and receive additional training. • Training is documented according to company requirements. • Training meets all relevant laws, policies, and regulations. • Where applicable safety information is tailored to meet the requirements of a specific job. • The training makes clear the electrical system voltages involved, and the safety requirements for each. 	<ul style="list-style-type: none"> • Knowledge of all topics and procedures required for employee safety (in particular how to wipe down a hot stick, inspect for damage, identify current test dates, and properly store a hot stick; identify current test dates for rubber goods; and proper installation of ground leads). • Knowledge of company requirements for training documentation. • Knowledge of safety laws and regulations. • Knowledge of safe work practices. • Knowledge of terminology for generation (hydro and thermal), including tools, equipment and systems. • Knowledge of specific job procedures and safety requirements. • Knowledge of electrical voltages and safety requirements for each. 	<ul style="list-style-type: none"> • Conducts task-specific training, coaches others to apply related concepts and provides constructive feedback/reinforcement. • Selects relevant data, identifies the need for data, predicts outcomes and analyzes data. • Communicates appropriate verbal/non-verbal messages, actively participates in discussion and presents complex ideas and information. • Confirms information and interprets, clarifies and influences communication. • Establishes rapport with co-workers and customers; modifies behavior to environment; shows understanding for others and encourages cooperation and negotiation.
A7 Perform housekeeping	<ul style="list-style-type: none"> • Tools are stored in proper location. • Materials are kept in a safe manner. • Unsafe conditions are identified and reported promptly. • Workstation is clean and clear of safety hazards. • Shop is organized to maximize efficiency. • Housekeeping protocols are followed. • Tools are cleaned, returned to proper location. • All hazardous materials procedures are followed in accordance with applicable laws and regulations. • All equipment repair and maintenance needs discovered during housekeeping are reported to appropriate personnel. • Working clearances for electrical equipment are maintained in accordance with policies and procedures. 	<ul style="list-style-type: none"> • Knowledge of proper cleaning and storage procedures. • Knowledge and ability to identify and correct for unsafe conditions. • Understanding of housekeeping protocols and requirements. • Knowledge of hazardous material laws, rules and regulations. • Knowledge of location of hazardous material cleanup equipment and storage location for hazardous materials after clean up. • Ability to identify nonfunctional tools and knowledge of communications and tagging requirements for nonfunctioning tools. • Knowledge of working clearances for electrical equipment. 	<ul style="list-style-type: none"> • Orders and maintains inventory and monitors safe and efficient utilization of materials. • Adheres to standards, demonstrates commitment to excellence and leads by example. • Analyzes situations and information, considers risks and implications, and compiles multiple viewpoints

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
A8 Prioritize and schedule work	<ul style="list-style-type: none"> ▪ Staff, materials and equipment are assessed to determine there are sufficient resources to complete the task. ▪ Timelines are established based on available resources, organizational priorities and weather conditions. ▪ All approvals are obtained as required. ▪ Schedules are communicated to appropriate personnel, customers and suppliers effectively and in a timely manner. 	<ul style="list-style-type: none"> • Knowledge of resource requirements for plan, facilities and system projects. • Knowledge of organizational priorities. • Knowledge of the impact of weather on scheduling of projects. • Knowledge of approvals required for scheduling. • Knowledge of personnel, customers and suppliers associated with the project or task. 	<ul style="list-style-type: none"> ▪ Understands the system organization and hierarchy and follows processes and procedures. ▪ Efficiently manages time, prioritizes daily tasks, prepares schedule and monitors and adjusts task sequence. ▪ Interprets information and transfers information between formats. ▪ Maintains self control, accepts constructive criticism, sets well defined/realistic goals and demonstrates commitment to self improvement. ▪ Understands negotiations process, identifies conflicts and demonstrates composure. ▪ Applies and analyzes rules and principles to processes and procedure and uses logic to draw conclusions.
A9 Perform lockout tagout and wear PPE (personal protective equipment)	<ul style="list-style-type: none"> • All required clearances are obtained. • Equipment to be locked out is correctly identified. • Impacts on the system are correctly identified and appropriate personnel are notified. • Equipment is properly de-energized and personal safety grounds are applied if required. • Lockouts tagouts are properly documented. • Correct lockout tagout procedures are followed in accordance with all applicable laws and regulations. • PPE (personal protective equipment) is thoroughly inspected prior to use, in accordance with all applicable laws and regulations. • PPE is properly worn and used. 	<ul style="list-style-type: none"> • Knowledge of procedures for acquiring clearances and ability to implement switching orders. • Knowledge of the system, its components and equipment and system interdependencies. • Knowledge of lockout tagout procedures. • Knowledge of equipment de-energization and personal safety grounds. • Knowledge of system voltages. • Knowledge of site communication equipment and protocols. • Knowledge of PPE (personal protective equipment) required for system voltages and arc flash protection. • Ability to read and use a one-line diagram and P&ID (Piping and Instrumentation Diagram). 	<ul style="list-style-type: none"> • Demonstrates honesty and trustworthiness, accepts responsibility for own behavior and analyzes implications of decisions. • Assists and encourages team members, actively participates, works to improve team skills and demonstrates commitment. • Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks. • Understands the requirements of the task and technological results and analyzes task/technology relationship. • Identifies relevant details, facts, specifications, follows set of instructions and qualifies/analyzes information.

Cluster: *Plant Electrician*

Critical Work Function: *B. Maintain and Repair Equipment*

<p>KEY ACTIVITY</p>	<p>Performance Indicators How do we know when the task is performed well?</p>	<p>Technical Knowledge Skills, Abilities, Tools</p>	<p>Employability Skills SCANS Skills and Foundational Abilities</p>
<p>B1. Perform preventive maintenance</p>	<ul style="list-style-type: none"> • Hazardous materials are correctly identified and proper procedures are followed with respect to handling and disposal. • Safety procedures are followed and proper personal protective equipment is worn or used. • Preventive maintenance sheet (check list) procedures are completely followed. • Maintenance is performed with qualified workers to ensure that the job is performed safely and efficiently. • Maintenance job is documented and verified according to company or department procedure. • Documentation is turned in to the correct parties for processing. • Required maintenance is performed correctly and completed on time and items not completed are identified and documented. • Suggestions to revise maintenance plan are made to appropriate personnel effectively and in a timely manner. • Where applicable, lockout tagout is correctly performed. • Equipment outage during preventive maintenance is requested and/or scheduled in accordance with company policy. • Plan is developed for the job and job task meeting is held when appropriate. • The lead of the electrical crew is identified where applicable. • Life safety systems are maintained as needed in accordance with policies and procedures. 	<ul style="list-style-type: none"> • Full understanding of the entire operational system. • Knowledge of equipment listed in the theory and concepts section of this document. • Knowledge of site-specific systems. • Ability to read and interpret manufacturer's recommendations, specifications, preventive maintenance sheets and standard operating procedures. • Knowledge of hazardous materials and safety procedures. • Knowledge of preventive maintenance requirements. • Knowledge of company preventive maintenance policies and procedures. • Ability to develop preventive maintenance job plan. • Ability to properly conduct a job task meeting. • Ability to take the lead of the electrical crew and take responsibility for the completion of the job. • Knowledge of bridge and gantry cranes and mobile equipment. • Understanding of water purification, steam generation and chemical interactions with steam generation. • Knowledge of systems such as thrust bearing systems, guide bearing systems, oil transport systems, cooling water, system water, potable and non-potable water, and ventilation systems. • Knowledge of governors and associated equipment. • Knowledge of oil filtration, fuel delivery systems, fire protection systems, ash removal and disposal, coal processing, and hydraulic and pneumatic systems. 	<ul style="list-style-type: none"> • Suggests system modifications/improvements and determines system components to be improved. • Understands computer operation, performs basic data entry and retrieves stored data. • Records information accurately, completes forms and writes simple documents. • Troubleshoots and corrects malfunctions and failures; evaluates performance of technology; analyzes failures. • Interprets and converts numerical data and predicts arithmetic results.

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
B2. Gather materials, tools and equipment	<ul style="list-style-type: none"> • Special tools, parts and equipment are located in a timely manner. • Repaired parts are checked to ensure they meet specifications. • If a part is not available, follow-up occurs to ensure that adequate supplies are maintained. • Calibration and certification of tools are ensured where applicable. • Tool boxes are properly maintained and inventoried. • All required tools, equipment and lubricants for the job are assembled at the job site. • Tools and equipment are checked to insure they are in safe and proper working order before work activity is initiated. • Procedures regarding nonfunctioning tools and equipment are followed. • Broken tools are removed from service, procedures regarding broken tools are followed and information regarding broken tools and equipment is communicated to appropriate personnel effectively and in a timely manner. • Recommendations for acquisition of new tools are made to appropriate personnel. 	<ul style="list-style-type: none"> • Knowledge of tool terminology and the locations of tools, parts and equipment. • Knowledge of tools such as hand tools and precision measuring tools. • Knowledge of different types of materials and parts and their application. • Ability to inventory, and verify calibration and certification. • Ability to plan and organize relevant materials and tools prior to job site work. • Ability to use prior documentation for planning and organizing work. • Ability to anticipate new equipment, tool needs and requisitions to perform necessary work and improve efficiency and safety. • Knowledge of established policies and procedures regarding materials, tools and equipment. • Ability to identify and broken tools and either repair them or remove them from service. 	<ul style="list-style-type: none"> • Orders and maintains inventory and monitors safe and efficient utilization of materials. • Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks. • Interprets and converts numerical data and predicts arithmetic results. • Interprets information and transfers information between formats.

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
B3. Perform troubleshooting	<ul style="list-style-type: none"> • The latest revision blueprints, P&IDs (piping and instrumentation diagrams) and schematics are consulted as necessary. • Status of equipment prior to beginning troubleshooting is checked and documented and baseline readings are acquired. • Information about the nature and possible causes of failure is systematically gathered through visual inspection, past experience, operator feedback, and observation of equipment during operations and disassembly of equipment, as appropriate. • Proper diagnostic tests are performed and repeated as necessary to determine the nature of the problem. • Diagnosis is timely and effective. • Manufacturer's performance specifications are used when evaluating equipment performance. • Procedures for isolating problems are initiated correctly and followed through completely. • Proper procedures and precautions are followed for prime mover versus auxiliary equipment. • Safety procedures are followed for troubleshooting in such areas as electrical isolation and stored energy. 	<ul style="list-style-type: none"> • Knowledge of the system and equipment, and how it interacts with other systems. • Knowledge of and ability to perform diagnostic tests, use test equipment and interpret the output from the tests and diagnostic equipment. • Knowledge of basic troubleshooting processes and procedures. • Ability to access and read equipment logs and histories. • Ability to execute isolation procedures. • Ability to read blueprints, P&IDs (piping and instrumentation diagrams) and schematics, and to identify the most current revision. • Knowledge of multiple trades and crafts and their functional boundaries and nomenclature. • Ability to read and understand manufacturer's specifications and manuals. • Knowledge of the differences between prime mover equipment versus auxiliary equipment. • Ability to test for and determine status of equipment. • Knowledge of normal operations of equipment and the ability to acquire and verify base line readings. • Knowledge of safety procedures, including electrical isolation and stored energy safety procedures. 	<ul style="list-style-type: none"> • Demonstrates creative thinking process while problem solving; develops creative solutions and applies them to new situations. • Analyzes possible causes, generates and evaluates solutions and generates and evaluates solutions. • Summarizes and translates mathematical data and manipulates formulas. • Utilizes previous training and experience to predict outcomes; visually analyzes relationship between parts/whole and process/procedure and interprets charts, graphs and symbols. • Understands technology applications, flows proper procedures and manipulates technology of desired results. • Applies and analyzes rules and principles to processes and procedure and uses logic to draw conclusions. • Interprets and applies new knowledge and experience and analyzes application of learning tools.

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
B4 Perform repairs	<ul style="list-style-type: none"> • Work is performed safely in accordance with company policies and procedures and in accordance with all applicable laws and regulations. • Repair procedures are followed. • Appropriate co-workers are informed regarding the repair process if working alone. • During repair process, equipment is thoroughly inspected to identify other repair needs. • Where appropriate, repair plan and job safety/hazard analysis are effectively communicated to appropriate personnel in a timely manner. • Replaced parts are properly disposed of or refurbished and returned to service. • Post maintenance testing is performed to ensure equipment is in proper working order. • Return to service documentation is prepared and submitted as required. 	<ul style="list-style-type: none"> • Ability to track how equipment is disassembled so they can be correctly put back together (i.e. pictures, diagrams, wire schemes, as-builts). • Knowledge of safe work practices with respect to repairs. • Knowledge of company policies and procedures regarding repairs. • Knowledge of technical requirements for specifications of parts to be repaired and manufacturer's recommended procedures. • Knowledge of equipment function and purpose within the system, and how they affect other systems. • Knowledge of equipment inspection procedures. • Knowledge of the different kinds of expertise required to complete the repair, and knowledge of the roles and responsibilities of all parties involved. • Ability to anticipate and communicate expertise and staffing needs prior to and during the repair job. • Ability to properly test and validate successful repair. • Knowledge of proper disposal and refurbishing procedures for parts and repairs. • Ability to interact with internal and external customers (other departments or vendors). 	<ul style="list-style-type: none"> • Understands the requirements of the task and technological results and analyzes task/technology relationship. • Summarizes and translates mathematical data and manipulates formulas. • Interprets and converts numerical data and predicts arithmetic results. • Analyzes work assignments, delegates responsibilities and assesses individual knowledge and skills.

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
B5 Document equipment maintenance & repair	<ul style="list-style-type: none"> • Documentation is performed according to company and department policies and procedures. • Documents and appropriate files are input into database, filed or distributed to correct parties. • Preventive maintenance schedule is properly adjusted to reflect repairs made. • Documentation is accurate, legible and complete and is completed in a timely manner. • Documentation is understandable and succinct. 	<ul style="list-style-type: none"> • Knowledge of documentation policies and procedures. • Ability to input relevant and accurate data into manual and electronic system. • Understanding of how documentation and procedures affect critical operations and timelines. • Ability to report findings and make recommendations based on documented history and findings. • Understanding of the operational system and how equipment maintenance issues can adversely impact operations. • Ability to use correct terminology. 	<ul style="list-style-type: none"> • Records information accurately, completes forms and writes simple documents. • Understands computer operation, performs basic data entry and retrieves stored data. • Adheres to standards, demonstrates commitment to excellence and leads by example. • Interprets information and transfers information between formats.
B6 Perform housekeeping	<ul style="list-style-type: none"> • Tools are stored in proper location. • Materials are kept in a safe manner. • Unsafe conditions are identified and reported promptly. • Workstation is clean and clear of safety hazards. • Shop is organized to maximize efficiency. • Housekeeping protocols are followed. • Tools are cleaned, returned to proper location. • All hazardous materials procedures are followed in accordance with applicable laws and regulations. • All equipment repair and maintenance needs discovered during housekeeping are reported to appropriate personnel. • Working clearances for electrical equipment are maintained in accordance with policies and procedures. 	<ul style="list-style-type: none"> • Knowledge of proper cleaning and storage procedures. • Knowledge and ability to identify and correct for unsafe conditions. • Understanding housekeeping protocols and requirements. • Knowledge of hazardous material laws, rules and regulations, location of hazardous material cleanup equipment and storage location for hazardous materials after clean up. SEE A7. • Ability to identify nonfunctional tools and knowledge of communications and tagging requirements for nonfunctioning tools. • Knowledge of working clearances for electrical equipment. 	<ul style="list-style-type: none"> • Orders and maintains inventory and monitors safe and efficient utilization of materials. • Adheres to standards, demonstrates commitment to excellence and leads by example. • Analyzes situations and information, considers risks and implications, and compiles multiple viewpoints.

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
B7 Monitor equipment indicators to ensure it is operating correctly	<ul style="list-style-type: none"> • Gauges and indicators are read and readings are noted to confirm they are within normal operating parameters. • Sights, sounds, and smell of equipment are noted as to confirm they are within normal operating parameters. • Vibrations are noted to confirm they are normal. • Pre-maintenance benchmarks are compared with post maintenance benchmarks to ensure the equipment components are operating properly. • Test instrumentation is installed to monitor equipment as needed. • Test equipment is checked to ensure it is properly calibrated. 	<ul style="list-style-type: none"> • Ability to read and understand gauges and indicators and normal operating levels. • Ability to perceive changes based on sensory perception (sight, sound and smell). • Ability to communicate and respond to changes based on sensory perception. • Knowledge of normal vibrations, sights, sounds and smells of equipment. • Ability to analyze comparison of pre-and-post maintenance benchmarks. • Knowledge of test instrumentation and how to install it to monitor equipment • Ability to check test equipment for calibration. 	<ul style="list-style-type: none"> • Selects relevant data, identifies the need for data, predicts outcomes and analyzes data. • Prepares basic summaries and integrates information. • Interprets information and transfers information between formats. • Monitors system performance, analyzes system operation, distinguishes trends in performance and diagnoses performance deviations. • Summarizes and translates mathematical data and manipulates formulas.
B8 Maintain and obtain proficiency in current and new technologies	<ul style="list-style-type: none"> • Technical trainings and working demonstrations are attended with full participation. • Initiative is demonstrated to participate in continuous learning opportunities. • Electrical procedures and technologies are kept current. • Initiative is demonstrated to recommend and request training opportunities from management and gain knowledge on an individual basis. 	<ul style="list-style-type: none"> • Ability to access information about training provided inside and outside the organization. • Knowledge of location of equipment instruction manuals and how to use them. 	<ul style="list-style-type: none"> • Defends own viewpoints, accepts responsibility for own behavior and understands own impact on others. • Understands computer operation, performs basic data entry and retrieves stored data. • Maintains self control, accepts constructive criticism, sets well defined/realistic goals and demonstrates commitment to self improvement. • Interprets and applies new knowledge and experience and analyzes application of learning tools. • Identifies relevant details, facts, specifications, follows set of instructions and qualifies/analyzes information. • Understands the requirements of the task and technological results and analyzes task/technology relationship.

Cluster: Plant Electrician

Critical Work Function: C. Install / Retrofit Systems

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
<p>C1. Install, move or remove equipment</p>	<ul style="list-style-type: none"> • Communications regarding the make-up of the team are made to appropriate personnel effectively and in a timely manner • Proper PPE (personal protective equipment) is worn and moving and removal of equipment is performed safely and in accordance with all applicable laws and regulations. • Plan of action is followed. • Lockout tagout is performed at the beginning of the project and removed upon completion • Moving and removal of equipment is completed to specification and in a timely manner. • Input is given to modify the plan of action as required during moving and removal of equipment. • Vendors are appropriately involved. • As-built diagrams are properly updated to reflect the move or removal of equipment. • P&IDs (Piping and Instrument Diagrams) are accurately updated to reflect current status. • Reference materials are consulted to accurately determine construction specifications. • Needs and resources are solicited, assessed, and incorporated into the construction • Work site is neat and contained and is ready for approval/use. • Applicable codes and industry requirements are met. 	<ul style="list-style-type: none"> • Knowledge of PPE (personal protective equipment), safety regulations, requirements and policies regarding equipment. • Ability to implement and follow a plan of action. • Knowledge of the personnel and skills of team members and the personnel requirements of the job. • Ability to modify the plans of action as needed. • Ability to understand and follow vendors' equipment requirements and recommendations. • Knowledge of lock out tag out concepts and procedures. • Knowledge of equipment moving and removal procedures. • Knowledge of vendor, equipment and system terminology. • Ability to create and understand as-built diagrams and blueprints. • Ability to understand and update P&ID (piping & instrument diagrams) to reflect current status. • Knowledge of location of reference materials and ability to interpret and analyze them. • Knowledge of work site conditions, electrical and work site hazards and procedures. • Knowledge of industry codes and requirements. 	<ul style="list-style-type: none"> • Interprets and converts numerical data and predicts arithmetic results. • Identifies relevant details, facts, specifications, follows set of instructions and qualifies/analyzes information. • Records information accurately, completes forms and writes simple documents. • Utilizes previous training and experience to predict outcomes; visually analyzes relationship between parts/whole and process/procedure and interprets charts, graphs and symbols. • Suggests system modifications/improvements and determines system components to be improved.

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
<p>C2. Test to ensure proper function after installation / retrofit</p>	<ul style="list-style-type: none"> • Prior to starting the test, communications are made to other crafts, management, supervisors and Dispatch regarding the test. • Testing is performed in accordance with organizational policies and procedures. • Test results are used to correct installation or retrofits as needed. • Test results are properly documented and submitted to appropriate personnel. • When work is completed, responsible parties are notified that equipment is ready for service. • Lockout tagout is performed when required. • Testing includes functional checks, in-service checks and remote data systems checks. • Equipment operates in accordance with specification based on OEM (original equipment manufacturer) information. 	<ul style="list-style-type: none"> • Knowledge of testing procedures and parameters. • Knowledge of standards and guides regarding testing and safe methods for connecting to equipment. • Knowledge and application of relevant safety policies and procedures, including lockout tagout. • Knowledge of how to interpret, apply and document test results to validate repair or installation. • Knowledge of notification procedures for return to service. • Knowledge of test equipment calibration and use. • Knowledge of and ability to perform functional checks, in-service checks and remote data systems checks. • Knowledge of equipment such as that which is listed on page 2 of this document. • Knowledge of equipment interfaces with the power system such as protective relaying, communications aided tripping, SCADA (Supervisory Control and Data Acquisition), PLC (Programmable Logic Controller), DCS (Distributed Control System), revenue metering, and DC batteries. • Ability to interpret and apply OEM (original equipment manufacturer) information. 	<ul style="list-style-type: none"> • Selects relevant data, identifies the need for data, predicts outcomes and analyzes data. • Interprets information and transfers information between formats. • Prepares basic summaries and integrates information. • Understands the requirements of the task and technological results and analyzes task/technology relationship. • Summarizes and translates mathematical data and manipulates formulas. • Analyzes situations and information, considers risks and implications, and compiles multiple viewpoints.

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
C3 Develop operating procedures	<ul style="list-style-type: none"> • OEM manuals are used and procedures are edited on the initial checkout to customize them to the specific system. • System walk through is provided to the personnel who will be operating the equipment, and new procedures are communicated. • Operating procedures are properly updated and documented. 	<ul style="list-style-type: none"> • Knowledge of how to access OEM manuals and technical support. • Knowledge of industry and manufacturer's terminology. • Knowledge of installation, move, remove, construction and operating procedures for equipment in the plant. • Knowledge of the site-specific equipment or system. • Knowledge of documentation and update requirements and procedures for operating procedures. 	<ul style="list-style-type: none"> • Conducts task-specific training, coaches others to apply related concepts and provides constructive feedback/reinforcement. • Records information accurately, completes forms and writes simple documents. • Confirms information and interprets, clarifies and influences communication. • Demonstrates creative thinking process while problem solving; develops creative solutions and applies them to new situations. • Applies and analyzes rules and principles to processes and procedure and uses logic to draw conclusions.
C4 Document the installation / retrofit	<ul style="list-style-type: none"> • As-builts, P&IDs (Piping and Instrumentation Diagrams), electrical schematics and one-lines are properly updated to reflect the installation. • Documentation is performed according to company and department policies and procedures. • Documents and appropriate files are input into database, filed or distributed to correct parties. • Documentation is accurate, legible and complete and is completed in a timely manner. • Documentation is understandable and succinct. 	<ul style="list-style-type: none"> • Knowledge of updating procedures for as-builts and piping and instrumentation diagrams, electrical schematics and one-lines. • Knowledge of documentation policies and procedures. • Ability to input relevant and accurate data into manual and electronic system. • Knowledge of how documentation and procedures affect critical operations and timelines. • Ability to report findings and make recommendations based on documented history and findings. • Ability to use correct terminology. • Ability to write clearly and concisely. 	<ul style="list-style-type: none"> • Records information accurately, completes forms and writes simple documents. • Understand the Organizational Hierarchy • Understands computer operation, performs basic data entry and retrieves stored data. • Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks. • Interprets information and transfers information between formats.

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
C5 Locate equipment & materials on work site	<ul style="list-style-type: none"> • Special materials/tools and parts are located. • All required materials/tools for the job are assembled at the work site. • Where applicable, certification of tools is verified. • Materials/tools are checked to ensure they are in safe and proper working order. • Procedures regarding nonfunctioning tools are followed. • Applicable safety standards as they relate to the industry for job-site safety are followed. 	<ul style="list-style-type: none"> • Knowledge of special materials/tools and parts. • Knowledge of how tools should work. • Knowledge of part ordering procedures. • Knowledge of procedures regarding nonfunctioning tools. • Knowledge of safe work practices. • Knowledge of occupational hazards and standard safety devices. • Knowledge of location of material and parts storage. 	<ul style="list-style-type: none"> • Utilizes previous training and experience to predict outcomes; visually analyzes relationship between parts/whole and process/procedure and interprets charts, graphs and symbols. • Orders and maintains inventory and monitors safe and efficient utilization of materials. • Confirms information and interprets, clarifies and influences communication. • Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.
C6 Perform housekeeping	<ul style="list-style-type: none"> • Tools are stored in proper location. • Materials are kept in a safe manner. • Unsafe conditions are identified and reported promptly. • Workstation is clean and clear of safety hazards. • Shop is organized to maximize efficiency. • Housekeeping protocols are followed. • Tools are cleaned, returned to proper location. • All hazardous materials procedures are followed in accordance with applicable laws and regulations. • All equipment repair and maintenance needs discovered during housekeeping are reported to appropriate personnel. • Working clearances for electrical equipment are maintained in accordance with policies and procedures. 	<ul style="list-style-type: none"> • Knowledge of proper cleaning and storage procedures. • Knowledge and ability to identify and correct for unsafe conditions. • Understanding housekeeping protocols and requirements. • Knowledge of hazardous material laws, rules and regulations, location of hazardous material cleanup equipment and storage location for hazardous materials after clean up. SEE A7. • Ability to identify nonfunctional tools and knowledge of communications and tagging requirements for nonfunctioning tools. • Knowledge of working clearances for electrical equipment. 	<ul style="list-style-type: none"> • Orders and maintains inventory and monitors safe and efficient utilization of materials. • Adheres to standards, demonstrates commitment to excellence and leads by example. • Analyzes situations and information, considers risks and implications, and compiles multiple viewpoints.

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
C7 Monitor equipment indicators to ensure it is operating correctly	<ul style="list-style-type: none"> • Gauges and indicators fall within normal operating parameters. • Sights, sounds, and smell of equipment are within normal operating parameters. • Vibrations are normal. • Monitoring is performed safely. • Corrective action is taken to return equipment to normal operating parameters. 	<ul style="list-style-type: none"> • Ability to read and understand gauges and indicators and normal operating levels. • Ability to perceive changes based on sensory perception (sight, sound and smell). • Ability to communicate and respond to sensory based changes. • Knowledge of normal vibrations, sights, sounds and smells of equipment. • Ability to analyze comparison of pre-and-post maintenance benchmarks. • Knowledge of test instrumentation and how to install it to monitor equipment • Ability to check test equipment for calibration. • Knowledge of equipment and how to safely interact with that equipment. • Ability to adjust equipment to return to normal operating parameters. 	<ul style="list-style-type: none"> • Orders and maintains inventory and monitors safe and efficient utilization of materials. • Adheres to standards, demonstrates commitment to excellence and leads by example. • Analyzes situations and information, considers risks and implications, and compiles multiple viewpoints.
C8 Maintain and obtain proficiency in current and new technologies	<ul style="list-style-type: none"> • Technical trainings and working demonstrations are attended with full participation. • Initiative is demonstrated to participate in continuous learning opportunities. • Electrical procedures and technologies are kept current. • Initiative is taken to recommend and request training opportunities from management and gain knowledge on personal time. 	<ul style="list-style-type: none"> • Ability to access information about training provided inside and outside the organization. • Knowledge of location of equipment instruction manuals and how to use them. • Knowledge of who to communicate with to obtain information. 	<ul style="list-style-type: none"> • Defends own viewpoints, accepts responsibility for own behavior and understands own impact on others. • Understands computer operation, performs basic data entry and retrieves stored data. • Maintains self control, accepts constructive criticism, sets well defined/realistic goals and demonstrates commitment to self improvement. • Interprets and applies new knowledge and experience and analyzes application of learning tools. • Identifies relevant details, facts, specifications, follows set of instructions and qualifies/analyzes information. • Understands the requirements of the task and technological results and analyzes task/technology relationship.

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
C9 Provide input to planning process	<ul style="list-style-type: none"> • Issues overlooked by the project engineer are communicated back to engineering effectively and in a timely manner. • When required, equipment is interfaced with existing field devices, and field devices are checked to ensure they are working properly. • Equipment, staffing and material assets required for the project are provided to the project manager. • Input regarding equipment orders is provided to engineers prior to order being placed. • Input regarding feasibility of the plan is provided to project manager. • Communication is clear and relevant to the situation. • Communication is made in a timely and accurate manner to the correct parties. • Suggestions are made in writing or verbal suggestions are followed up in writing. • Suggestions take internal and external customer needs into account. • Planning include environmental impacts. 	<ul style="list-style-type: none"> • Knowledge of installation, move, remove, construction and operating procedures for equipment in the plant. • Knowledge of the power generation system. • Knowledge of equipment interface with field devices. • Knowledge of equipment, staffing and material assets required for projects involving plant equipment. • Knowledge of issues and challenges of interfacing new equipment with legacy equipment. • Knowledge of feasibility issues and challenges of planning for moving, removing, installing and operating plant equipment. • Knowledge of environmental impacts that may exist during installation. 	<ul style="list-style-type: none"> • Communicates appropriate verbal/non-verbal messages, actively participates in discussion and presents complex ideas and information. • Demonstrates creative thinking process while problem solving; develops creative solutions and applies them to new situations. • Defends own viewpoints, accepts responsibility for own behavior and understands own impact on others. • Efficiently manages time, prioritizes daily tasks, prepares schedule and monitors and adjusts task sequence. • Understands negotiations process, identifies conflicts and demonstrates composure. • Selects relevant data, identifies the need for data, predicts outcomes and analyzes data.

Cluster: *Plant Electrician*

Critical Work Function: *D. Communicate with Co-Workers and Management*

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
<p>D1. Prepare maintenance and repair logs</p>	<ul style="list-style-type: none"> • Status reports are clearly communicated from shift to shift. • Documentation is accessible to all appropriate parties. • Documentation is performed according to company and department policies and procedures. • Documents and appropriate files are input into database, filed or distributed to correct parties. • Documentation is accurate, legible and complete and is completed in a timely manner. • Documentation is understandable and succinct, and in a technical format. • Recurring issues are correctly identified. 	<ul style="list-style-type: none"> • Knowledge of equipment, system, electrical and maintenance terminology. • Knowledge of status reports. • Knowledge of documentation policies and procedures. • Ability to use internal company computer maintenance management system. 	<ul style="list-style-type: none"> • Records information accurately, completes forms and writes simple documents. • Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks. • Analyzes situations and information, considers risks and implications, and compiles multiple viewpoints. • Understands computer operation, performs basic data entry and retrieves stored data. • Monitors system performance, analyzes system operation, distinguishes trends in performance and diagnoses performance deviations.

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
D2. Participate in meetings and problem solving groups	<ul style="list-style-type: none"> • Meetings are attended with active participation and with adequate preparation to be well informed about the meeting topic. • Information is accurately given and received. • Participation is encouraged and questions are answered in a courteous and respectful manner. • Issues are accurately and thoroughly discussed and solutions are defined. • Communication is respectfully carried out without discrimination. • Where applicable, meeting minutes and notes are taken and submitted to appropriate departments and parties. • All required job task safety meetings are conducted in accordance with applicable laws, regulations and organization policies and procedures. 	<ul style="list-style-type: none"> • Knowledge of industry, plant, company, equipment, electrical, safety, regulatory, maintenance, repair and personnel terminology. • Knowledge of the power generation system. • Knowledge of plant equipment. • Knowledge of the roles and responsibilities of company personnel and departments. • Knowledge of laws, regulations and organization policies and procedures regarding job task safety meeting requirements. 	<ul style="list-style-type: none"> • Establishes rapport with co-workers and customers; modifies behavior to environment; shows understanding for others and encourages cooperation and negotiation. • Demonstrates creative thinking process while problem solving; develops creative solutions and applies them to new situations. • Defends own viewpoints, accepts responsibility for own behavior and understands own impact on others. • Analyzes possible causes, generates and evaluates solutions and generates and evaluates solutions. • Communicates appropriate verbal/non-verbal messages, actively participates in discussion and presents complex ideas and information. • Applies and analyzes rules and principles to processes and procedure and uses logic to draw conclusions. • Confirms information and interprets, clarifies and influences communication. • Recognizes differences, understands the legal aspects of discrimination, respects the rights of others recognizes the value of diversity.

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
D3. Communicate safety and job-specific needs	<ul style="list-style-type: none"> • Communication is effective and ensures that safety issues are understood and safety practices used. • The high priority nature of safety is communicated. • Safety and job-specific issues and concerns are discussed and quickly resolved. • Communication demonstrates knowledge of customer and business needs. • Communication is clear and relevant to the situation. • Communication is made in a timely and accurate manner to the correct parties such as management, coworkers, customers and stakeholders. • Communications are tracked and documented, as appropriate. • As situations arise, communication priorities are shifted to meet changing business and safety priorities. • Job scope changes are clearly communicated. 	<ul style="list-style-type: none"> • Knowledge of the criticality of safety in the workplace. • Knowledge of industry, plant, company, equipment, electrical, safety, regulatory, maintenance, repair and personnel terminology. • Knowledge of customer and business needs. • Knowledge of resource requirements for jobs such as number of people, lengths of time and budgets. • Knowledge of the roles and responsibilities of company personnel and departments. 	<ul style="list-style-type: none"> • Communicates appropriate verbal/non-verbal messages, actively participates in discussion and presents complex ideas and information. • Analyzes work assignments, delegates responsibilities and assesses individual knowledge and skills. • Identifies relevant details, facts, specifications, follows set of instructions and qualifies/analyzes information. • Interprets and applies new knowledge and experience and analyzes application of learning tools. • Confirms information and interprets, clarifies and influences communication. • Records information accurately, completes forms and writes simple documents. • Recognizes differences, understands the legal aspects of discrimination, respects the rights of others recognizes the value of diversity.

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
D4 Suggest ways (new ideas) to prevent future equipment malfunction or improve equipment performance	<ul style="list-style-type: none"> • Ongoing preventive maintenance and services are communicated to appropriate people in a timely manner. • Suggestions are made to adjust maintenance scheduling or maintenance plan on evidence from the last preventive maintenance for the equipment. • Communication is clear and relevant to the situation. • Communication is made in a timely and accurate manner to the correct parties. • Suggestions are made in writing or verbal suggestions are followed up in writing. • Suggestions take internal and external customer needs into account. • Equipment repair and maintenance history is consulted where possible. 	<ul style="list-style-type: none"> • Knowledge of ongoing maintenance and services. • Knowledge of scheduling and maintenance plans and challenges. • Knowledge of internal and customer needs. • Ability to access information on equipment and repair histories. • Knowledge of terminology. • Knowledge of industry, plant, company, equipment, electrical, safety, regulatory, maintenance, repair and personnel terminology. • Knowledge of the roles and responsibilities of company personnel and departments. • Knowledge of how maintenance procedures affect critical operations and timelines. 	<ul style="list-style-type: none"> • Suggests system modifications/improvements and determines system components to be improved. • Defends own viewpoints, accepts responsibility for own behavior and understands own impact on others. • Analyzes situations and information, considers risks and implications, and compiles multiple viewpoints. • Analyzes work assignments, delegates responsibilities and assesses individual knowledge and skills. • Prepares basic summaries and integrates information. • Records information accurately, completes forms and writes simple documents.
D5 Provide consultation to coworkers and management	<ul style="list-style-type: none"> • Requests for assistance are responded to in a timely manner. • Communications are clear, accurate and effective. • OEM (original equipment manufacturer) manuals, inventory system and standard operating procedures are referred to. • All required follow up actions are taken. • Information provided is accurate. • Engineering support is used as required. 	<ul style="list-style-type: none"> • Knowledge of industry, plant, company, equipment, electrical, safety, regulatory, maintenance, repair and personnel terminology. • Knowledge of the power generation system and equipment. • Knowledge of plant equipment. • Knowledge of the roles and responsibilities of company personnel and departments. 	<ul style="list-style-type: none"> • Understands the system organization and hierarchy and follows processes and procedures. • Conducts task-specific training, coaches others to apply related concepts and provides constructive feedback/reinforcement. • Establishes rapport with co-workers and customers; modifies behavior to environment; shows understanding for others and encourages cooperation and negotiation. • Communicates appropriate verbal/non-verbal messages, actively participates in discussion and presents complex ideas and information. • Recognizes differences, understands the legal aspects of discrimination, respects the rights of others recognizes the value of diversity.

Cluster: **Plant Electrician**

Critical Work Function: **E. Maintain Tools, Test Equipment and Supplies**

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
<p>E1 Maintain, inspect and repair electrical hand tools and test equipment</p>	<ul style="list-style-type: none"> • Electrical hand tools and test equipment are assessed to determine if they are beyond repair and if not, proper repair procedures are followed. • Information regarding broken electrical hand tools and equipment is communicated to appropriate personnel effectively and in a timely manner. • Calibration tags are checked to verify if calibration is needed, proper procedures are followed to attain calibration. • Supplies are stocked and maintained. • The correct checklists are used properly. • Safety procedures are followed. • Equipment malfunctions and readiness are communicated to appropriate personnel effectively and in a timely manner. • Bench testing is conducted following repairs. 	<ul style="list-style-type: none"> • Knowledge of tool and equipment terminology and the locations of tools, parts and equipment. • Knowledge of calibration tags. • Ability to properly inspect tools and submit nonfunctional tools for repair. • Ability to repair electrical hand tools and test equipment. • Knowledge of established policies and procedures regarding tools. • Knowledge of tools and equipment function and use. • Knowledge of approved company, state, federal and manufacturer’s inspection procedures and specifications. • Knowledge of tests to ensure electrical hand tools and test equipment are in good and safe working order. • Knowledge of standard operating and safety procedures. • Knowledge of bench testing following tool repairs. 	<ul style="list-style-type: none"> • Troubleshoots and corrects malfunctions and failures; evaluates performance of technology; analyzes failures. • Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks. • Identifies relevant details, facts, specifications, follows set of instructions and qualifies/analyzes information. • Records information accurately, completes forms and writes simple documents.

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
E2 Maintain working stock	<ul style="list-style-type: none"> • Adequate supply of tools, equipment and materials is available for everyday use or scheduled work. • Adequate spare parts are maintained and stocked. 	<ul style="list-style-type: none"> • Knowledge of tool and equipment terminology and the locations of tools, parts and equipment. • Knowledge of tools, equipment and materials required for everyday use or a scheduled job. • Knowledge of procedures for stocking spare parts. • Knowledge of spare parts required for electrical work. 	<ul style="list-style-type: none"> • Orders and maintains inventory and monitors safe and efficient utilization of materials. • Understands computer operation, performs basic data entry and retrieves stored data. • Understands the system organization and hierarchy and follows processes and procedures. • Interprets and applies new knowledge and experience and analyzes application of learning tools.
E3 Maintain inventory control	<ul style="list-style-type: none"> • Inventory of parts and supplies needed to keep system in operation is maintained and updated as needed. • Parts and supplies purchased for inventory are of desired quality and quantity. • Inventory records are accurate and up-to date. • Warranty items are handled according to manufacturer's and employer's instructions • Ordering procedures are followed. • Requisition / warehouse system is used as required. • Where applicable, spare parts are properly value rated and obsolete parts are removed. 	<ul style="list-style-type: none"> • Knowledge of vendor quality and service. • Ability to evaluate parts and components for compatibility and suitability. • Ability to utilize computer database and parts and supplies ordering software. • Knowledge of parts and supplies recordkeeping system. • Knowledge of purchase orders, supply and requisition system and associated procedures. • Knowledge of cost, shelf-life, lead time to purchase, downtime, and obsolescence as factors for value rating parts. 	<ul style="list-style-type: none"> • Orders and maintains inventory and monitors safe and efficient utilization of materials. • Understands computer operation, performs basic data entry and retrieves stored data. • Interprets and converts numerical data and predicts arithmetic results.

Cluster: *Plant Electrician*
Critical Work Function: *F. Operate Equipment*

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
F1. Inspect equipment	<ul style="list-style-type: none"> • Pre start up checks/inspections are thoroughly performed. • The correct checklists are used properly. • Equipment is signed off and sheets are submitted in accordance with company procedures. • Proper tools are used and measurements are accurate. • Safety procedures are followed and appropriate equipment safety guards are in place. • Inspection documentation is filled out completely and in a timely manner. • Equipment malfunctions and readiness are communicated to appropriate personnel effectively and in a timely manner. • Four senses are used during inspection: sight, hearing, smell and feel. 	<ul style="list-style-type: none"> • Knowledge of equipment and function and use. • Knowledge of approved company, state, federal and manufacturer's inspection procedures and specifications. • Knowledge of safety procedures and use of equipment safety guards. • Knowledge of checklists and how to use them. • Knowledge of equipment sign-off procedures. • Ability to measure accurately. • Ability to accurately complete documentation forms manually and electronically. • Knowledge of inspection results and equipment terminology. • Ability to accurately use inspection tools and methods. 	<ul style="list-style-type: none"> • Utilizes previous training and experience to predict outcomes; visually analyzes relationship between parts/whole and process/procedure and interprets charts, graphs and symbols. • Records information accurately, completes forms and writes simple documents. • Applies and analyzes rules and principles to processes and procedure and uses logic to draw conclusions.
F2. Monitor equipment indicators to ensure it is operating correctly	<ul style="list-style-type: none"> • Gauges and indicators fall within normal operating parameters. • Sights, sounds, and smell of equipment are within normal operating parameters. • Vibrations and temperatures are normal. • Monitoring equipment is tested to ensure it is working properly. 	<ul style="list-style-type: none"> • Ability to read and understand gauges and indicators and normal operating levels. • Ability to acquire proficiency in perceiving changes based on sensory perception (sight, sound, touch and smell). • Ability to communicate and respond to sensory based changes. • Ability to acquire proficiency in ascertaining normal vibrations, temperature, sights, sounds, touch and smells of equipment. • Ability to obtain parameters for baseline operation of equipment. 	<ul style="list-style-type: none"> • Selects relevant data, identifies the need for data, predicts outcomes and analyzes data. • Prepares basic summaries and integrates information. • Interprets information and transfers information between formats. • Monitors system performance, analyzes system operation, distinguishes trends in performance and diagnoses performance deviations. • Summarizes and translates mathematical data and manipulates formula.

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
F3. Operate rolling / mobile equipment	<ul style="list-style-type: none"> • Proper endorsement, license and authorization requirements are met. • Equipment is operated safely, in accordance with all applicable laws and regulations. • Inspection schedule is thoroughly checked to ensure it has been followed. • Proper training and certification for operating and rigging has been obtained. • Rigging requirements are followed. • Lift plans are correctly developed and followed when required. • Loads are properly secured. 	<ul style="list-style-type: none"> • Knowledge of and ability to obtain licenses, certifications and authorizations. • Knowledge of bridge and gantry cranes and mobile equipment. • Knowledge of safe equipment operation and manufacturer's specifications. • Knowledge of company safety policies and equipment operation procedures. • Knowledge of and ability to apply proper rigging techniques. • Ability to develop and implement a lift plan including staffing and technical requirements. • Knowledge of inspection schedule. • Knowledge of load securing procedures. • Knowledge of live-line clearances/minimum approach distances. 	<ul style="list-style-type: none"> • Analyzes situations and information, considers risks and implications, and compiles multiple viewpoints. • Identifies relevant details, facts, specifications, follows set of instructions and qualifies/analyzes information. • Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks. • Adheres to standards, demonstrates commitment to excellence and leads by example.
F4. Operate heavy lifting equipment	<ul style="list-style-type: none"> • Checks are made to determine that an adequate number of people are assigned to the operation. • Safety procedures are followed, and personal protective equipment is worn in accordance with all applicable laws and regulations. • Proper training and certification for operating and rigging is obtained and maintained. • Rigging requirements are followed. • Lift plans are developed and followed when required. • Loads are properly secured. 	<ul style="list-style-type: none"> • Knowledge of bridge and gantry cranes. • Knowledge of company safety policies, manufacturer's specifications, equipment operation procedures and weight limitations. • Knowledge of live-line clearances/minimum approach distances. • Knowledge of and ability to apply proper rigging techniques. • Knowledge of and ability to obtain required licenses and authorization. • Knowledge of development and implementation of a lift plan including staffing and technical requirements. • Knowledge of personal protective equipment and safety laws and regulations. • Knowledge of load securing procedures. 	<ul style="list-style-type: none"> • Conducts task-specific training, coaches others to apply related concepts and provides constructive feedback/reinforcement. • Analyzes situations and information, considers risks and implications, and compiles multiple viewpoints. • Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks. • Interprets and converts numerical data and predicts arithmetic results. • Summarizes and translates mathematical data and manipulates formulas.

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
F5 Operate switches and circuit breakers	<ul style="list-style-type: none"> • Switches and circuit breakers are operated by qualified personnel. • Correct PPE (personal protective equipment) is inspected and worn and all applicable safety procedures are followed. • Where applicable, switching orders are obtained and followed. • Correct equipment is identified and verified prior to starting activity. • Proper personnel are present. • Correct operating procedures are followed. • All safety policies and procedures are followed. 	<ul style="list-style-type: none"> • Knowledge of switching orders and ability to confirm information they contain. • Knowledge of qualifications required for operating switches and circuit breakers. • Knowledge of PPE (personal protective equipment) required for all voltages. • Ability to read a one-line diagram / P&ID (piping and instrumentation diagram). • Knowledge of safety and operating policies and procedures for switches and circuit breakers. • Knowledge of live-line clearances/minimum approach distances/arc flash boundaries. 	<ul style="list-style-type: none"> • Interprets and applies new knowledge and experience and analyzes application of learning tools. • Adheres to standards, demonstrates commitment to excellence and leads by example. • Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.
F6 Operate generation equipment	<ul style="list-style-type: none"> • Correct PPE (personal protective equipment) is inspected and worn and all applicable safety procedures are followed. • Switching orders are obtained and followed. • Correct equipment is identified and verified prior to starting activity. • Proper personnel are present. • Correct operating procedures are followed. • Environmental requirements are met in accordance with all applicable laws and regulations. • Operational testing of generation and auxiliary equipment is performed in accordance with all applicable laws and regulations. 	<ul style="list-style-type: none"> • Knowledge of PPE (personal protective equipment) required for all voltages. • Knowledge of safety procedures for operating generation equipment. • Ability to obtain switching orders and knowledge of the information they contain. • Ability to use a one-line diagram / P&ID (piping and instrumentation diagram). • Knowledge of operating policies and procedures for generation and auxiliary equipment. 	<ul style="list-style-type: none"> • Demonstrates sensitivity to customer concerns and responds to and analyzes customer needs. • Interprets and applies new knowledge and experience and analyzes application of learning tools. • Understands technology applications, flows proper procedures and manipulates technology of desired results. • Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks.

Cluster: Plant Electrician

Critical Work Function: G. Control Power Generating Equipment and Monitor Alarms

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
<p>G1. Operate PLC and DCS (programmable logic controller) and (distributed control system)</p>	<ul style="list-style-type: none"> • PLC and DCS are operated in accordance with the procedures in the handbook • PC (personal computer) is properly synched • Software key is obtained in accordance with policies and procedures • Proper network procedures are followed. • For PLC, correct logic is uploaded 	<ul style="list-style-type: none"> • Knowledge of components of PLC and DCS program and ladder logic • Knowledge of the power generation control system. • Knowledge of PC (personal computer) / PLC (programmable logic controller) interface and ability to synch up the PC (personal computer). • Knowledge of acquisition procedures and use of software key. • Knowledge of network procedures and devices. 	<ul style="list-style-type: none"> • Understand Organizational System • Understands computer operation, performs basic data entry and retrieves stored data. • Interprets and applies new knowledge and experience and analyzes application of learning tools. • Monitors system performance, analyzes system operation, distinguishes trends in performance and diagnoses performance deviations.
<p>G2. Program PLC and DCS (programmable logic controller) and (distributed control system)</p>	<ul style="list-style-type: none"> • Key switch is in the proper position for online programming • For offline programming the proper instructions are downloaded to the PLC and DCS • All proper safety precautions are in place prior to online programming • Plans for online programming are communicated to all appropriate personnel effectively and in a timely manner. • Equipment readiness to change state is ensured. • Interfaces are correctly identified • When applicable, change management procedures and policies are followed. 	<ul style="list-style-type: none"> • Knowledge of manufacturer's specifications and requirements • Knowledge of the power generation system. • Knowledge of online programming procedures and safety precautions. • Knowledge of equipment readiness to change state. • Knowledge of interfaces. • Knowledge of change management procedures and policies. • Knowledge of PLC / DCS and associated equipment. 	<ul style="list-style-type: none"> • Understands computer operation, performs basic data entry and retrieves stored data. • Analyzes possible causes, generates and evaluates solutions and generates and evaluates solutions. • Applies and analyzes rules and principles to processes and procedure and uses logic to draw conclusions. • Interprets information and transfers information between formats. • Demonstrates creative thinking process while problem solving; develops creative solutions and applies them to new situations. • Suggests system modifications/improvements and determines system components to be improved. • Records information accurately, completes forms and writes simple documents.

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
G3 Troubleshoot the controls	<ul style="list-style-type: none"> • PC (personal computer) is properly synched • Proper troubleshooting procedures are followed • Proper safety equipment is used • Alarms are correctly identified • Units are properly checked • Initial operational parameters of controls are properly documented/backed up prior to starting troubleshooting process • Error situations are correctly identified and communicated to appropriate parties effectively and in a timely manner. • Malfunctions are corrected when appropriate. • For electro-mechanical controls, diagram is properly followed to locate problem. 	<ul style="list-style-type: none"> • Knowledge of PC/PLC/DCS interface (personal computer/programmable logic controller/distributed control system). • Knowledge of requirements for safety equipment and proper use of that safety equipment. • Knowledge of alarms and how to analyze them and use alarm information to check units. • Ability to back up/document initial operational parameters. • Knowledge of controls and the ability to identify error situations and correct malfunctions. • Knowledge of electro-mechanical controls and the ability to read and follow diagrams to check controls, analyze the situation, identify errors and correct malfunctions. 	<ul style="list-style-type: none"> • Understands computer operation, performs basic data entry and retrieves stored data. • Analyzes possible causes, generates and evaluates solutions and generates and evaluates solutions. • Applies and analyzes rules and principles to processes and procedure and uses logic to draw conclusions. • Interprets information and transfers information between formats. • Demonstrates creative thinking process while problem solving; develops creative solutions and applies them to new situations. • Suggests system modifications/improvements and determines system components to be improved.

Cluster: *Plant Electrician*

Critical Work Function: *H. Maintain Environmental Quality*

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
<p>H1 Perform Compliance Activities</p>	<ul style="list-style-type: none"> • Air and water monitors are checked in accordance with organization policies and procedures and all applicable laws and regulations. • Instruments are calibrated regularly in accordance with all applicable laws and regulations and organization policies and procedures. 	<ul style="list-style-type: none"> • Knowledge of flue gas, air and water monitors. • Knowledge of instrument calibration procedures, policies and regulations. • Knowledge of EPA (Environmental Protection Agency) QA/QC (quality assurance / quality control) manual. 	<ul style="list-style-type: none"> • Assists and encourages team members, actively participates, works to improve team skills and demonstrates commitment. • Interprets and applies new knowledge and experience and analyzes application of learning tools. • Records information accurately, completes forms and writes simple documents. • Understand the Organizational System • Pays attention to details, demonstrates initiative, monitors performance standards and follows up on assigned tasks. • Monitors system performance, analyzes system operation, distinguishes trends in performance and diagnoses performance deviations.
<p>H2 Maintain water quality and quantity</p>	<ul style="list-style-type: none"> • Proper flow and quality of water are maintained to ensure that fish and wildlife habitats are healthy. • Spills are properly contained and cleaned in accordance with all applicable laws and regulations. • SPCC (spill prevention containment and control) equipment is properly maintained • Spill alarms are correctly maintained. • Gate positions and flow through the gates are correctly monitored and adjustments are made as required. 	<ul style="list-style-type: none"> • Knowledge of pressure, flow, level and position transducers. • Knowledge of water quality requirements and regulations to preserve habitat. • Knowledge of spill containment procedures, laws and regulations • Knowledge of SPCC (spill prevention containment and control) equipment, its location and applicable maintenance policies and procedures. • Knowledge of spill alarms and applicable maintenance policies and procedures. • Knowledge of gates and flow and the ability to adjust gates. • Knowledge of gate monitoring equipment and the ability to analyze output. 	<ul style="list-style-type: none"> • Summarizes and translates mathematical data and manipulates formulas. • Interprets and converts numerical data and predicts arithmetic results. • Identifies relevant details, facts, specifications, follows set of instructions and qualifies/analyzes information. • Records information accurately, completes forms and writes simple documents. • Understands the system organization and hierarchy and follows processes and procedures. • Analyzes situations and information, considers risks and implications, and compiles multiple viewpoints.

KEY ACTIVITY	Performance Indicators How do we know when the task is performed well?	Technical Knowledge Skills, Abilities, Tools	Employability Skills SCANS Skills and Foundational Abilities
H3 Maintain air quality	<ul style="list-style-type: none"> • Air quality monitoring instruments are calibrated regularly in accordance with all applicable laws and regulations and organization policies and procedures. • Preventive maintenance is performed on the scrubber and electrostatic precipitator. 	<ul style="list-style-type: none"> • Knowledge of air quality requirements and regulations to preserve habitat. • Knowledge of air quality monitoring instrument calibration procedures, policies, laws and regulations. • Knowledge of the scrubber and electrostatic precipitator and applicable maintenance policies and procedures. 	<ul style="list-style-type: none"> • Summarizes and translates mathematical data and manipulates formulas. • Interprets and converts numerical data and predicts arithmetic results. • Monitors system performance, analyzes system operation, distinguishes trends in performance and diagnoses performance deviations. • Maintain Technology • Understands the system organization and hierarchy and follows processes and procedures. • Analyzes situations and information, considers risks and implications, and compiles multiple viewpoints.
H4 Perform environmental inspections	<ul style="list-style-type: none"> • All spills and leaks are stopped and reported to appropriate personnel effectively and in a timely manner. • Activities that cause erosion are correctly identified, ceased and solutions are found and utilized. 	<ul style="list-style-type: none"> • Knowledge of air and water quality requirements and regulations to preserve habitat. • Knowledge of spill and leak containment procedures, laws and regulations • Knowledge of SPCC (spill prevention containment and control) equipment, its location and applicable maintenance policies and procedures. • Knowledge of spill alarms and applicable maintenance policies and procedures. • Ability to stop leaks and spills. • Knowledge of erosion-producing activities and the ability to develop work-arounds. 	<ul style="list-style-type: none"> • Demonstrates creative thinking process while problem solving; develops creative solutions and applies them to new situations. • Applies and analyzes rules and principles to processes and procedure and uses logic to draw conclusions. • Interprets and applies new knowledge and experience and analyzes application of learning tools. • Identifies relevant details, facts, specifications, follows set of instructions and qualifies/analyzes information. • Analyzes possible causes, generates and evaluates solutions and generates and evaluates solutions. • Records information accurately, completes forms and writes simple documents.

INTEGRATION

Assessment and Certification: A Vital Connection

Assessment Strategies

Assessment Design

Assessment and Certification: A Vital Connection

Skill standards, while useful on their own, are just one part of a much larger equation. Skill standards establish the standard of competent performance, but they do not tell a person whether he or she has succeeded in meeting that standard.

For this reason, developing skill standards does not end with their publication. Next steps should include developing voluntary assessments and certifications which will make it possible for students, workers and any interested persons to determine their strengths and weaknesses based on the standards, and to earn certification showing that they can perform work competently as established by the skill standards.

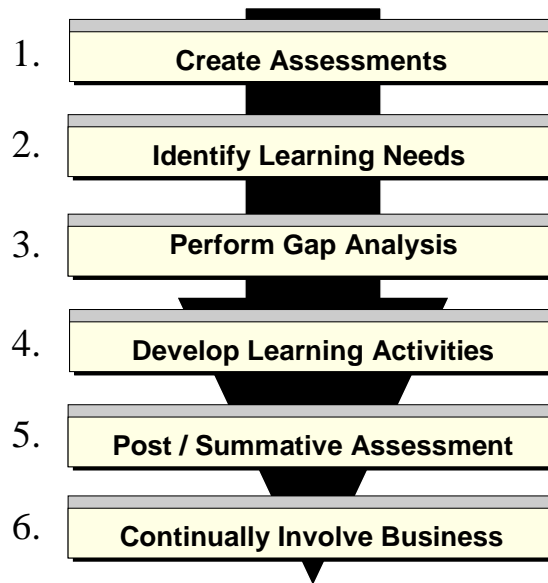
In today's fast-moving technological economy, the necessity for assessments and certification is crucial. The demand for both technical and employability skills are escalating as work becomes more complex. The workforce is more mobile, with workers moving freely between jobs and industries. This job mobility requires that workers must be able to communicate their qualifications to potential employers. They must keep up with technological change through continuous learning and worker retraining, and must be able to prove they have kept pace. All of these factors mean more training and education for individuals, and the ability to show evidence that this training translates to performance on the job.

Voluntary assessments and certifications based on skill standards will help us address all these needs because of the guiding principles upon which skill standards are based, and because of the stakeholders—employers, labor, educators, workers, students, and government—whose needs skill standards are designed to meet.

***Please Note:** To ensure the use of standards and their related assessments and certifications do not contradict U.S. employment law, employers will need to conduct an internal validation of the standards before using the skill standards to make hiring and promotion decisions. The purpose of this validation is to ensure that the knowledge, skills and performance described by the standards are needed for competent performance in an employer's organization. The need to validate the standards internally is a key requirement of U.S. employment law, which seeks to protect individuals from discrimination in hiring and promotion.*

A step toward a statewide system of assessments and certifications is the development of assessments which measure an individual's ability to perform work competently as defined by the skill standards. Once these assessments are developed, curriculum can be reviewed to determine that all necessary topics and practicums sufficiently cover the items in the assessment. As gaps are identified, learning activities and content adjustments can be made, and post/summative assessments can be administered. Finally, it is critical that industry be involved every step of the way, and that standards are continuously reviewed and updated. The diagram below provides a summary of this process.

Integrating Skill Standards



Assessment Strategies

Upon completion of the development of skill standards, performance assessment can be created to assess the criteria identified. Sample assessments and standards may be distributed to instructors and curriculum developers who will be educated on the skill standards elements.

Assessments based on the skill standards may include pre-and post-evaluations of the student to measure skill progression and to track the success rate of obtaining certification, where applicable.

Within a skill standards or competency-based system, assessment is the generation and collection of evidence of performance which can be matched to specified explicit standards that reflect expectations of performance in the workplace. There are two main forms of evidence:

- Evidence of actual performance
- Evidence of underpinning knowledge, skills and abilities

The types of evidence may vary and will include:

- Direct evidence (products and items produced by the performer)
- Indirect evidence (supporting evidence and information about the performer)

Evidence can be collected in a wide variety of educational or business settings. To a large extent, the range of opportunities available for demonstration will determine the

most appropriate setting. Often it is difficult to actually perform the task in the authentic work setting. In this case, evidence generated during an educational course or an in-house training session can be collected by individuals and added to their overall portfolios.

By requesting that the student or trainee produce tangible results in the form of take-away products (videos, tapes, paper, and electronic products), the participant will have created real evidence which can be shown to human resource personnel, hiring managers, supervisors or assessors. When assessing these products, the trained assessor will seek:

- Validity
- Currency
- Authenticity
- Sufficiency

Therefore, when designing a skill standards-based assessment for an educational course or training session, the assessment process and results will meet four criteria:

Validity: The assessment instrument/process clearly relates to the relevant standards.

Currency: The assessment instrument/process calls for a demonstration of the current standards in the industry.

Authenticity: The individual being assessed produces the assessment results; it is their own work. Team activities will be useful to demonstrate the skills and abilities to work effectively with others, not necessarily the total end results. The individual can, if possible, identify his or her part of the team project to demonstrate evidence of his or her own results.

Sufficiency: Enough evidence is collected to match the key task and the performance criteria included in the skill standards.

When designing/revising the curriculum for power generation, students will be assisted in generating high-quality evidence of performance or of underpinning skills, knowledge and abilities which will help them to be successfully assessed as fully competent.

Adapted from the *Skill Standards Volume 2: Assessment*, 1999, Washington State Board for Community and Technical Colleges, and *Designing Competency-Based Training*, Shirley Fletcher, 1991, Pfiffer & Company, p. 86-88.

Assessment Design

Type of Authentic Assessment	Description of Authentic Assessment Strategies
Project	<ul style="list-style-type: none"> • Hands-on demonstration of knowledge, skills and attitudes that reveals a student's ability to plan, organize and create a product or an event.
	<ul style="list-style-type: none"> • Documentation of process of development from initial steps to final presentation.
Portfolio	<ul style="list-style-type: none"> • Collection of pieces of evidence of a student's knowledge, skills and attitudes.
	<ul style="list-style-type: none"> • Showcase of best work, work-in-progress.
	<ul style="list-style-type: none"> • Record of student's progress over time.
	<ul style="list-style-type: none"> • Content selection by student in collaboration with the teacher.
	<ul style="list-style-type: none"> • Centerpiece for parent conferences.
On-Demand Demonstrations	<ul style="list-style-type: none"> • Hands-on performance by a student, which illustrates levels of knowledge, skills and attitudes.
	<ul style="list-style-type: none"> • Typically involve a "real life" problem or situation to solve.
	<ul style="list-style-type: none"> • Focus on the application of knowledge and skills learned in one situation as it connects to a new and different one.
Case Studies	<ul style="list-style-type: none"> • Analysis of events and individuals in light of established criteria. • Synthesis of evidence to support generalizations based on individual cases.
Paper/Pencil Tests	<ul style="list-style-type: none"> • Multiple-choice, essay, true-false questions that rely on extended responses to further clarify a student's understanding of the knowledge being assessed.
	<ul style="list-style-type: none"> • Graphic representations that reveal a students' understanding of connections among ideas.
Structured Observation	<ul style="list-style-type: none"> • Observation of events, groups and individuals that focuses on the salient traits of the skill or attitude being observed.
Scenarios	<ul style="list-style-type: none"> • A problematic or challenging situation presented in the context of a career-technical perspective.
	<ul style="list-style-type: none"> • Study required to analyze or evaluate a situation.
	<ul style="list-style-type: none"> • Apply relevant knowledge or skills.
	<ul style="list-style-type: none"> • Prepare and justify a reasonable solution.
Critical Incident	<ul style="list-style-type: none"> • An interview where the assessee is asked to describe past experiences which demonstrate skill standards.

From: Center for Occupational Research and Development, November 1996, and the forthcoming *Skill Standards Volume 2: Assessment*, 1999, Washington State Board for Community and Technical Colleges.

Appendices

References

Ordering Information

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For more information -- Web references:

<http://www.energycentraljobs.com/>

<http://www.nwppa.org/web/jobs/jobindex.shtml>

<http://www.westernenergy.org/>

<http://energyjobsearch.com/>

<http://www.wa-skills.com/energy.html>

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