Qualification Standard for Power Plant Operators

Technical Report

Qualification Standard for Power Plant Operators

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REPORT SUMMARY

The complexities of electrical generation demand expectations beyond the potential of a traditional training program. The challenge—to maintain a capable workforce that evolves with new technology—is a dynamic system within the electrical generation industry. Qualification standards and operator competency are critical components of this dynamic training system.

Background

In response to competition, stringent regulatory requirements, and greater operational demands, many power producers have an increased interest in developing consistent qualification standards for power plant operators.

Objective

- To provide a training system model for companies to use as a guideline when establishing their own power plant operator qualification program
- To provide a qualification standard that will manage the dynamic training system

Approach

With the active participation of funders, EPRIsolutions developed techniques such as apprenticeships, structured on-the-job training, qualification guidelines, and system descriptions into a model qualification standard for power plant operator training.

Results

This report will allow users to customize and implement a dynamic training system at their location. With qualification, plant owners will gain extra confidence in their production staff and can be assured that the staff has the skills to safely and responsibly operate and maintain plant equipment.

EPRI Perspective

This report was developed to provide bases and guidelines for a company to work from to develop a standardized operator qualification program. Power companies around the world employ individuals as control room operators. These operators are responsible for making critical decisions about the operation of their units and are directly responsible for providing the maximum amount of power to the customers. To ensure that these operators possess the knowledge and skills required by this position, performance assessments and training need to be part of the company's normal operating procedures.

The Operator Qualification Standard uses a systematic approach to evaluating a person's knowledge and skills and then outlines a procedure for correcting any deficiency found.

Fossil-fuel plant operator licensing has been a topic of discussion for years. A 1999 EPRI report, *Operator Certification Standards for Fossil Fuel Fired Plants* (TR-114259), surveyed state and local municipalities about their licensing requirements and the basic knowledge required to possess such a license. The study found that while many local jurisdictions have licensing requirements, very few had a way to measure the skills of the individuals they were certifying.

As the need for more qualified operators becomes apparent in the coming years, many companies will be seeking ways to ensure that the people at the controls of these multimillion dollar plants have the necessary training, skills, and knowledge to handle malfunctions and emergencies and continue to operate these plants at maximum efficiency.

Keywords
Operator
Training
Certification
Qualification
Certification program
Qualification program

ABSTRACT

Effective training programs help power plant owners and operators enhance plant performance, avoid operating mishaps, and reduce the risk of on-the-job errors. The need for prudent training investment is heightened as competition strengthens links between worker proficiency and plant profitability. But managing an effective power plant training program is challenged by reduced budgets, an array of new technologies and training media, outsourcing of the training function, and the changing nature of responsibilities in the work force.

Generation companies have an increasing interest in developing qualification standards for power plant operators. Several states have existing license requirements for power plant operators and the EPA is establishing a Standard for Qualification of High Capacity Fossil Fuel Fired Plant Operators as part of the Clean Air Act amendment. These standards are not regionally consistent, addressing only a part of the power plant operator's job. The standards also cover a broad range of boilers, from building package heating boilers to utility boilers. Power plant owners can benefit from the development and administration of a single standard qualification program.

EPRI has investigated existing regional, state, and federal licensing and certification requirements for safety, reliability, and emissions prevention in order to propose establishing a national qualification standard for power plant operators. EPRI has taken the qualification standard a step further, gathering all job and task requirements into a complete training system. This qualification standard will address the administration requirements for testing, qualification, and requalification.

The standards and guidelines found in this report allow users to implement a qualification program that meets or exceeds any current efforts to establish national guidelines.

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INTRODUCTION

The changing world of technology impacts not only the way we work but also the nature of work itself. The complex equipment and systems of the power plant require more than robotic motions from the operator. New multifunctional job responsibilities and reduced staff levels have made many existing power plant training programs obsolete. The operator of the past, who had only a high school diploma and learned on the job, can no longer meet the needs of the changing industry.

A training system that encourages the use of knowledge and skill to better perform job tasks will allow the trainee to acquire the experience and confidence to excel in the changing technological environment. A procedure-based training system that includes both knowledge and skill demonstrations to earn qualification will ensure operator excellence.

Dynamic Training System

This report will explore the dynamic training system, its purpose, components, and control methods. A typical training system purpose might be *to develop and maintain a capable workforce that safely and cost effectively operates the power station to meet customer demand.*

The components of the dynamic training system are shown in Figure 1-1.

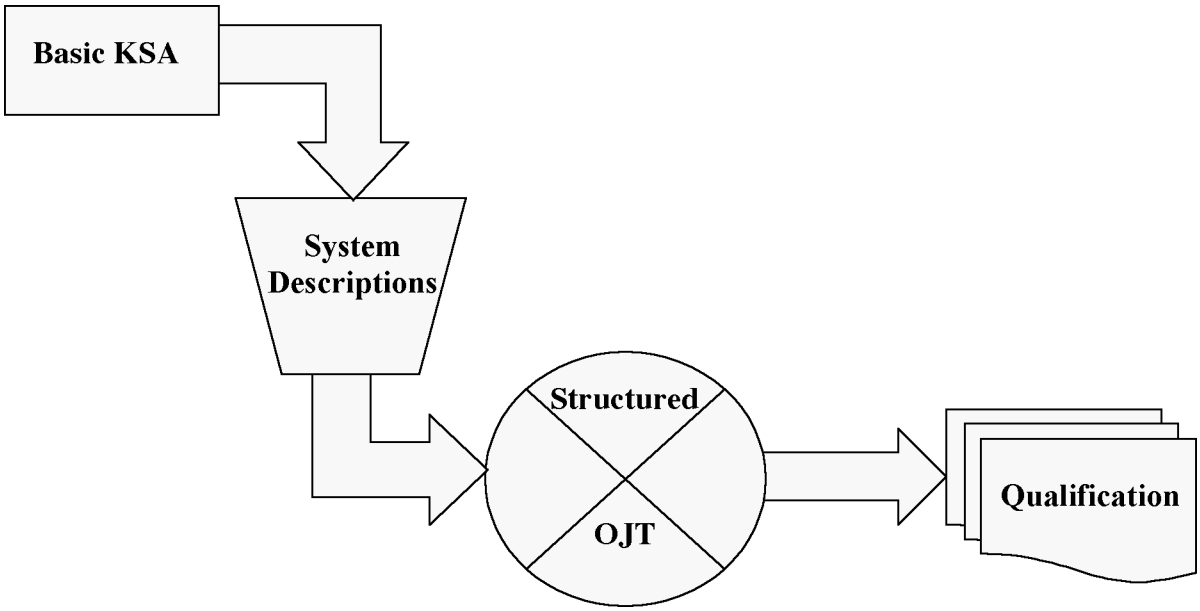

Figure 1-1
Dynamic Training System

The components of the dynamic training system can be described as follows:

1. Before on-the-job training (OJT), the trainee must have the basic knowledge, skills, and ability (KSA). This component of the training system might be a prerequisite for job applicants. Colleges now offer certificate and degree programs for becoming a power plant operator. Knowledge and skills training is also readily adapted to a self-study program, which might include computer-based training (CBT).

2. System descriptions written specifically for your site's equipment will be the foundation of your customized training system. These descriptions blend fundamentals with the actual work environment so that the trainee gains knowledge of plant design and operation.

3. Structured OJT is a critical component of the dynamic training system. Structured OJT defines the job position, identifies needed resources, states what the trainee will perform, and maps the training methods and evaluations that ensure success. Structured OJT applies knowledge and skill to required job tasks. This component of the training system requires contact between the trainer and trainee. This resource is money well spent; the trainee advances from acquiring knowledge, skill, and attitude to job performance.

4. Qualification measures the operator's ability to use the acquired knowledge and skills to perform critical job tasks correctly. Power plant operators must possess the ability to perform routine tasks as well as manage crisis situations. Several knowledge- and performance-based methods are used to assess operator knowledge, skill, and ability. Each method addresses a specific facet of human performance.

Qualification Standard

The dynamic training system model is the working piece of the qualification standard. If we were to peel back the layers, we would find an intricate operating system that manages the training system. Using the instructional systems development (ISD) model, EPRI has designed a Power Plant Operator Qualification Standard. This Qualification Standard describes how to develop and manage a training system. Each step of the ISD model is critical to ensuring that the Qualification Standard will manage the dynamic training system. See Figure 1-2.

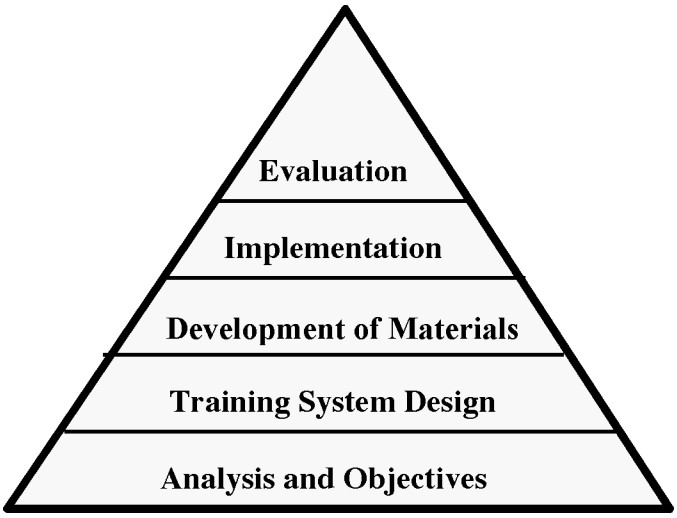

Figure 1-2
ISD Model

EPRI Training System Model

The Qualification Standard is a guide to developing and managing your training system. Our guideline offers a sample training system called the EPRI training system model. The model is broken down into two phases. Phase I details steps to include in basic skills qualification. Phase II describes steps to include in operator skills qualification.

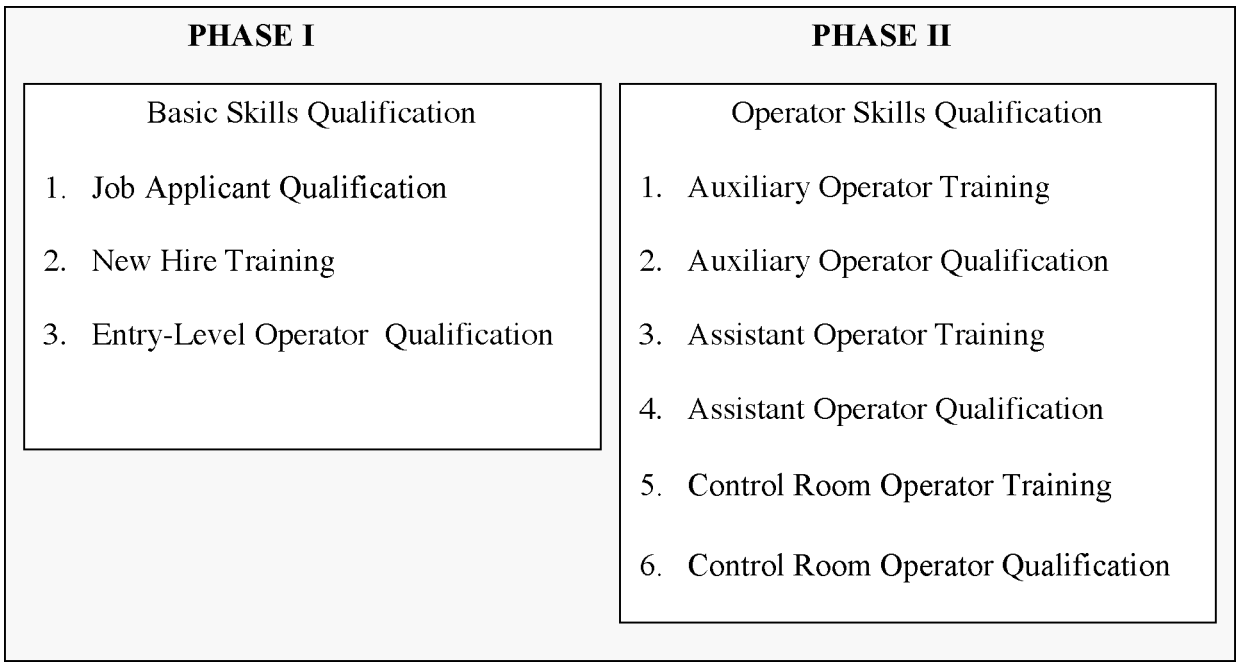

Figure 1-3
EPRI Training System Model

Selection of training program features that meet budget requirements and allow flexibility while achieving performance expectations will be unique to each location. Today, new technology and media offer a wide range of options for training material development, presentation, and implementation. This technical report will focus on minimum performance standards for an operator to earn qualification. Options to customize modules will be highlighted in the form of recent customer success stories. Users can blend basic guidelines and options to best meet their needs.

2
QUALIFICATION STANDARD

1. Introduction

The Qualification Standard provides power plants with a generic resource and guide to prepare a site-specific power plant operator qualification program.

The Qualification Standard describes a training system model that combines a variety of training methods into an easy-to-administer program that prepares operators for qualification. The target audience for the training system model is qualified job applicants who will progress through the operation job levels at a typical power plant.

Training system model procedures and responsibilities make up the management process that will govern the learning process. How training material is developed, how training is conducted, and how qualification is earned are all defined within this Qualification Standard.

2. Training System Objectives

The objective of a training system is to provide standards and resources to create learning events. Structured learning events allow operators to develop the knowledge, skill, and ability required for qualification. Application of the EPRI Qualification Standard will allow power plants to achieve specific plant objectives similar to the following:

- The plant will operate without recordable injuries.
- The plant will operate within environmental guidelines.
- The plant heat rate will be less than or equal to _____ BTU/kW.
- Plant operational “runs” will be extended to _____days, and the run will not be terminated by an operational error.
- Assuming no delay due to silica and given a warm turbine and boiler, the plant will be brought to full load in ____ hours.
- Mastery of terminal objectives in the following areas of plant operation will be facilitated:
  - Plant startup, shutdown, and power changes
  - Transients caused by equipment malfunctions
  - Plant operation without use of service equipment

- Recovery from plant trips
- Plant operation at the best efficiency and best utilization of plant life expenditure

The program can be accomplished using courses, demonstrations, and OJT defined in this document.

3. Training Material General Requirements

Training material developers will select and use consistent formats and software based on available resources. Document access and control methods must be defined in the training system design specification. Training information and procedures must be made available to the trainee and continue to be available for the operator on the job. Document control must protect the verified information; changes must be managed and approved. Plant activities must be managed so that training documents are revised when changes are made.

Table 2-1 is a generic chart that should be customized and used to document training material selection, use, and availability.

Table 2-1
Qualification Standard

Position	Training Phase	Training Material (Examples)	On-Site	Acquire
New Hire	Basic Skills	*Outsource College*		
		Apprenticeship		
		CBT		
		NUS		
		Pre-Employment Training		
		Qualification Guide and Card		
Operator Levels	Knowledge	*CBT*		
		NUS		
		System Descriptions		
		Plant Walkdown		
		Qualification Guide and Card		
	Job Skills	*Procedures*		
		Video Tapes		
		Simulator		
		Instrument Labs		
		Mechanical Labs		
		Rounds		
		Inspections		
		Qualification Guide and Card		

4. Training

Phase I Training – Basic Skills

Introduction

Phase I training prepares the qualified job applicant to be an entry-level operator. Basic skills training includes the knowledge and skill necessary to safely enter the power plant and begin power plant operator skills training.

This phase will typically take two years to complete. Some of the objectives might be designated as prerequisites of a job applicant. In this case, candidates will earn qualification of the objectives, instead of training. The program length is typical of the time it takes a high school level candidate to obtain prerequisites at a college or similar program. If you elect to have a minimal amount of job applicant prerequisites, then an on-site apprenticeship style program would achieve the same results within two years.

Regardless of how many prerequisite job applicant objectives are selected, a need will still exist for some on-site training of the newly hired employee. Match your list to available resources.

Objectives for Job Applicant or New Hire

This chart gives a suggested list of areas to address when developing objectives for Phase I training - basic skills. Table 2-2 represents a typical power plant training program curriculum available at colleges and trade schools. Your training system design specification should designate which areas will be included in training and which areas will be part of job applicant qualification.

Table 2-2
Basic Skill Areas

Basic Skill Areas	Objective	Train	Job Applicant Qualification
Personal Safety			
Fire Safety			
Respiratory Protection			
Hazardous Materials			
Government Regulations			
MSDS			
Zero Energy State			
Confined Spaces			
Boiler Design			
Boiler Auxiliaries			
Boiler Operation			
Fuel Equipment			
Combustion Principles			
Turbine Design			
Turbine Auxiliaries			
Generator Principles			
AC Power			
Generator Auxiliaries			
Electrical Principles			
Electrical Protection			
Electrical Distribution			
Three-Phase Power			
Steam Systems			
Water Systems			
Water Treatment			
Plant Systems			
Instrumentation and Controls			
Mechanical Tools and Equipment			
Heat Transfer			
Power Plant Operation			

Phase II Training – Operator Skills

System Descriptions - Introduction

Phase II training should begin with an in-depth study of systems at the plant. This training should be presented using the best training methods, such as a classroom environment, self-study with the crew, the simulator, actual plant activities, and other training aids, to accomplish the objectives.

The audience for this training phase will be entry-level operators through control room operators. This training should be tailored to match each job level SOJT. An entry-level operator would complete the system description training along with SOJT in a two-year period. System description training should occur at each operator level. More in-depth detail is shared and more complex exercises are developed for qualification.

Objectives of System Descriptions

System description objectives include the following activities. These objectives should be tailored and matched to the appropriate power plant operator level as needed to prepare for SOJT and qualification.

- STATE the power generation function of the system.
- DRAW and LABEL a simplified schematic of the system with all major components in flow path order.
- LIST the normal operational parameters for the systems, and STATE where these parameters are read in the control room.
- LIST the location of systems controls.
- STATE all major control inputs and outputs of the system.
- STATE the principle of operations for all procedural steps, trip functions and /or interlocks, alarms, and environmental regulations for the systems.
- LIST the systems that support the operation of this system.
- LIST any support requirements that the system fulfills.
- List any applicable system-specific safety precautions and the reasons for the precautions.

The systems to be covered are listed in Table 2-3. Users should modify the system list and boundaries to match their plant.

Table 2-3
System Description Modules and Boundaries

System	System Boundaries
Condenser	Condenser cooling water, condenser vacuum, hotwell and deaerator level control system and the condenser.
Condensate and Feedwater	Condensate system, feedwater heaters, heater drain system (turbine drain), feedwater system, boiler feed pump lubrication, extraction steam and feedwater heating. [condenser up to the boiler economizer]
Air/Gas System	Flue gas, primary air, secondary air, and all the fans and dampers. [from FD fan suction through the boiler to the stack including the stack gas environmental controls system, SO_2 and NO_x]
Boiler	Soot blowers, boiler ash disposal, boiler drains, economizer, drum, superheater and reheater.
Fuels	Boiler firing, coal handling, coal feed and pulverizing, fuel oil, fuel flow control, the master fuel trip and the ignition system
Steam Systems	Main superheat steam, superheat spray water, gland steam, reheat steam, reheat spray water, auxiliary steam, steam temperature control, auxiliary steam system, steam relief system and steam drains
Turbine	Turbine system, turbine control and protection, lubricating oil, main oil, turning gear, turbine stress indicator, turbine control system, turbine protection system, and exhaust hood cooling system
Generator	Generator system, hydrogen supply, seal oil, voltage control system, hydrogen cooling, stator cooling system, main transformers, output circuit breakers, and generator protective relaying]
Electrical Distribution	AC distribution system, the station batteries, the 120 VAC vital ac system, the 125 VDC system
Miscellaneous	Auxiliary cooling water and service and instrument air systems.
Plant Controls	Boiler master, fuel/air ratio, turbine master and load controls.

Qualification for System Descriptions

Sample qualification exercises for system descriptions are shared in Section 5. System descriptions are an active form of self-study. They not only feed information to the trainee but also call upon him or her to complete challenging “knowledge exercises.” Unlike traditional classroom tests, there are no multiple-choice questions. To complete a knowledge exercise, the trainee must follow a hands-on learning process similar to what would be used to resolve an actual question on the job, rather than just consulting a textbook.

Structured On-the-Job Training - Introduction

Step 2 of operator skills training is structured on-the-job training. This training provides in-depth demonstration and practice of power plant operating procedures and job position requirements. This training typically uses self-study with the crew, the simulator, actual plant activities, and other training aids, to accomplish the objectives.

Objectives of SOJT

The terminal objectives for this phase of training should include activities similar to those listed below. Specific standards and conditions are given for each type of operator performance.

- Demonstrate job performance of *routine job* tasks from memory without prompts or assistance, maintaining plant operations and critical parameters stated in the specific procedure in the normal range.
- Demonstrate job performance of selected *non-routine job* tasks:
  - From memory without prompts or assistance, maintaining plant operations and critical parameters stated in the specific procedure in the normal range.
  - When prompted, using the procedure if needed, maintaining plant operations and critical parameters stated in the specific procedure in the normal range *without assistance*.
  - When prompted, using the procedure if needed, maintaining plant operations and critical parameters stated in the specific procedure in the normal range *with assistance* if needed.
- Demonstrate job performance of first response actions for *emergency* without prompts, bringing the plant to a stable condition and then referring to the procedure if needed to complete the required job tasks as stated in the emergency procedure.

5. Qualification

The trainee-trainer will follow the training guidelines. During the learning, the trainee will gain knowledge, observe a demonstration of skills, and practice the skills. After learning is complete, the trainee will perform demonstrations or answer questions that measure the trainee's ability.

The training system design specification describes pass and fail criteria. The qualification guide and card clearly define what successful qualification is for each objective being measured. This includes the following activities and conditions used to measure trainee performance as well as expected responses from the trainee:

- Oral exam with minimum expected response
- Written exam with minimum expected response
- Job demonstration procedure with minimum expected response
- Critical parameter normal range guidelines

Pass and fail procedures describe the actions taken after the trainee completes the evaluation process. Specific procedure steps that includes actions for the following training outcomes should be written into your training system design specification:

- Satisfactory skills and knowledge; no weak points.
- Satisfactory skills and knowledge; the trainee lacked information on some minor details.

- Unsatisfactory; the trainee lacked necessary skills or showed a significant lack of knowledge and understanding.

6. Program Evaluation

Evaluation of your training system will not only confirm program design success but also identify opportunities to improve your training system. Refresher training requirements will also be identified during evaluation of the training system. Table 2-4 provides a guideline for evaluation and recommendations for refresher training.

Table 2-4
Program Evaluation Schedule

Task	Schedule
Emergency procedure refresher training	Annually
Fundamentals	Jr. Operator – every two years Sr. Operator – every five years
Trainee's reaction to training	Completion of each training event
Learning system	First year program – after each qualification Established program - Annually
Management system	First year program – quarterly Established program - Annually

3
ISD MODEL - ANALYSIS

The qualification standard is the operating guideline that manages the training system model. The next five sections share the instructional system development (ISD) model, the method EPRI used to design the Qualification Standard and training system model. As you follow these five sections, take the time to use the documents and matrix found in the appropriate appendix. These tools will help you to customize the Qualification Standard and develop your training system. This section reviews Step 1, Analysis, of the ISD model.

Analysis Step

The analysis stage has three purposes:

- Assess the current status of training. This step will also identify how to measure program success.
- Determine the knowledge, skills, and abilities that are needed to meet the minimum performance expectations.
- Investigate what resources are available for the training program.

The analysis stage is accomplished in three separate activities that are similar but gather different types of information. The activities or steps are:

- Administrative analysis

  The administrative analysis will explore current management requirements and expectations. The analysis will look at objectives, testing procedures, cost, enforcement, delivery methods, and measurable outcomes.

- Job and task analysis

  The job and task analysis will catalog and evaluate the needed skills, knowledge, and abilities of power plant operators. During this step a comprehensive list or matrix of requirements will be identified. The matrix will become the foundation of the qualification standard. Users will add plant-specific requirements.

- Training analysis

  The training analysis will investigate training delivery and media options. This will include evaluating current training programs, delivery methods, cost, and availability of quality training programs.

The documents and matrices in Appendix A, generated during the EPRI analysis, are guidelines to use in developing your program. A review of our analysis follows. Perform similar activities and expand on these, analyze your plant, and customize your training system.

Administrative Analysis

Operational philosophies are reviewed to ensure that training program objectives meet management objectives. Pass/fail criteria must be prepared for management approval. The target audience is identified and program goals are generated. A project schedule or timeline is established, and objectives are presented to management for approval. When you earn approval at this stage, you establish management commitment, a key to program success. See Figure 3-1.

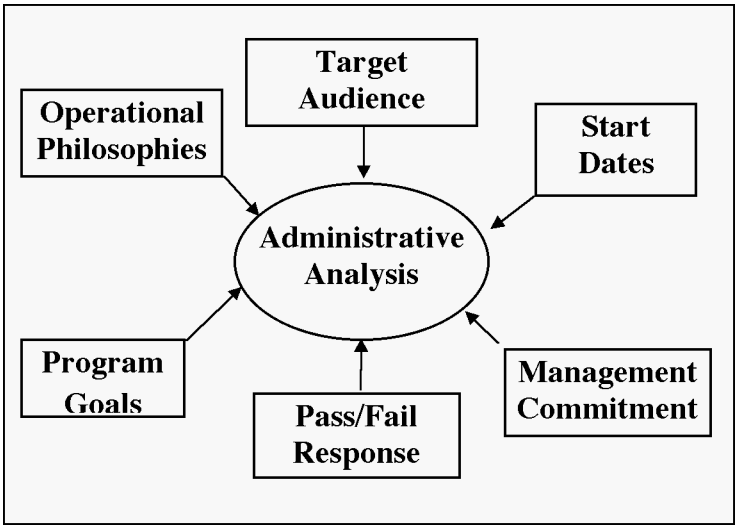

Figure 3-1
Administrative Analysis

Job and Task Analysis

The job and task analysis will evaluate job positions. Standards are developed for each position. Standards include job descriptions and a list of tasks associated with each position. The tasks are then broken down to specific knowledge and skill requirements to support each task. See Figure 3-2.

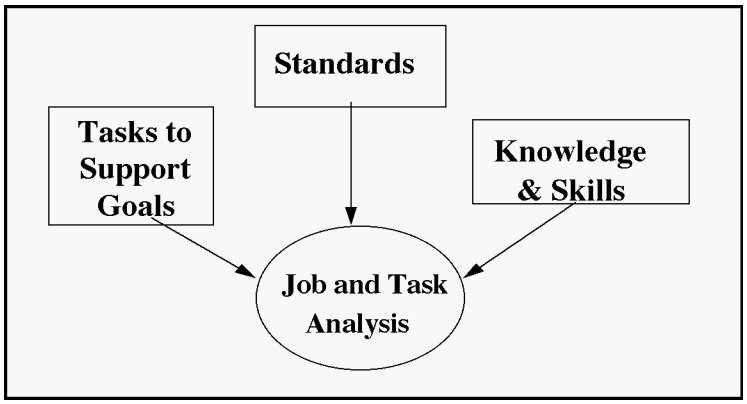

Figure 3-2
Job and Task Analysis

The EPRI Qualification Standard will include two phases within the training system: basic skills and operator skills.

The basic skills phase includes the knowledge and skills that you expect an entry-level operator to already possess. This phase will include some training, but it might also include qualification of prerequisites that are not a part of the training event. When candidates successfully complete basic skills qualification (see Figure 3-3), they earn the title of entry-level operator.

Figure 3-3
Training System Phase I

In the operator skills phase, the entry-level operator will receive training and earn qualification at each job level. The operator skills phase has three levels: auxiliary operator, assistant control room operator, and control room operator. See Figure 3-4.

Figure 3-4
Training System Phase II

Determine Job Descriptions and Task Lists

Each phase includes job descriptions and task matrixes that list job requirements. Review these documents and customize them for your location. At this point, you are not concerned with how you might divide the list of requirements, but that the list is complete.

To successfully customize each task matrix, the template is structured by plant systems. This helps prompt the review process to look beyond the job positions and encompass plant equipment and activities as well. Remember that task matrixes include routine, non-routine, and emergency tasks. Also include soft skills—human performance skills—that enable the operator to successfully perform job-specific skills.

Determine Job Task Objectives

Job task objectives are learning goals that clearly state the knowledge, skill, or ability that the trainee should demonstrate. The objectives state the conditions and the *standards of performance*. The course or job task descriptions provide the framework for the development of core competencies and lesson plans. Evaluation standards or *core competencies* are the criteria by which the instructor/evaluator determines if a trainee has sufficient mastery of the course or job task objectives.

Objectives should follow these guidelines

- Does the step contain an action verb and a direct object?
- Is the step broad enough to cover a significant section of the knowledge, skill, or ability without being all encompassing?
- Is it easy to determine if the trainee accomplished the objective?

During a job and task analysis, objectives should be generated that contained three distinct parts: initial condition, action verb, and *standard*. The standard portion of the objective becomes the core competency. See examples in Table 3-1.

Table 3-1
Generic Standard Example

Generic Standard Example: For Equipment Limits	
Good:	Operator maintains furnace pressure within normal operating limits.
Bad:	Operator constantly monitors furnace pressure.
Good:	Operator verifies starting permissive prior to starting any equipment.
Bad:	Operator knows equipment starting permissive.

Training Analysis

The training analysis is both a data gathering and a data developing effort. See Figure 3-5. The data gathered in this activity are used in other ISD steps. The objectives of the training analysis are:

- Identify resources for development, implementation, and evaluation of the training program.
- Determine training facilities and training aid capabilities.
- Decide what tasks will be included in the training program.

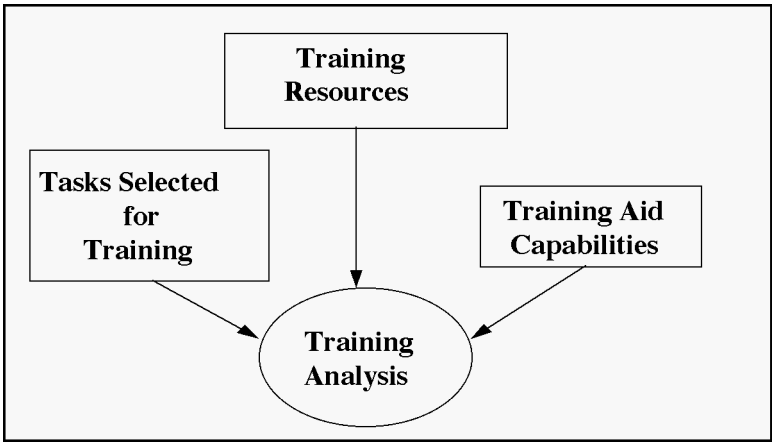

Figure 3-5
Training Analysis

Step 1: Identify Resources.

Resources must be identified during the training analysis. Be sure to determine if the resources desired are actually available and within the budget. See Figure 3-6.

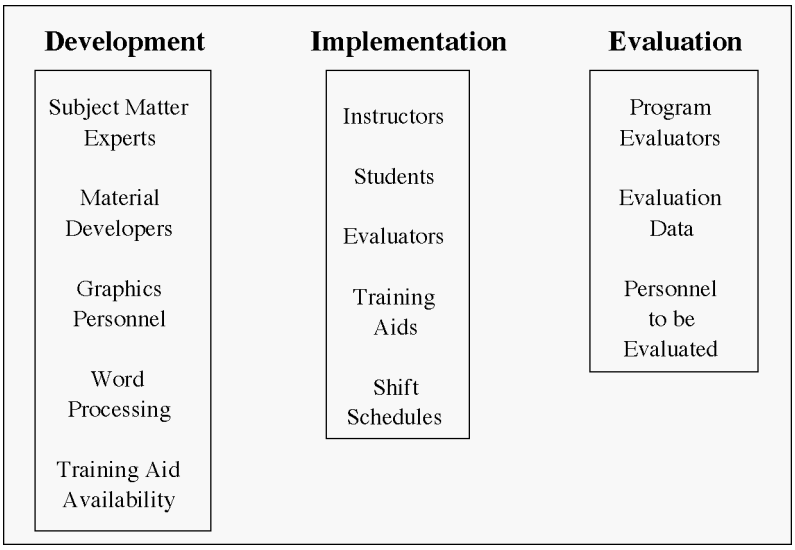

Figure 3-6
Types of Resources

Step 2: Training Capabilities

Using the task matrix, subject matter experts can determine what training aids are needed. Be sure to discuss the capabilities and limitations of each training aid selected.

Step 3: Tasks Selected for Training

There must be a selection process due to the large number of tasks that will be generated. There will never be enough time, instructors, trainees, or training aids to accomplish all the tasks. Now is the time to narrow the list. The truth table shown in Figure 3-7 can be used as the first pass at reducing the number of tasks in the program.

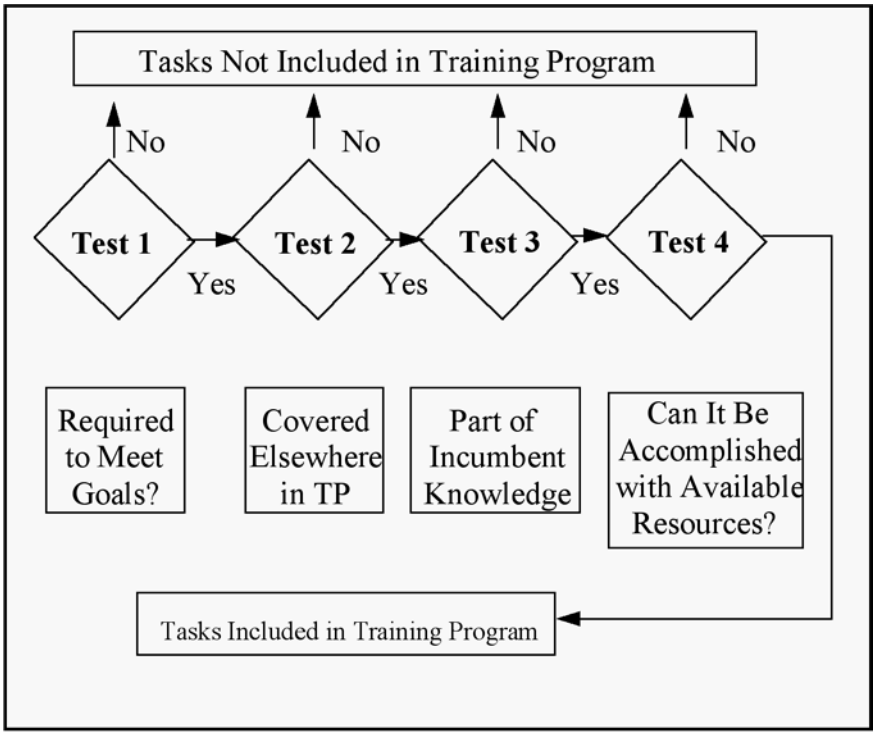

Figure 3-7
Truth Table – Task Selection

The training value test is another method to further reduce the list. Ask the following questions.

- Is accomplishment of the task one of or part of the goals for the training program?
- Is the task covered elsewhere in the training program or in other training program currently underway at the facility?
- Is the task part of the "incumbent knowledge" for the job?
- Can the training task be accomplished with the current training resources?

4
ISD MODEL - DESIGN

The training system specification is developed during the design step. For this report, EPRI's training system design specification is called the Qualification Standard. It becomes the operating guideline that manages the training system model. In this section, we will review how the EPRI Qualification Standard was developed. As you follow this section, take the time to use the documents and matrix in Appendix B. These tools will help you to customize the Qualification Standard and develop your training system. This section reviews Step 2, Design, of the ISD model.

Design Step

The training system design specification contains the following items, which are shown in Figure 4-1:

- Terminal objectives: learning goals for each operator level
- Evaluation standards: criteria by which the evaluator determines if an operator has sufficient mastery of the terminal objective
- Training method: appropriate learning environment to accomplish the terminal objective
- Evaluation instruments: design of the hardware, software, and courseware that will be used to perform the evaluation of the operators

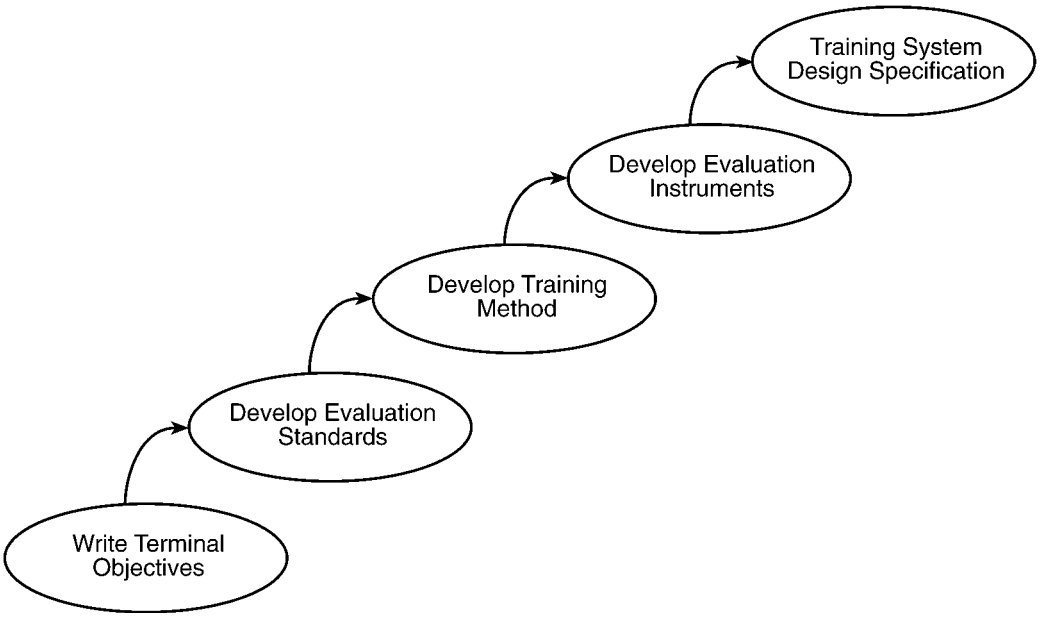

Figure 4-1
Training System Design Process

Writing Terminal Objectives

Terminal objectives are learning goals that clearly state the knowledge, skill, or ability that the trainee should demonstrate, including the conditions and standards of performance. These are translated from the task matrix and provide the framework for the development of evaluation standards and lesson plans. Terminal objectives should be clear and easily understood by management and the target audience. See Table 4-1.

Table 4-1
Terminal Objective Examples

Terminal Objective Examples:
Perform routine tasks from memory without assistance while maintaining normal plant operations, safety, and environmental compliance.
Recognize and take corrective action when selected abnormal or alarm conditions occur to bring plant to stable condition, from memory and then refer to plant procedures if needed to complete required tasks.
Communicate with personnel during routine operation, per procedures, without prompts.
Interface effectively with plant personnel during abnormal and emergency conditions with required precise and logical thinking.

Developing Evaluation Standards

Evaluation standards are the criteria by which the instructor/evaluator determines if a trainee has sufficient mastery of the terminal objective. See Table 4-2.

Table 4-2
Evaluation Standard Examples

Evaluation Standard Examples:
Performs routine tasks from memory without prompting or assistance.
Performs selected nonroutine tasks from memory without prompting or assistance (may also use the standard “when prompted” instead of “from memory” or the condition “referring to plant procedures” instead of “without prompting”).
Performs task keeping the following parameters in the normal range. (List the parameters.)

Writing the Generic Standards

Using the operational philosophy and training goals discussed in the analysis section, make a list of the practices that apply to all training programs or courses. These practices can come directly from the generic objectives. See Table 4-3.

Table 4-3
Generic Standard Examples

Generic Standard Examples:
Perform the task following safe operating guidelines.
Perform the task as written in the work procedure.
Perform the task wearing proper personal protective equipment (PPE).
Stop the task if an unsafe condition is recognized.

Writing Specific Standards for Each Terminal Objective

Using information determined in the analysis, write a statement that identifies the system- or plant-oriented endpoint of each terminal objective. See Table 4-4.

Table 4-4
Generic Standard Examples

Specific Standards for Terminal Objectives Examples:
The training program should train the people who could operate plant equipment from the new control board and all those personnel who might be called upon to operate the power plant in the future.
What's Wrong?
This goal is not simple and straightforward. Beware of statements such as "people who could operate." A better statement would be simply "plant operators."
This statement provides no measurable success criteria. How would someone determine if an attendee were trained?
This statement is not attainable. How could any program train "all those personnel who might be called upon to operate the power plant in the future"?
There is no timetable for accomplishment. From this statement, someone could work on this goal forever and still be meeting the goal.
The statement is not a requirement. Beware of statements with should, might, and other such vague words.
GOOD:
Upon successful completion of the program, control room operators will be able to take the plant from a cold iron condition to full load in less than 24 hours, not counting time for silica holds.

Objectives and standards will be written at many times. Objective setting will occur at these levels: Qualification Standard, training system, each operator level, and each task level.

Determining a Training Method

After the terminal objectives and standards have been developed, the designer must select appropriate training methods to accomplish each objective. The designer should remember that the end result is to create an event where the trainee learns. You might elect multiple methods for an objective. See Table 4-5.

Table 4-5
Training Method Example

Multiple Training Method Example:
First, review the material in the classroom, and then run supporting exercises on the simulator or in the field.

Each objective is matched to the best training method, given the resources that are available. Table 4-6 includes sections for each task description and the training methods selected for the given terminal objectives.

Table 4-6
Training Method to Terminal Objectives - Example

Course	Approach Used	Terminal Objectives
Control Room and Control System Orientation	Classroom – Discussions of terminology and actions required for equipment manipulation. Simulator - Operators are given "lab" time to work with the control system and thereby reinforce equipment manipulation skills, as well as become comfortable with the arrangement and presentation of data from the control system.	LIST the duties and responsibilities of the control room operator. LOCATE the major control stations for plant equipment. ACCESS the sections of the control system. PERFORM operational uses of the control system, such as trending, generating reports, logging, and alarm manipulation. DEFINE plant availability factor, and LIST five specific ways that the operator can affect the plant availability factor. DEFINE plant heat rate, and LIST four specific ways that the operator can affect the heat rate.
Systems Orientation	Classroom - Discussions of control modes, control signals, equipment manipulation, control graphics, and operator interface with the system equipment. Simulator - Demonstrations of interlocks, trip functions, and control system actions. Independent Study - Operators will use study guides to walk down sections of the systems to locate the components in flow path order and to develop a knowledge of plant components.	STATE the power generation function of the system. DRAW and LABEL a simplified schematic of the system with all of the major components in flow path order. LIST the normal operational parameters for the systems, and STATE where these parameters are read in the control room. LIST the location of systems controls. STATE all major control inputs and outputs of the system. STATE the principle of operations for all procedural steps, trip functions and /or interlocks, alarms, and environmental regulations for the systems. LIST the systems that support the operation of this system. LIST any support requirements that the system fulfills. LIST any applicable system-specific safety precautions and the reasons for the precautions.
Plant Operations	Classroom - Discussion of when, why, and how the systems and equipment are started up and shut down. Discussion of diagnosis, analysis, and control system manipulations for transient management.	DIAGNOSE operational situations, and INITIATE corrective action within five seconds if the parameters exceed the normal operating limits/values for the learning event being performed. Upon direction, FIND control stations/graphics and initiate actions for operation of the equipment within five seconds.

Course	Approach Used	Terminal Objectives
Plant Operations (Continued)	Discussion of diagnosis, analysis, and control system manipulation for heat rate improvement. Simulator - Actual control system manipulation to accomplish functions and/or demonstrate accomplishment of objectives. Performance of transient management scenarios that reinforce classroom lessons and present new situations for testing of diagnosis, analysis, and other skills.	PERFORM procedural steps from memory for those steps requiring immediate operator action. STATE the reason for all procedural steps. SOLVE problems dealing with theoretical applications for the given circumstances. DEMONSTRATE proper event reporting in accordance with plant operating procedures.

Developing Evaluation Methods

An evaluation method is selected to maintain consistency with the objectives and training methods. It should measure the trainee's performance against the standards stated in the learning objectives. There are a number of possible evaluation methods from which to choose:

- Formal testing, written and oral - Indicates that a set of test questions will be developed. Need to specify type, etc.
- Demonstration on the simulator, monitored by an evaluator - Indicates that there will be evaluated exercises devised.
- Walk-through in the plant - Indicates the need for developing guided questions, check lists, pictures, slides, or video tapes.
- Actual accomplishment of the task in the facility, monitored by an evaluator.

Whatever the method or instrument chosen, the designer should keep the following in mind:

- The best way to determine if a person accomplished an objective does *not* yield a grade. Either the person accomplished the objective or they did not.
- If the trainee did not accomplish all the objectives, they did not "pass." Do not use objectives that do not need to be mastered to pass the course.
- Chose evaluation methods that are impartial. Use plant indicators when possible.

Summary: The Training System Design Specification

The analysis phase and the preliminary design work are complete. As with any project, after the front-end work is done, it is time to collate the data into a design specification. Appendix B includes the Sample Training System Specification Form. The EPRI Qualification Standard is the guideline to developing your plant-specific training system design specification.

The design specification contains the following parts:

Introduction

This part should open with a statement that defines what the project is about, what it is for and to what it applies. A brief description should be included about who will prepare and present the program as well as who is the final approval authority.

Objective

Objectives should clearly state what the program is supposed to accomplish. The goals of the training program should be stated along with methods to measure program success.

General Requirements

This section should specify what types of training material (plant-specific as well as generic) would be used. There should be a clear statement as to the source of the material, who will provide it, when they will provide it, and the location of reference material for training program development. This section should define the hardware and software requirements for the word processing and graphic files.

Courses and Materials to Be Prepared

This section should list:

- All the courses, demonstrations, and OJT requirements
- Terminal objectives for each phase of training
- Instructor formats and what the training material will consist of
- What constitutes a complete training package
- A training schedule for each operator level

Management

This section is a description of how the training system will be managed. Personnel and their responsibilities are described in this section. How trainee selection is made, who determines trainer and mentor assignments, reports and record keeping, evaluation guidelines, etc., are included in this section.

Training System

This section is a description of the dynamic training system. The learning system for each training level is covered. A step-by-step guide is written for the trainee. The guide describes training material, training events, and qualification guidelines.

Project Schedule

This section spells out delivery schedules, presentation schedules, and project management information such as how and by whom the material will be prepared and reviewed.

5
ISD MODEL - DEVELOPMENT

Successful qualification requires learning events that include practice to master knowledge and skills. These guidelines will be valuable as you customize your training materials. As you follow this section, take the time to use the documents in Appendix C. This section reviews Step 3, Development, of the ISD model.

Development Process

The developmental process is a step-by-step production of training material. The end result is verified and validated training material. General guidelines include:

- Title: The title presents the content of the lesson or procedure.
- Rationale statement: The rationale statement tells the trainee why the training is important by stating what the trainee can do with the knowledge and skills that he or she acquires.
- Training objectives: The training objectives specify what the trainee should know or be able to do as a result of the training.
- Trainee prerequisites: Trainee prerequisites are the knowledge, skills, and behaviors that trainees must possess on entering the training session.
- Training resources: Training resources specify the resources needed for training.
- Training content: The training module should document the learning situation completely.
- Training events: Training events describe how to deliver information or structured OJT to trainees in the most effective way.
- Performance tests and feedback forms: Each lesson includes the appropriate performance tests to document the trainees' performance (pass or fail), such as performance-rating scales or cognitive tests (for example, job performance measures).
- Validation: Each lesson plan or written procedure will be practiced in the work place using knowledgeable operators to verify procedural accuracy, and the results documented.
- Additional information: A training module can also include additional information that serves to supplement or enrich the training content.

Training Material Development

Training material should be developed using a process that produces validated and verified documents. The developmental process consists of six steps to produce validated training material. The six steps are shown in Figure 5-1.

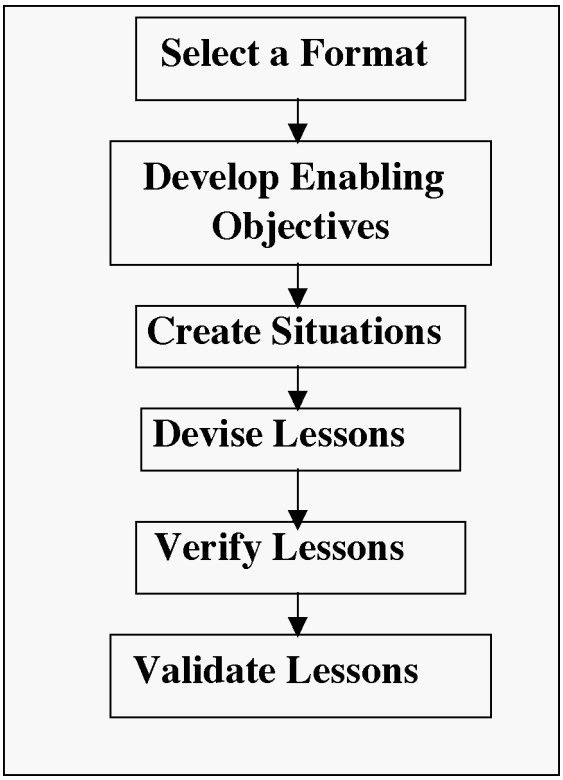

Figure 5-1
Training Material Development

Selecting a Format

Format determines how the material looks and what tools will be used in development.

Develop the Enabling Objectives

This step develops the elements of the terminal objectives. The enabling objectives are those required tasks that enable accomplishment of the terminal objectives.

Create Learning Situations

Creating learning situations will allow demonstration and practice to master the objectives.

Devise Lessons

Use plant drawings, plant knowledge, or other references to structure the lessons. The presentation should lead trainees into the desired learning events.

Verify the Lessons

Practice presenting the lesson material to ensure that it directly conveys the information to be learned by the trainee in a smooth and logical fashion.

Validate the Lessons

Perform the lesson with several "sample" trainees who are representative of the training program target population. Ask questions to learn if the objectives have been met.

Lesson Plan/Instructor Guide

A lesson plan includes the sequential set of events that lead to a desired goal and a checklist of necessary actions to accomplish the objectives. A lesson plan summarizes who will conduct the instruction; to whom the instruction is directed; and what, where, when, why, and how the instruction will take place. The lesson plan controls consistency of training.

In addition to describing the training itself, the lesson plan specifies objectives, needed materials and tools, the way the lesson complements other training, and the date the lesson was completed. A lesson plan worksheet is designed to guide the development of each lesson plan. Appendix C contains a sample lesson plan, developed by answering the following questions.

- What is the lesson title?
- Who is the trainee? (Should be a description of the target audience.)
- Who is the trainer? (Should be a qualification list for prospective trainers.)
- Why is training being conducted now? (Provide reasons.)
- What are the training objectives (What should the trainee be able to do upon completion of the lesson?)
- What materials, equipment, tools, or other resources are necessary to conduct training?
- How does this lesson connect to or fit in with other training?
- What training will be presented, and how will it be presented?
- How will the trainee's mastery of the objectives be assessed or verified?

The developer should use the lesson plan worksheet to help focus on the needs to be met by the lesson plan. When the lesson plan is complete, the lesson plan worksheet should be reviewed to ensure that all questions in the lesson plan are answered.

Trainee Handouts

Trainees learn better if they are exposed to the material before the presentation. Trainees retain information better if they leave class with material or have access to the material in the workplace. The material will help them to picture or recreate the learning event and associate the learned performance with the current job situation.

When preparing trainee handouts, ask yourself if it will be relatively easy to keep the trainee handout current and up to date. Effective options include placing the material in reference binders or where it can be accessed by computer stations in the workplace. There are software packages available that can catalogue training material for easy access by trainees. Other features include document management, revision control, and even steps to manage the training process itself. See Table 5-1.

Table 5-1
Training Material Document Control

Material Type	Document Control Method	Phrase on the Bottom of Each Printed Page
Trainee Handout	Date each page	This learning guide is good for this training session only – *insert date.* Current procedures and reference material are located - *insert location*.
Learning Management Software	Date each printable page	This document is valid for today's date only – *insert date*. Current procedures and reference material are located - *insert location*.
Reference Binders	Color code section of text	If this document is missing the – *insert description of colored text,* – then this is a copy and may contain outdated information. Current procedures and reference material are located - *insert location*.

Remember that it is critical for the operators to know where they can find needed information. Be sure to include prompts and actual practice in finding the available information in each lesson plan.

System Description Guidelines

System descriptions contain narratives about the system design and operation, one-line drawings, charts of equipment data and operating parameters, and illustrations or pictures, as applicable.

These documents will be one of the trainee's first steps to linking basic knowledge and skill to actual job tasks. The flow of information must be presented to include enough detail without overwhelming the trainee. Format design will structure the information so that it is easy to read and serves as a source for reference data about equipment design and plant operating guidelines. See Table 5-2.

Table 5-2
System Description Table of Contents

System Description Chapters	Example Knowledge Exercise Used for Qualification
Purpose and Major Actions	Draw a simple line diagram showing system inputs and outputs.
Flow Diagram	Using the mock flow diagram, label the components.
Components	Trace the plant system, locating each component. Identify the parts of each component and describe their normal operation.
Instruments and Controls	Locate each instrument in the field and add instruments to the mock flow diagram. Describe how each controller will change the system indicators' readouts.
Critical Control Parameters	Complete a chart defining the normal operating range, alarm points, and location of each indicator.
Emergency Conditions	Locate the interlock devices in the field, and complete the logic chart for each device, describing the abnormal condition that caused the trip.
Review	Answer essay questions that test your ability to apply this knowledge to operating scenarios.

The training material developers should craft knowledge exercises with input from the appropriate plant staff. Evaluation can be done the same way as other training methods or a special feature of the evaluation might be to allow the operations crew to measure trainee performance. This form of evaluation is easily adapted to a mentor-trainee style of self-study. When using crew qualification, the crew has an opportunity to instill expectations of the trainee. And it eliminates the old phrase, "The trainer told me…"

For example, instead of simply asking "When will the drum level trip the fuel out of the furnace?", a knowledge exercise requires activities in the work place. The evaluation might include asking the trainee to locate the drum level equipment in the control room, draw what the drum level indicator looks like, discuss the instrument with the control room operator, and mark the drawing to indicate the alarm and trip points. The learning is more complete, more in context, and more memorable.

Test Banks

If test banks are used, there should be a complete set of exam questions with answers. Each objective should have at least two relevant questions with answers prepared. The test questions can be of the multiple choice, fill in the blank, or other type. The questions should not be the true/false type.

The difficulty of the questions should be rated on a scale from 1 to 10, and the questions should apply precisely to the objectives of the lesson. Separate answer sheets should be provided with explanations of the correct answer and/or location within the trainee handout or instructor guide. The answer should indicate specifically to what objective the examination question applies.

SOJT Qualification Guides

The purpose of the qualification guide is to ensure consistent delivery of training—a key component in performance-based training. Standard features of a qualification guide include:

- Outlines the information from the training standard and the evaluation standard in one location.
- Specifies whether the requirements are perform, simulate (walk-through), or discuss.
- Lists acceptable methods of satisfying the knowledge requirements (for example, complete classroom lesson XYZ, complete CBT module XYZ, etc.).
- Identifies trainee prerequisites, learning activities, training equipment, materials needed for training, and specific guidance for their use.
- Lists references and the resources (equipment, material, etc.) to aid in the completion of the task training and qualification.
- Provides specific direction to the instructor for guiding the learning process.

Training System Qualification Guide

The qualification guide template can also be used to provide the trainee with information on how the training program operates, what will be expected of him/her, and how or where to obtain training-related help. It should provide the trainee with information regarding the use of the training materials and qualification cards, and how to use the qualification guide. This section of the qualification standard should also address:

- Restrictions on unsupervised trainee operation of unit equipment/systems
- Guidelines on self-study
- Guidelines on improving listening habits
- Established goals and how trainee progress will be tracked
- Expectations for trainee interaction with the coordinator or his or her supervisor regarding training
- Performance test preparation

When the qualification guide is completed, reviewed, and validated, the qualification guide provides a comprehensive definition of that job position. It becomes the standard for all training related to that job position.

OJT Qualification Cards

The qualification card provides a record of the trainee’s progress. The trainee must perform (P), simulate (S), or discuss (D) all performance items on the qualification card. Each performance item will specify the level of performance expected for sign-off.

6
ISD MODEL - IMPLEMENTATION

The EPRI Qualification Standard outlines an implementation plan that must be customized for your location. This section provides "how-to" instructions to plan the implementation of your training system. As you follow this section, use the EPRI Qualification Standard and your training system design specification. This section describes Step 4, Implementation, of the ISD model.

At this point, final job-level descriptions and qualification requirements have been developed. Your training system has a number of phases. This section uses the EPRI model of a six-phase training system. A structured procedure-based system has been developed that *expands* the knowledge and skill of the job applicant through job levels to the control room operator position, as shown in Figure 6-1.

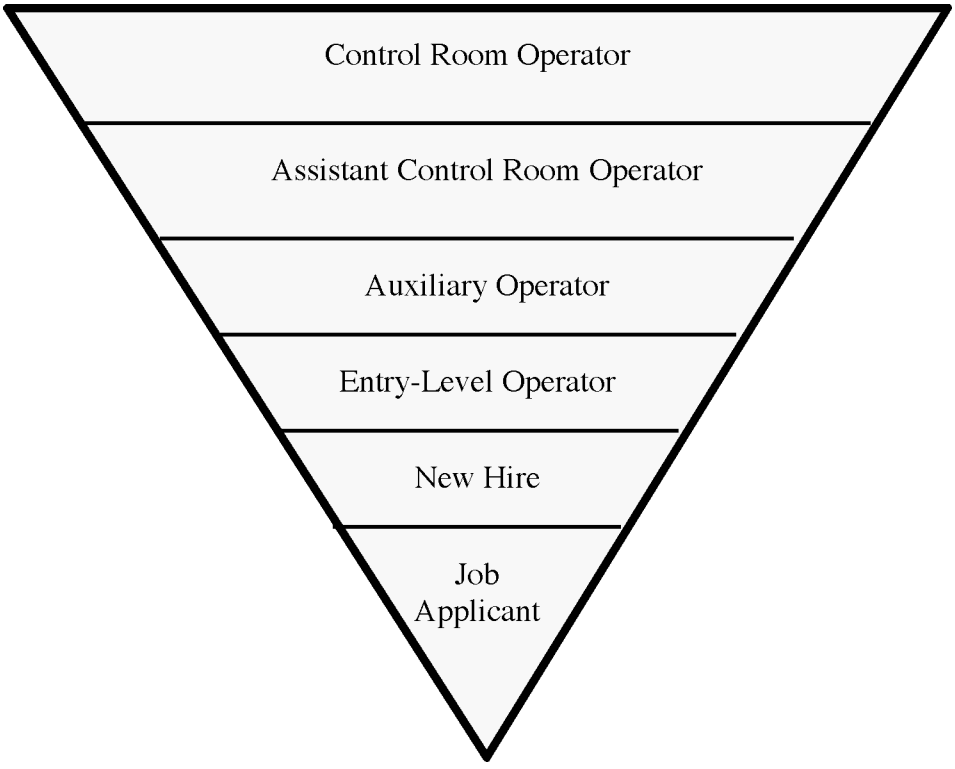

Figure 6-1
Training System Model

The EPRI Qualification Standard describes a training system model. Each level contains learning activities, practice to prepare the trainee for qualification, and a qualification guide. The guide

prepares the operating team, training team, and employee for training. The qualification guide template is discussed in this section.

The Training System Team

Training System Coordinator

The training system at a plant may have many instructors for training and qualification. However, one person from the line organization staff or the training department staff should be designated as the training system coordinator. The training system may have a coordinator for each phase of training. The duties of the coordinator should include:

- Communicate training system procedures to plant personnel.
- Tailor the training system to individual trainees.
- Provide the trainee with a schedule, access to materials, and qualification requirements.
- Provide assistance to instructors and trainees.
- Track trainee progress and set target dates to reach qualification milestones/goals.
- Ensure proper documentation of training and performance tests.
- Provide program feedback, and evaluate the effectiveness of program materials and instructors.
- Schedule training to take advantage of unusual or infrequent job-related activities.
- Counsel trainees and assign remedial training resulting from unsatisfactory performance.
- Maintain communication with instructors regarding program and qualification progress.
- Perform entry-level evaluations of trainee's knowledge and skills.
- Provide the trainee with an overview of the OJT program.
- Provide coordination of and documentation of exemption requests for training requirements.

Training Mentors, Instructors, and Evaluators

All training styles require human contact with the trainee. Self-study training uses a mentor who is available while the trainee is performing self-study lessons. The mentor not only answers questions but also will seek out the trainee for meaningful contact during training. Meaningful contact includes discussions to assess the trainee's progress, feedback, and reinforcement of training system procedures.

At some point, formal instructors will be used, typically during SOJT. Lesson plans summarize presentation, demonstration, feedback, and evaluation steps to ensure consistency of training sessions.

You may choose to have a different person evaluate the trainee instead of the instructor. Both methods achieve effective results. The evaluation phase should be separate and distinct from the instruction phase. During the evaluation phase, the instructor or evaluator tests the trainee; the time for instruction has ended.

Trainee

The trainee is an employee who, at the current position, has the prerequisites and opportunity to progress to the next level. After the employee is designated as a trainee, the training coordinator will schedule the appropriate training activities. The trainee will review the qualification guide and begin the required training events. This review will occur with the training coordinator or designated training instructor/mentor.

Presenting Training Phases

The training schedule, delivery, and qualification must be defined. To achieve the intended training objectives, training delivery should include the five training events listed below. It is assumed that the instructor/mentor and the training site are prepared.

- Prepare the trainee.
- Present the training.
- Let the trainee perform the knowledge exercises or the task.
- Provide feedback to the trainee.
- Evaluate the trainee's performance.

These steps are valuable in all types of training, especially for training with no instructor and limited contact with a training mentor. Lesson guidelines describe how to deliver each training event. The information is presented in a procedural format to enhance a complete understanding of this process. When instructors are used, they should be encouraged, after gaining experience, to blend their own individual styles into training delivery. Communication of information is vital to successful trainee performance. Planned contact with the trainee and planned feedback are important activities during the training process.

Prepare the Trainee

There are five main actions required to prepare the trainee for the learning experience. They are as follows:

- Explain the purpose and rationale of training.
- Determine whether the trainee has the prerequisites.
- Explain general safety and quality requirements.

- Explain how training will be done.
- Respond to questions about the training.

A training mentor or instructor should perform the same basic five actions for all styles of training. In practice, this training event can occur immediately before the training, a few hours before the training, or even a few days before the training. Sometimes, this training event takes place well before the SOJT so that the trainee has plenty of time to review the training module. When this training event occurs often depends on the complexity or the difficulty of the task.

Present the Training Lesson

Basic Skills and System Descriptions

Basic skills and system descriptions are shared at all levels. Knowledge and skills might simply be reviewed and evaluation of ability be planned for a qualification exercise. Other times, planned instruction will take place. Knowledge events are easily adapted to self-study. Computer-based training (CBT), workbook-style training like NUS books, and site-specific system descriptions can be effective when the trainee has contact with a training mentor.

This type of training requires close connection with job expectations for it to become meaningful and valuable to the trainee. Retention is low if the training is not connected to job tasks. The mentor's role includes reviewing knowledge exercises that give the trainee practice in using the information.

SOJT

The instructor demonstrates how to perform the job function and how to meet measurable performance standards. The instructor actually shows the trainee what to do, often with the trainee and instructor standing or sitting side by side. The instructor should discuss performance cues that provide guidance about what to do, the ways the trainee can recognize these cues in the future, and the exceptions, if any, to the procedure being taught.

Depending on the type of training being administered, effective presentation steps vary. See Table 6-1.

Table 6-1
Methods of Presenting Information

Managerial (Administrative)	Technical	Awareness
Position the trainee.	Position the trainee.	Position the trainee.
Present an overview of the model or process.	Present overview of operation, equipment, or workflow.	Present an overview of the topic or issue.
		Inform
Present examples of the model or process in use.	Describe and show each behavior.	Explain the parts of the topic or issue.
Explain parts of the model or process.	Explain specific safety and quality points.	Present examples of the topic or issue.
		Motivate
Demonstrate techniques, applying the model or process.	Summarize the entire task.	Describe the present condition and its consequences.
Summarize the entire task.		Describe the desired condition and the associated opportunities.
		Present examples of the desired condition.
		Describe the implications for individuals and the organization.
		Discuss commitment behaviors.

After the instructor has demonstrated to the trainee how to perform the task, the next step should be to reinforce what was just demonstrated by explaining and emphasizing the key points of the task. At this point, the instructor may want to question the trainee to double-check what he or she knows about the task-related knowledge:

- Who should perform this action?
- What should be done?
- When should the function be performed?
- Where should this function be performed, and what tools, equipment, or other support devices should be used?
- Why should the function be performed? How does the function relate to the work of others? How does it help to meet or exceed customer needs?
- How should the function be performed? Are there policies, procedures, or regulations that affect the way the function is to be performed, or do trainees have the discretion to perform the task however they see fit?
- How is success measured? What are the performance standards that affect the function?

Let the Trainee Perform the Task

Research on short-term memory suggests that people forget about 75 percent of what they learn within 48 hours. Letting the trainee perform the task with the assistance of the instructor increases the odds that what has been demonstrated will be retained.

Letting the trainee perform the task at this point will reinforce the learning; however, if the complexity of the task is too great (chunks are too big), it may be advisable to break the performance into two distinct steps as follows:

1. Let the trainee perform the simple parts of the job. Complex activities should be broken down into discrete, manageable parts, and the trainee given a chance to demonstrate the simplest parts first with instructor feedback. The instructor should offer constructive feedback, praising what is done right and offering suggestions for improvement. The importance of feedback in improving individual performance is great and should not be underestimated.

2. Let the trainee perform the whole job. When the trainee can perform the simple parts of the task, the trainee is allowed to perform the whole task under the supervision of the instructor. The trainee becomes self-confident and the instructor more observant. The instructor should provide feedback only when the trainee is experiencing significant performance problems, when he/she asks for help, or when there is a safety or quality issue.

Managerial, technical, and awareness types of training require different types of responses from the trainees. See Table 6-2.

Table 6-2
Methods to Collect Desired Responses from the Trainee

Managerial (Administrative)	Technical	Awareness
Ask the trainee to explain the purpose and rationale.	Ask the trainee to explain the purpose and rationale.	Ask the trainee to explain the purpose and rationale.
Ask the trainee to describe the model or process.	Ask the trainee to present an overview.	Ask the trainee to present an overview of topic or issue.
		Inform
Ask the trainee for examples of the model or process in use.	Ask the trainee to explain general safety and quality requirements.	Ask the trainee to explain the parts of the topic in his or her own words.
Ask the trainee to explain parts of the model or process.	Ask the trainee to show and describe each behavior.	Ask the trainee for examples of the topic.
		Motivate
Ask the trainee to demonstrate techniques.	Ask the trainee to explain specific safety and quality requirements.	Ask the trainee to describe the present condition and its consequences in his or her own words
Ask the trainee to summarize the task.	Ask the trainee to summarize the entire task.	Ask the trainee to describe the desired condition and the associated opportunities.
		Ask the trainee for examples of the desired condition.
		Ask the trainee to discuss the implications for him or her and others.
		Ask the trainee to describe commitment behaviors.

By this time, the instructor has faded from the scene, leaving the trainee alone to perform the whole job and assume responsibility for it. Instructors who are reluctant to allow workers to function independently risk encouraging time-consuming dependency. They also reinforce the unwillingness of some trainees with low self-esteem to assume complete responsibility for what they do.

Provide Feedback

Three main actions are required by the instructor to provide feedback based on an objective assessment of the adequacy of the trainee's response. They are as follows:

- Inform about the correctness of responses
- Provide coaching and guidance as required
- Point out embedded cues in the task setting

While it is important for the instructor to provide the trainee with feedback and coaching, not all the feedback should come from the instructor. The instructor should help trainees to identify independent sources of feedback embedded in the task itself. Feedback is often more effective when it comes from sources that tell the trainee directly whether his or her response is correct without necessarily involving others.

Evaluate Performance

Three main actions are required by the instructor to determine whether the trainee has, in fact, achieved the intended training objective. The actions are as follows:

- Evaluate the trainee's self-report
- Evaluate the performance test results
- Document the trainee’s performance

The instructor will use trainee self-reports and objective performance tests to determine whether the trainee has achieved the intended training objective. The instructor considers the available information and documents the decision on the trainee’s qualification card and in the trainee's development plan or similar personnel record.

Cognitive tests can be useful in testing the understanding of concepts and principles associated with awareness training. Tests are often used for basic skills training. The tests can be either oral or written. Each question has a predetermined minimum response that must be earned for the trainee to receive a passing score.

Activities planned in the workplace provide for evaluation of the trainee by the work crew. This evaluation method provides a connection between knowledge and job expectations. This method of evaluation is popular for system description training.

The term *trainee self-report* refers to the trainee's own evaluation of his or her progress. To gather such information, the instructor should ask the trainee to reflect critically on what he or she has accomplished and on the areas in which he or she may require additional practice. An instructor should not be coy. For example, you can ask directly, “Do you feel that you have achieved the objective? Do you think you can now perform the task on your own? What areas of the task are still unclear to you?”

The term *performance test* refers to the instructor's judgment of the adequacy of the trainee's responses. The instructor bases his or her judgment on standards that refer to the training objectives.

Qualification

Qualification guides are used for each training phase. These guides are divided into tasks or groups of tasks. Each guide defines the knowledge and performance objectives that satisfy the requirements of the task. The evaluation standards are also specified. Each guide is a stand-alone document that specifies the qualification requirements.

The qualification card is the trainee's way to document and track his or her progress through the qualification process. When the trainee has studied the associated material indicated in the qualification guide and walked through the performance with the instructor or mentor, the trainee can arrange for an evaluator to evaluate his or her performance and knowledge related to that task or group of tasks. Upon satisfactory completion of the evaluation, the evaluator signs those items on the trainee's qualification card.

The use of qualification cards accomplishes the goals of the program with minimal impact on the instructor-mentor. It shares the burden of learning with the individual trainee as well as the training team.

7
ISD MODEL - EVALUATION

The evaluation step describes methods to evaluate how well the training system is functioning. The management portion of the training system, as well as the learning portion, will be evaluated. The EPRI Qualification Standard includes a section on evaluation. Use this to customize the evaluation section of your training system design specification. Appendix D provides a Training System Evaluation Sample Form. This section covers Step 5, Evaluation, of the ISD model.

Evaluation Resources

The training system must be evaluated to see if it met the objectives. To perform an evaluation, you will need:

- Training system evaluators

  Select personnel to perform the training system assessment. The evaluators should not be the instructors or the developers.

- Evaluation data

  The availability of comparison data is important. It is impossible to determine if the heat rate has been improved if the “before” heat rate is not known. Baseline data should be collected during the training system analysis and design steps.

- Personnel to be evaluated

  Select personnel currently in training, personnel who recently completed training, and experienced operators. Also, interview the training coordinator, instructors, mentors, evaluators, and subject matter experts. Observing personnel performing tasks in the workplace is an effective method to evaluate operator skill and the ability to follow written procedures.

Evaluation Plan

Training system evaluations should occur on a set frequency. There are three types of evaluation: trainee’s reaction, learning system, and management system.

Trainee's Reaction

This evaluation will show whether the training program met with the approval of the target population. It does not verify that the training met its objectives.

Each trainee's reaction should be collected after each training event. The qualification guide and card include a "trainee evaluation" form. Target audience appeal significantly improves the effectiveness of the training system. Listen and respond to the advice from each trainee. Discuss the review with the trainee to pinpoint the root cause of any concerns. An appropriate action plan can then be developed. Let the trainee be a part of developing the action plan. Operator ownership in the training system is vital to its success.

Learning System

The purpose of this evaluation is to determine if learning actually did take place. To accomplish this, at a minimum, some sort of measurement needs to be made before and after the implementation of training.

This evaluation should take place at least twice a year, even if there is little or no training activity. This exercise will identify operator deficiencies and refresher training needs. The solution might be to revamp the original training design or to add refresher training.

Learning system questions focus on the various effects of training. These questions look at what is left after the training has been completed. These areas should be the focus of the evaluation:

- Training objectives
- Trainee's development goals
- Organizational goals
- Unanticipated effects of training

This evaluation will usually raise the most interest among system stakeholders. Simply put, if a senior manager wants proof that training works, the learning system questions provide the basis for a response.

Management System

This evaluation will identify possible management gaps in your training system. Gaps in the training system require changes in the training system design specification and implementation plan.

This evaluation should occur at least each quarter during the first year of a training system implementation, every six months the following year, and then annually after.

Select questions that focus on the behaviors of the instructor and trainee. These questions ask how the training was carried out and how the content was learned. These questions will provide

valuable insights into the workings of training. Answering these questions usually requires observation during training and interviews after training. To ensure that the observational data that is gathered is consistent, standardized forms that measure the observational frequency of the instructor's and trainee's behaviors should be developed.

Another series of questions should focus on the system components used during training:

- Task
- Training module and training design
- Training location
- Trainee
- Instructor

These questions will identify gaps between "desired training design" and actual training events. Absence of training system design components can seriously impact training.

Possibly the most critical issue is the extent of management commitment to the training system. Another key issue is the way in which training interacts with other systems in the organization, both positively and negatively. Training interacts with other organizational systems such as:

- Plant operations department
- Human resources department
- Labor-management relations
- Plant maintenance department
- Plant management and administration

For training to be effective, it must harmonize with the other systems around it. That is, the goals of one system must be consistent with the goals of the other systems. When supervisors complain that the training system is interfering with the ability to get work done, they mean that the goals of the two systems—training and work—are in conflict.

Conclusion

After the evaluation information has been gathered and conclusions about the results have been drawn, the task at hand is to troubleshoot and fix the problems within the system.

8
TRAINING PHASE I

Just as industry expectations of the operator on-the-job are expanding, management is looking for talented job applicants that have the ability to meet these new standards. Requirements are divided into two categories: job applicant and new-hire employee. Phase I training will qualify the job applicant and prepare the newly hired employee to be an entry-level operator.

Background

A national conference was held in the summer of 1999 to address this same subject. EPRI, along with Bismarck State College (BSC) in Bismarck, North Dakota, sponsored this conference that brought together industry and educational professionals. The conference focus was the formation of an energy technology educational program that addresses basic knowledge and "specialty areas." The program will produce successful job applicants for the energy industry. Industry desires an applicant that is ready to learn site-specific job tasks and skills.

BSC Power Plant Technology Program

Students in the Power Plant Technology Program at BSC learn the technical and safety aspects of plant operations, the responsibility of plant operators, and the mechanical and chemical technology needed for working in related industrial operations.

BSC offers their Power Plant Technology Program on the Internet. Online students must complete a "capstone" for the required laboratory experience. They can either complete 80 hours of lab work at BSC or set up a co-op position with a power plant close to their home. The co-op position would consist of 80 hours of shadowing a power plant operator in designated operations.

The Power Plant Technology Program takes one academic year and one summer session to complete. Students have the option of earning a certificate, a diploma, or an Associate in Applied Science degree. Table 8-1 describes the requirements for each.

Table 8-1
BSC Power Plant Technology Program

Certificate	Diploma
Prescribed courses outlined in this section	Prescribed courses outlined in this section
4 general education (GE) credits	9 GE credits
	Associate in Applied Science
	15 additional GE credits

Basic Skills of the Job Applicant

Industry representatives agree that the BSC curriculum will prepare students to become successful job applicants. The EPRI Qualification Standard for power plant operators has adopted the BSC curriculum (see Table 8-2) as job applicant prerequisites. Appendix E charts describe the requirements.

Your training system may describe hiring practices that seek out successful BSC graduates or graduates that attend a similar college. You may elect to form a partnership with BSC and your local community college to offer this program in your local area. Another option is to develop an in-house apprenticeship program to provide this level of training to new hires.

All options achieve the same result, a job applicant with basic skills. Your training system should include a method to assess job applicants for all prerequisites. This would be the first level of qualification.

Table 8-2
Basic Skills Training Curriculum for Job Applicants (BSC Curriculum)

Semester 1 Classes	Description	Credits
Plant Terminology	The study of steam and heat theory and plant technology.	3
Basic Math	The study of basic math principles as applied to power and process plants.	3
Safety	The study and practice of multimedia first aid and industrial safety.	3
Water Chemistry	The study of water chemistry as used in modern fossil fuel power plants and the process industry. Water treatment systems as applied to power generation, process plants, and refineries are covered.	2
Mechanical Fundamentals	The study of pumps, valves, and heat exchangers used in power and process plants. Basic types of bearings and general lubrication are covered.	3
Schematics and Diagrams	The study of the cycle of power and process plants using piping and instrumentation diagrams. Power and process plant operation is studied.	3

Semester 2 Classes	Description	Credits
Plant Systems	Various types of pumps and required maintenance are studied as applied to power generation and process plants and refineries.	3
Power Principles	The study of power plant science and cycles in power generation and process plants and refineries. The study of pneumatics and hydraulics systems.	4
Fuels and Combustion	This course explains the difference between solid and liquid fuels, their combustion properties, and their uses in power and process plants. Study of environmental protection systems as applied to refineries and power plants.	2
Boilers	The study of the safe and efficient operation of high-pressure and low-pressure boilers and related equipment as used in power generation plants, process plants, refineries, and heating systems	4
Turbines	The study of the safe and efficient operation of steam turbines and related equipment as used in power generation plants, process plants, refineries, and heating systems.	1
Applied Math	The study of advanced math principles as applied to power and process plants and refineries.	2

Semester 3 Classes	Description	Credits
Gas Turbine and Diesel	This course covers the construction and operation of water and gas turbines as well as diesels.	1
Electrical Principles	The study of basic electricity, Ohm's Law, basic electrical circuits, basic motor and generator theory.	2
Power Generation	Covers the construction of motors and generators used in power plants.	2
Electrical Systems	Transformers, circuit breakers, switch gear, and switch yard equipment are covered in detail as to the construction and maintenance required.	2
Plant Protection	Power plant lockouts and safety devices are discussed in detail. Simulator training in the power plants is included.	2
Plant Instrumentation	Examines the application of measurement of flow, temperature, pressure, and level in the modern day power plant.	4
Instrumentation and Control	Covers the construction and operation of controllers and final control elements and their interaction in power generation systems. Study and lab exercises on programmable controllers as used in power generation.	4

Basic Skills for the New-Hire Employee

At the National Conference, industry added additional requirements (specialty areas) for employees before they are ready to be entry-level operators.

These specialty areas are well suited for new-hire training. The learning events will familiarize the new hire with the plant, the training system, and the operating crew. Safety and environmental expectations are set. At qualification, the new entry-level operator is ready for operator skills training.

The first specialty area is asset management. This area focuses on the employee as a vital asset to the utility. Table 8-3 provides a list of knowledge and skills necessary for each competency.

Table 8-3
Basic Skills "Asset Management" Training for New Hires

Competency: Basic Business	
Knowledge	**Skill**
Knowledge of terms related to business	Read an annual report or income statement.
Understanding of cost justification	Perform a cost justification analysis.
Understanding of bench working	Apply value-engineering to processes
Familiar with budgeting methods	Identify cost-effective use of tools and equipment
Competency: Process Improvement	
Knowledge	**Skill**
Understanding of what is meant by "process"	Identify inputs and outputs of a process.
Understanding of measurement	State the critical parameters for a job area.
Knowledge of process improvement techniques	Collect data and complete logs.
Familiar with quality teams	Identify customers and suppliers.
Competency: Logical Thinking	
Knowledge	**Skill**
Understanding of effective learning concepts	Show attention, concern, and responsibility.
Familiar with stop-think-act-review	Read and follow procedures.
Knowledge of using interactive listening	Make connection between old and new skills.
Competency: Safety and Environmental Awareness	
Knowledge	**Skill**
Knowledge of what OSHA is	Identify actions indicate commitment to safe work
Knowledge of what the EPA is	Identify actions show commitment to environment
Understanding of what is meant by "compliance"	Demonstrate questioning attitude to safety and environment

The second specialty area is maintenance. This area is evolving as utilities change to meet the demands of the market place. Operations and maintenance will continue to grow as individual fields, but there is a strong trend toward high-performance work teams. The power plant operator will master certain skills and excel in a wide variety of basic skills that are required to meet the challenges of new technology and productive work performance.

Table 8-4
Basic Skills "Maintenance" Training for New Hires

Competency: Predictive and Preventive Maintenance (PM)	
Knowledge	**Skill**
PM theory	Read and understand OEM manuals.
Analysis techniques	Develop PM plans.
PM tools	Demonstrate use of tools.
Maintenance management system (MMS)	Use the MMS.
Competency: Electrical Diagrams/Blueprints/Schematics	
Knowledge	**Skill**
Simple line diagrams	Identify symbols on schematics.
Diagram location	Follow path on schematic.
Diagram modification process	Sketch a simple line diagram.
Relationship of diagrams to field equipment	Recognize equipment in the field.
Competency: Control Logic	
Knowledge	**Skill**
Types of control systems: analog, digital, distributive control system (DCS)	Identify instrument drawing symbols.
Process measures: flow, temp, pressure, level, etc	Identify critical process variables and how they are measured.
Relationship of process to instrument: setpoint, input and output signals, readouts	Read diagrams and ladder logic.
Knowledge of what sensors, transmitters, control elements, controllers, analyzers, displays are	Determine if a valve is open or closed and its position on loss of control power.
Competency: Power Tools	
Knowledge	**Skill**
Safe procedures for operating tools	Explain safety precautions of each tool.
Purpose of each tool	Identify available types of tools.
Tool storage and clean-up	Describe tool storage and application.
Application and selection of tools	Demonstrate selection and use of tools.
Competency: Rigging	
Knowledge	**Skill**
Proper uses of rigging equipment	Describe safe rigging/lifting procedures.
Load calculations	Demonstrate use of rigging.
Knots used in rigging	Demonstrate equipment inspections/record keeping.
Knowledge of the available rigging devices	Make a vertical lift of an object.

The third specialty area is communication. As multimedia continues to advance, the workforce must keep current on the optimum methods for communicating effectively. In a noisy, sometimes hectic, work environment, the power plant operator might have to communicate with management, accounting, engineering, or even the local emergency response team. Table 8-5 is a list of knowledge and skills for this competency.

Table 8-5
Basic Skills "Communication" Training for New Hires

Competency: Communication Skills and Technical Writing	
Knowledge	**Skill**
Methods: verbal, written, email, visual	Communicate complex idea, using a diagram/sketch to communicate the idea.
Decision-making tools (types 1-4)	Apply decision-making tools to solve a problem
Use of etiquette/code of conduct	Use effective listening skills.

The fourth specialty area is troubleshooting. Management expects the operator to understand and drive performance to maximize the bottom line. Knowing how to identify the root cause versus fixing the symptom is an essential skill for the power plant operator. The operator must recognize what parameters he or she controls and their effect on plant efficiency in order to prioritize work activities to maximize plant efficiency. See Table 8-6.

Table 8-6
Basic Skills "Troubleshooting" Training for New Hires

Competency: Root Cause Analysis (RCA)	
Knowledge	**Skill**
Systematic approach to problem identification	Demonstrate understanding of plant systems.
Knowledge of RCA tools	Describe steps of root cause analysis.
Criteria for selecting problem to address	Collect, organize, and analyze information.
	Demonstrate ability to apply RCA to plant.
Competency: Plant Efficiency	
Knowledge	**Skill**
The Rankine Cycle	Explain the concept of plant efficiency.
Factors that affect boiler reliability	Describe the major efficiency losses in the plant.
Familiar with adjustments to plant operations that maximize efficiency	Calculate heat rate and efficiency.
Relationship of plant malfunctions to controllable losses.	Identify controllable losses.

9
TRAINING PHASE II

Even the most simple energy plant consists of multiple processes and intricate pieces of mechanical equipment. These plants require elaborate control and operating strategies. Training becomes a complicated and continuous endeavor. Phase I training focused on value-added human performance; operators need strong basic skills including math, science, business, problem solving, decision making, communication, and operations and maintenance. In Phase II training, the focus shifts to job-specific requirements.

Job Descriptions

There are four basic positions in every power plant. Depending on the size of the plant, these positions might be divided into additional levels to adequately provide manpower for the safe and efficient operation of the plant equipment.

- Entry level operator. Knowledgeable about safe work practices, familiar with processes, performs routine rounds, completes logbooks, and maintains housekeeping.
- Auxiliary operator. Job safety leader, troubleshoots and corrects problems, performs equipment checkouts and operational duties, follows preventive/predictive maintenance programs, inventories materials, and operates local control stations where applicable.
- Assistant control room operator. Knowledgeable about plant processes, familiar with control systems. Performs routine control room operating tasks and rounds.
- Control room operator. Understands the technical operation of the plant, decision making and operating strategy. Performs as team leader, and customer/supplier negotiator.

Training System

Step 1

This chapter includes a generic list of knowledge and skill requirements for each of the four operator positions in Tables 9-1 through 9-4.

Each list is divided by skill type: Safety, Administration, Maintenance Skills, Basic Skills, Controls, Operating Systems, and Performance/Hygiene. Customize these lists for your location.

Table 9-1
Operator Skills for Entry-Level Operator

ENTRY-LEVEL OPERATOR	
SAFETY	**BASIC SKILLS**
Company orientation	Material handling
Safety orientation	Forklift operation
Accident prevention, commitment to safely	Auto equipment operation
Recognize/problem solve unsafe acts	Scaffolding
Safety audits/observation process	Rigging and lifting
Safety meetings/discussions	Hydraulic cranes
Responsibilities for emergency response	Overhead cranes
How to document/report unsafe conditions	PIMS/MMS operation
Personal protection equipment/hearing	Fossil plant fundamentals
Hazard communication	Sketches and flow diagrams
Introduction to MSDS	Basic electricity
HAZWOPER	Introduction to motors
Spill protection and CC	Introduction to pumps
Introduction to fire protection	Introduction to valves
Lubricants	Introduction to hand tools/power tools
Asbestos awareness	**CONTROLS**
Boat/water safety	Pressure and level instruments
Solvents and operating tools	**OPERATING SYSTEMS**
Blood-borne pathogens	Bottom ash system
Respiratory protection	Fly ash system
Lead, arsenic, chlorine, other inhalants	Sootblower systems
Clearance permit system	Precipitators
Confined space entry	Circulating water systems
Hot work, burning and fire permits	Water treatment
Zero energy	Deep wells and sumps
ADMINISTRATION	Fuel supply system
Customer and supplier requirements	Coal handling systems
Total quality process	Boiler setup
Housekeeping standards	Introduction to heat rate
Impact on job costs	**PERFORMANCE/HYGIENE**
Communication with customers/suppliers	Collecting coal samples
Use of PA system	Bulk chemical handling
Work group meetings	Water treatment
Paperwork associated with assignments	Boiler water treatment
Use of e-mail and log keeping	Drinking water equipment

Customer service orientation	Waste water treatment
MAINTENANCE SKILLS	OSHA compliance
Filters and strainers	Lubricating equipment
Insulation and refractory	
Basic plumbing	
General maintenance	

Table 9-2
Operator Skills for Auxiliary Operator

AUXILIARY OPERATOR	
SAFETY	**MAINTENANCE SKILLS**
Safe work practices and procedures	V-belts, and chain drives
Corrective action for unsafe acts or conditions	Sootblower maintenance
Conduct safety audits/observation process	Coal handling maintenance
ADMINISTRATION	Precipitator maintenance
Maintenance record keeping	Steam trap maintenance
Communications	Valve maintenance
On-the-job training	Pump maintenance
Quality team member	Insulation and refractory maintenance
Negotiate customer/supplier requirements	Lighter, igniters. and nozzles
Use Total Quality Process tools	General maintenance
Controlling job costs	Packing
Efficient use of tools and equipment	Pulverizer maintenance
Document work using MMS	Coupling alignment
Stock material procurement process	Bearing and coupling maintenance
Written and oral correspondence	Yard sampling 2
Negotiate with co-workers and supervision	**CONTROLS**
Transfer information between shifts	Gauges, switches, manometers, sight glasses
Feedback on expectations	**OPERATING SYSTEMS**
Results using teamwork within work group	Boiler startup and shutdown
Work effectively with peers and management	Breakers, batteries, and switchyards
BASIC SKILLS	Mills and feeders
Hand Tools 2	Turbine systems
Precision tools	Generator systems
Machine tools	Oil lighters and oil filtering
Introduction to arc welding	Heat exchangers
Introduction to oxyfuel welding	Scrubber system
Rigging 2	**PERFORMANCE/HYGIENE**
Scaffolding 2	Coal sampling and handling equipment

	Water treatment systems
	Drinking water
	Boiler water analysis
	Boiler water systems

Table 9-3
Operator Skills for Assistant Control Room Operator

ASSISTANT CONTROL ROOM OPERATOR	
SAFETY	Transmitters
Safe work practices and procedures	Display devices
Positive safety role model for others	Process control loops
Pre-job safety briefings	Block diagrams
Near miss and accident investigation	Feed forward control loops
Fire protection	Limits and run backs
ADMINSTRATION	Types of controllers
Customer/supplier relations	Two position controllers
Negotiate customer/supplier requirements	Proportional controllers
Improvement and prevention methods	Integral control
Using tools of the Total Quality Process	Proportional plus integral controllers
Support process review	Rate (derivative) control
On-the job training	Proportional plus integral control plus derivative controllers
Stock materials orders and credits to control cost	Analog control systems
Write clear concise reports and correspondence	Digital control systems
Seek guidance from supervision and peers	Single loop digital controllers
BASIC SKILLS	Multiple loop digital controllers
Basic control systems	Distributive control systems
Sensors and transmitters	Integrated control scheme
Final control elements	Load demand computer
Controllers	**OPERATING SYSTEMS**
Temperature measurement	Boiler systems (steam, air and water)
Pressure measurement	Boiler startup and shutdown
Flow measurement	Breakers, batteries, and switchyards
Level measurement	Coal handling system
Analyzers	Mills and feeders
	Turbine and generator systems
	Control rooms and control systems

Table 9-4
Operator Skills for Control Room Operator

CONTROL ROOM OPERATOR	
SAFETY	Initiate actions for plant efficiency/cost reduction
Safe work practices and procedures	Stock materials orders & credits to control cost
Positive safety role model for others	Write clear concise reports and correspondence
Pre-job safety briefings	Prepare and conduct meetings/training
Near miss and accident Investigation	Seek guidance from supervisors and peers
Fire protection	Achieve results through teamwork
ADMINSTRATION	Involve personnel in consensus building
Customer/supplier relations	Environment for airing differences
Negotiates customer/supplier requirements	Support process review
Improvement and prevention methods	On-the job training
Using tools of the Total Quality Process	**OPERATING SYSTEMS**
Applying Total Quality Process	Boiler systems (steam, air and water)
Identifying root causes of problems	Boiler startup and shutdown
Use labor and resources efficiently	Breakers, batteries, and switchyards
Support supervision in cost control	Coal handling system
	Mills and feeders
	Turbine and generator systems
	Control rooms and control systems

These lists are broad, but still more job knowledge and skills need to be identified. Use the matrix found in Appendix G to broaden your task list to include specific plant equipment and process skills.

Step 2

After all the knowledge and skill areas are identified, determine which items are included for each level of qualification. The matrix format in Appendix G has a column for this purpose. Also note what type of training methods will be used.

Step 3

Develop materials to train and qualify operators. This will include procedures, lesson plans, qualification guidelines, and qualification cards. Most of the items on these lists will be part of the SOJT training method.

Step 4

Evaluation standards or *core competencies* are the criteria by which the instructor/evaluator determines if a trainee has sufficient mastery of the course or job task objectives.

A generic competency list for each job level has been developed and can be found in Appendix F. Customize these lists for your location. These lists will help you to develop qualification cards for your training system.

A
ADMINISTRATION ANALYSIS WORKSHEET

The following questions prompt discussion and flush out critical information. Use your data to customize the Training System Design Specification Form in Appendix B.

Manager responsible for training
Plant operating strategies and objectives
Training budget
Training objectives
Training team members

Administration Analysis Worksheet

Training team leader
Time constraints: overtime limits, manpower schedule, deadlines
Who to train: incumbents, new hires, what levels
Pass/fail criteria: score, minimum response, retrain timetable, how many attempts, action if fail
Timetable
Presentation to management: agenda and date (commitment and approval of training system plan)

Job and Task Analysis Matrix

Basic Skill Matrix

A matrix of tasks is included in Section 8 and Appendix E. Customize a matrix of required basic skills from these lists.

Operator Skill Matrix

A matrix of tasks is included in Section 9 and Appendices G and F. Customize a matrix of required operator skills from these lists.

Training Analysis Worksheet

Training rooms and office space? Size, location accessible, noise/interruption control, work surfaces
Training materials in-house? NUS, basic theory books, system descriptions, job procedures (routine, nonroutine, and emergency), courseware and lesson plans, simulator, checklists, logs, movies, CBTs
Computers, overhead projectors, VCRs, wash-off boards, bulletin boards, shelves

Administration Analysis Worksheet

Final task matrix – Using the job and task matrix that you customized by adding and deleting tasks to match your plant, following the truth flow diagram and answering the value test questions in Section 3. Reduce the matrix as appropriate.
Desired training aids? Use the final matrix for your plant to determine training aid need.

B
TRAINING SYSTEM SPECIFICATION FORM

1. Introduction

This document describes the training system and qualification standards in practice for *(describe type of Units and Name of Power Station this document applies to)*

The training system has been prepared in accordance with the EPRI Technical Report, *Qualification Standard for Power Plant Operators*. The training system is designed to combine *(list types of training such as self-study, classroom, computer-based, simulator, hands-on, on-the-job, etc)* into an easy-to-administer program that prepares operators for qualification. The target audience is *(describe operator levels that the training system applies to.)*

The training materials and guidelines are developed and maintained by *(list team or personnel positions).* The training system is the responsibility of *(list who is responsible for what: operator, supervisor, training team, manager, etc).* Final approval and authority are the responsibility of *(list team or personnel position).*

2. Objective

The objective of this training program is to provide standards and resources to create learning situations that will allow plant operators to develop knowledge, skill, and ability required for qualification. *(The following are examples .. remove or tailor for your plant)*

- Plant will operate without recordable injuries.
- Plant will operate within environmental guidelines.
- Plant heat rate will be less than or equal to 10,000 BTU/kW.
- Plant operational “runs” will be extended to 180 days and the run will not be terminated by an operational error.
- Assuming no delay due to silica and given a warm turbine and boiler, bring the plant to full load in seven hours.
- Facilitate mastery of terminal objectives in the following areas of plant operation:
  - Plant startup, shutdown, power changes
  - Transients caused by equipment malfunctions
  - Operating the plant with out use of service equipment

- Recovery from plant trips
- Operating the plant at the best efficiency and best utilization of plant life expenditure.

The program can be accomplished using courses, demonstrations and OJT defined in this document.

3. General Requirements

All developed training material will be completed in both hard copy and in word processing files on *(types of disk and back-up)* disks using *(types of programs)*. The contents of the files shall be editable using *(types of programs)* software. There shall be complete instructions for editing all files.

All generic provided training material would be purchased and managed by *(name team or personnel position). (Customize the table to include your list of training materials and source.)*

Position	Training Phase	Training Material (Examples)	On-Site	Acquire
New Hire	Basic Skills	*Outsource College*		
		Apprenticeship		
		CBT		
		NUS		
		Pre-Employment Training		
		Qualification Guide and Card		
Operator Levels	Knowledge	*CBT*		
		NUS		
		System Descriptions		
		Plant Walkdown		
		Qualification Guide and Card		
	Job Skills	*Procedures*		
		Video Tapes		
		Simulator		
		Instrument Labs		
		Mechanical Labs		
		Rounds		
		Inspections		
		Qualification Guide and Card		

4. Training

4.1.a Basic Skills Introduction

This phase *(define phase coverage: provides an in-depth review, provides training, or assesses abilities, etc.)* of knowledge and skill necessary to safely enter the power plant and begin the power plant operator training system. This phase will be presented *(describe: a classroom environment, self-study with crew, with the simulator or actual plant activities, other training aids, assessment tools)* to accomplish the objectives.

The audience for this phase will be *(defining who takes the training and or assessments)*. This phase shall be designed such that it can be delivered to the target audience and successfully completed utilizing *(define quantity of manpower used: ____contact hours of instruction, self-study, etc)*. The phase shall be modularized by objectives.

4.1.b Objectives of Basic Skills

Chart Instructions: Customize the Basic Skills Area List. Add objectives for each item, referring to Appendix E. Determine if these items are going to be part of the training program or prerequisites that you assess before qualification as an entry-level operator in the power plant training program.

Basic Skill Area	Objective	Train	Assess
Personal Safety			
Fire Safety			
Respiratory Protection			
Hazardous Materials			
Government Regulations			
MSDS			
Zero Energy State			
Confined Spaces			
Boiler Design			
Boiler Auxiliaries			
Boiler Operation			
Fuel Equipment			
Combustion Principles			
Turbine Design			
Turbine Auxiliaries			
Generator Principles			
AC Power			
Generator Auxiliaries			
Electrical Principles			
Electrical Protective Devices			

Basic Skills Area	Objective	Train	Assess
Electrical Distribution			
Three-Phase Power			
Steam Systems			
Water Systems			
Water Treatment			
Plant Systems			
Instrumentation and Controls			
Mechanical Tools and Equipment			
Heat Transfer			
Power Plant Operation			

4.2.a System Descriptions Introduction

This training phase provides an in-depth review of systems at the plant. This training phase will be presented *(describe: in a classroom environment, self-study with crew, with the simulator, or actual plant and other training aid)* to accomplish the objectives.

The audience for this training phase will be *(define who takes the course)*. The training phase shall be designed such that it can be delivered to the target audience and successfully completed utilizing *(define quantity of manpower used: ____ contact hours of instruction, self-study, etc).* The course shall be modularized by plant systems.

4.2.b Objectives of System Descriptions

The terminal objectives for each system and/or subsystem shall be as follows:

- STATE the power generation function of the system
- DRAW and LABEL a simplified schematic of the system with all major components in flow path order
- LIST the normal operational parameters for the systems, and STATE where these parameters are read in the control room
- LIST the location of systems controls
- STATE all major control inputs and outputs of the system
- STATE the principle of operations for all procedural steps, trip functions and /or interlocks, alarms and environmental regulations for the systems
- LIST the systems that support the operation of this system

- LIST any support requirements that the system fulfills
- LIST any applicable system specific safety precautions and the reasons for the precautions

Systems to be covered *(Modify the system list and boundaries to match your plant.)*

System	System Boundaries
Condenser	Condenser cooling water, condenser vacuum, hotwell and deaerator level control system, and the condenser.
Condensate & Feedwater	Condensate system, feedwater heaters, heater drain system (turbine drain), feedwater system, boiler feed pump lubrication, extraction steam, and feedwater heating. [condenser up to the boiler economizer]
Air/Gas System	Flue gas, primary air, secondary air, and all the fans and dampers. [From FD Fan suction through the boiler to the stack including the stack gas environmental controls system, SO_2, and NO_x]
Boiler	Soot blowers, boiler ash disposal, boiler drains, economizer, drum, superheater, and reheater.
Fuels	Boiler firing, coal handling, coal feed and pulverizing, fuel oil, fuel flow control, the master fuel trip, and the ignition system
Steam Systems	Main superheat steam, superheat spray water, gland steam, reheat steam, reheat spray water, auxiliary steam, steam temperature control, auxiliary steam system, steam relief system, and steam drains
Turbine	Turbine system, turbine control and protection, lubricating oil, main oil (MO), turning gear, turbine stress indicator, turbine control system, turbine protection system, and exhaust hood cooling system
System	System boundaries
Generator	Generator system, hydrogen supply, seal oil (SO), Voltage control system, hydrogen cooling, stator cooling system, main transformers, output circuit breakers, and generator protective relaying]
Electrical Distribution	AC distribution system, the station batteries, the 120 VAC vital ac system, the 125 VDC system
Miscellaneous	Auxiliary cooling water and service and instrument air systems.
Plant Controls	Boiler master, fuel/air ratio, turbine master, and load controls.

4.3.a Structured On-the-Job Training (SOJT) Introduction

This training phase provides an in-depth review of plant operating procedures and job position requirements. This training phase will be presented *(describe: a classroom environment, self-study with crew, with the simulator, or actual plant activities and other training aid)* to accomplish the objectives.

The audience for this training phase will be *(defining who takes the course)*. The training phase shall be designed such that it can be delivered to the target audience and successfully completed utilizing *(define quantity of manpower used: ____ contact hours of instruction, self-study, etc).* The course shall be modularized by routine, nonroutine, and emergency procedures.

4.3.b Objectives of SOJT

The terminal objectives for this phase of training are as follows: *(Customize this list.)*

- DEMONSTRATE job performance of routine job tasks from memory without prompts or assistance, maintaining plant operations and critical parameters stated in the specific procedure in the normal range.
- DEMONSTRATE job performance of selected nonroutine job tasks from memory without prompts or assistance, maintaining plant operations and critical parameters stated in the specific procedure in the normal range.
- DEMONSTRATE job performance of selected nonroutine job tasks when prompted, referring to the procedure if needed, maintaining plant operations and critical parameters stated in the specific procedure in the normal range without assistance.
- DEMONSTRATE job performance of selected nonroutine job tasks when prompted, referring to the procedure if needed, maintaining plant operations and critical parameters stated in the specific procedure in the normal range with assistance if needed.
- DEMONSTRATE job performance of first response actions for emergency without prompt, bringing the plant to a stable condition, and then referring to the procedure if needed to complete the required job tasks as stated in the emergency procedure.

Use the matrix developed for Phase II training.

5. Qualification

The trainee-trainer will follow the training guidelines. During the learning, the operator will gain knowledge, observe demonstration of skills, and practice skills. After learning is complete, the operator will perform demonstrations or answer questions that measure the operator's ability.

The qualification guide and card, clearly define what successful qualification is for each objective being measured. This includes the activity and conditions used to measure trainee performance as well as expected responses from the trainee:

- Oral exam with minimum expected response
- Written exam with minimum expected response
- Job demonstration procedure with minimum expected response
- Critical parameter normal range guidelines

Pass and fail procedures describe the actions taken after the trainee completes the evaluation process. Procedures are as follows:

- Satisfactory skills and knowledge; no weak points.

  Action: *(describe action to take, per administration analysis)*

- Satisfactory skills and knowledge; the trainee lacked information on some minor details.

  Action: *(describe action to take, per administration analysis)*

- Unsatisfactory; the trainee lacked necessary skills or showed a significant lack of knowledge and understanding.

  Action: *(describe action to take, per administration analysis)*

6. Project Schedule

Phase	Training Material Development	Draft Due Date	Delivery Date of Final Updated Material
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

Phase	Operator Training	Start Date	Qualification
1	Prerequisite Basic Skills Qualification		
2	New Hire Basic Skills Training		
3	Entry-Level System Descriptions		
4	Entry-Level SOJT		
5	Auxiliary Operator SJOT		
6	Assistant Control Room Operator SOJT		
7	Control Room Operator SOJT		
8			
9			
10			

C
SAMPLE DOCUMENTS

Lesson Plan Sample C1-C5

LESSON PLAN NO. 18 - Boiler Feed Pump Trip	
SETTING/DURATION - Classroom/Simulator - 1 hour	INITIAL CONDITION – 135 MW1.IC - On line 135 MW
REFERENCE/HANDOUT 1. Lesson No. 18 Objectives	MALFUNCTIONS (File LP18.MLF) 1. "A" Boiler Feed Pump Trip 2. "B" Boiler Feed Pump Trip 3. "C" Boiler Feed Pump Trip
LESSON SUMMARY - During steady-state operation at 135 MWs, one of two operating boiler feed pumps trip. The LDC begins a runback to the one BFP limit. The trainee, prompted by the BOILER 4160V MOTOR TRIP alarm, should start the standby BFP and stabilize the steam drum water level without tripping the unit. The trainee should also use judgement when shutting down a pulverizer so not to compound drum level swings. This scenario can also be set up with the Boiler and/or Turbine Master in MANUAL. A unit load runback will not occur with either station in MANUAL. During the scenario, the drum water level, feedwater, and megawatts will be plotted and reviewed at the completion of the lesson.	
LEARNING OBJECTIVES - <u>Terminal Objective</u> Provided with classroom instruction, the trainee is expected to maintain the drum water level between the high and low limits following a BFP trip, and return the plant to stable operation. <u>Enabling Objectives</u> At the completion of this lesson, the trainee should be able to: 1. Identify the abnormal condition. 2. Gain control of a decreasing drum water level and return it to normal. 3. Prevent a low drum level unit trip. 4. Time the shutdown of fuel firing equipment so not to compound a decreasing drum water level. 5. Maintain control of the unit. 6. Investigate the cause of the pump trip. 7. Maintain an awareness of overall plant status. 8. Communicate effectively with plant staff during all plant conditions.	

LESSON PLAN NO. 18 - "A" Boiler Feed Pump Trip (Cont.)			
Training Activity	**Instructor Activity**	**Expected Student Response**	**Ref.**
	Omit the following and fill out the applicable performance evaluations if this lesson is used as the student's final evaluation: • Briefing • Questioning • Coaching • Post-Scenario Critique		
Briefing (Classroom)	Hand out Lesson No. 18 objectives. Show overhead of Lesson No. 18 objectives. Discuss the objectives.		
	Summarize the lesson. 1. State the initial condition. 2. Summarize the abnormal condition scenario. 3. Discuss the effects of a BFP trip on unit operation. 4. Discuss what a BFP runback, priority raise, and lower inhibit are and under what conditions they occur. 5. Discuss the steps involved with gaining control of a decreasing drum level. 6. Discuss the possible causes of a BFP trip.	The trainee should ask questions concerning the abnormal condition scenario.	
Simulator Setup	Load initial condition 135MW1.IC - On line 135 MW		
	Set up trend plots of the drum water level, feedwater flow, and megawatts on the instructor console.		
	Inform the trainee that during the scenario, the instructor will assume the role of off-going CRO, Shift Supervisor, ACRO, and SA. All verbal communication normally directed to these people should be directed to the instructor.		
Insert Malfunction	Insert the selected malfunction and set up to initiate on a time delay.		
Begin Scenario (Simulator)	Have the trainee man their simulator station and inform them of the role they will be playing.	The trainee assumes their role.	
	Place the simulator in the RUN mode. Assume control until relieved.	Assume the role of the on-coming CRO.	
	OPTIONAL - Place the Boiler Master and/or the Turbine Master in MANUAL. An automatic runback will not occur when a BFP trips.		
Relieve the Shift	Assume the role of the off-going CRO. Brief the trainee of the current plant status. When all questions have been answered, inform the trainee that control of the unit has been transferred.	The trainee assumes control of the unit.	

	With the simulator running, allow the trainee approximately 10 minutes to scan the screens for the current plant status.	The trainee should scan all screens including the alarm panel and ask questions concerning the shift relief completed in the previous step.	
	Observe the trainee's actions during normal and abnormal operation. Make note of the trainee's actions on the instructor's notes form.	The trainee continues to monitor the unit making adjustments as necessary.	
	During the scenario, provide suggestion, guidance, and corrective criticism as necessary.		
	Assume the role of the ACRO and SA as necessary to respond to the trainee's requests.	The trainee should dispatch the ACRO and SA as necessary.	
Malfunction Begins	After a time delay, the selected BFP will trip, sounding the BOILER 4160V MOTOR TRIP alarm. Observe and make note of the following: • Immediate actions • Subsequent actions • Appropriate and inappropriate actions • Control board manipulation • Stress management	Start standby BFP and increase flow to match operating pump. Place on AUTOMATIC. Remove one feeder from service if required.	
	Monitor the drum level and make note of operator actions that either worsen the level of problems or improve the situation.		
		Place the boiler and turbine masters in MANUAL regulate in hand if necessary.	
	Runback starts 25 seconds after pump trip. If trainee's response is immediate, the feedwater be satisfied prior to completion of runback (runback will stop).	Monitor the unit, making adjustments as required and dispatch SA to check boiler feed pump.	
		Place feedwater controls in MANUAL and regulate in hand if necessary. Return to AUTO when the level is normal and stable.	
		Inform the Load Dispatcher of the plant status when possible.	
	If the trainee found it necessary to place any controls in MANUAL, make note of the time. After the scenario, ask the trainee why this option was chosen.	If unit requires additional time to stabilize, remove one mill from service.	

Return to Normal		Inform the Load Dispatcher the unit is ready for normal operation. Increase the unit load to 135 MW.	
	When the unit is stable ask what caused the BFP trip.	Check the alarm panel and trends for clues why the BFP tripped.	
End Scenario	Freeze the simulator when the unit is stable at 135 MW.	The trainee ends control board manipulations.	
Break	Have the trainee take a 10-minute break and return to the classroom.	The trainee takes a break.	
	Print the trend plots of the drum water level, feedwater flow, and megawatts.		
	Prepare for the post-scenario critique. • Review notes • Identify inappropriate actions • Determine how well the trainee met the objectives		
Post-Scenario Critique	Show the trainee an overhead of the enabling objectives. Present the trend plots. Tell the trainee to use the enabling objectives and review the trend plot to assist in personal evaluation. Have the trainee list the things that were done well and the areas that may need improvement, and why. Record the trainee's comments on the board under columns labeled STRENGTHS and WEAKNESSES.	The trainee lists strengths and weaknesses.	
	Review the trainee's list of STRENGTHS and WEAKNESSES. Add comment, suggestion, and constructive criticism as necessary.	The trainee should provide input to the critique.	
End Lesson	Request feedback on realism of the scenario.	The trainee provides feedback.	

INSTRUCTOR NOTES

Name _____ Date _____ Crew _____

Malfunctions 1. _____

2. _____

3. _____

Make notes as applicable for the Control Room Operator, Supervisor, and the overall crew performance. These notes provide the basis for the scenario performance evaluations.

1. Identify the abnormal condition.

2. Gain control of a decreasing drum water level and return it to normal.

3. Prevent a low drum level unit trip.

4. Time the shutdown of the fuel firing equipment so not to compound a decreasing drum water level.

Example Qualification Guide C6-C11

"Header"

Training Standard

Task Title: _____ Task Number: _____

Terminal Objective(s):

1. Terminal objective 1.
2. Terminal objective 2.

Enabling Objectives:

Knowledge:

1. Enabling objective 1. (Student HO XYZ, Section 3.2.3; Course XYZ, Lesson ABC)
2. Enabling objective 2. (XYZ System Description, Section 4.2.5; Systems CBT, Module XYZ)

Performance:

1. Enabling objective 7. (P)
2. Enabling objective 8. (S)

Training Prerequisites:

Knowledge:

1. Completion of Course XYZ
2. Completion of Systems CBT, Module XYZ

Performance:

1. Completion of Outside Operator Qualifications
2. Six months as Station Attendant

Materials and Equipment: (NOTE: Provide guidance if necessary.)

1. Normal Safety Equipment (hard-hat, safety glasses, hearing protection, etc.)
2. Valve Wrench - 18 inches or larger
3. Two-way Radio

Instructor Notes:

1. High noise area. Perform pre-and post-training briefings in break room.
2. Lesson plan XYZ-05

Evaluation Standard

- **Prerequisites:**

1. Completion of Course XYZ
2. Completion of Systems CBT, Module XYZ
3. Completion of Outside Operator Qualifications
4. Six months as Station Attendant

- **Amplifying Conditions:**

1. High noise area
2.

- **Standard(s):**

1. (List standards here.)
2.

- **Performance Test and Instructions:**

1. JPM-XYZ-05
2. (List instructions for giving the exam here.)

- **Required Records:**

1. Instructor sign-off on trainee's qualification card.
2. Complete grading of JPM and review with the trainee
3. Forward to clerk for entry into trainee's record and training database

REFERENCES:

1. Training Course XYZ
2. Systems CBT, Module XYZ
3. Safety Manual
4. Procedures for System XYZ
5. Piping & Instrument Diagrams
6. Other

Performance Test and Qualification Card Code Guidelines

1. The following questions may help to determine the most applicable performance code for a given performance test or qualification card item. For each question, circle an "S" for simulate or a "P" for performance.

	YES	NO
Can the task be performed under actual job conditions?	P	S
Is the task observable under actual job conditions?	P	S
Is the task hazardous or does it involve any unnecessary safety or other hazardous conditions?	S	P
Is performing the task on the job costly?	S	P
If performed, could the task adversely affect facility operations?	S	P

After the results have been determined, use the table below as an aid in determining the performance code:

Results	Performance Code
All Ps	Perform
Ps and Ss	Perform or Simulate
All Ss	Simulate

For the cases where "Simulate" is indicated as the result of the table, but where manipulative skill demonstration is important to the evaluation of adequate task performance, a "Perform" may still be warranted. Conversely, if a "Simulate" is indicated, but the cost, the effect on plant operations, or the risks involved due to safety considerations and/or other hazards are considered excessive, a "Discuss" may be the recommended performance code.

Structured OJT Program Evaluation Questions

Evaluating the SOJT Training Program

Training Outputs (Are the trainee's performance and knowledge satisfactory?)

1. Were the training objectives achieved?
2. What were the effects on job performance? on organizational performance?
3. Were the training outcomes consistent with the trainee's development needs?
4. Were there unanticipated effects?

Training Process (Is the training process working correctly?)

1. How much time did it take to conduct the training?
2. Was the training location adequate? Were the needed resources available?
3. Did the trainer get ready to train?
4. Did the trainer use the module as intended?
5. Did the trainer use the training events as intended?
6. Did the trainer document the training as expected?
7. Did the trainer use effective communication skills?
8. Did the trainee use the module as instructed?
9. Did the trainee attend to the trainer?
10. Did the trainee ask questions?
11. Did the trainee like the content/training approach?

Training Inputs (Was the analysis phase performed correctly?

1. Was the learning task appropriate?
2. Was the learning task analyzed adequately?
3. Was the module accurate and complete and appropriately formatted?
4. Was the training design appropriate?

5. Were training resources available in the training location?
6. Was the training location suitable for the delivery of training?
7. Did the trainee have the prerequisites needed for training?
8. Did the trainee have the personality or learning style suitable for structured OJT?
9. Was the most appropriate experienced employee selected as trainer?
10. Did the experienced employee receive adequate training and development experiences?

Evaluating the Organization

Organizational Context (Is there a management problem that is hampering the OJT program from performing correctly?)

1. Did management provide sufficient resources to support the structured OJT?
2. Can the structured OJT occur within the constraints of the production or service delivery schedule?
3. Do labor-management contractual agreements allow employees to participate as trainers?
4. Are staffing levels sufficient to allow experienced employees to take tine to train others?

Example Job Performance Measure C12- C21

"Header" with Unit, Plant, System, JPM #, etc.

System/Duty Area: Generator

Task: Synchronize the Generator to the System

Task Number: 4-GEN-005

IC Number: 37

Suggested Testing Environment and Method (Perform OR Simulate)

Lab: _____ Control Room: Perform

Approximate Completion Time in Minutes: 25

References: 4-IP-01, Rev. 5, Section 10.0

Position Evaluated: CO

Actual Testing Environment: Lab: ____ Control Room: X

Testing Method: Simulate: _____ Perform: _____

The examinee's performance was evaluated against the standards contained in this JPM and is determined to be:

Unsatisfactory: _____ Satisfactory: _____

Questions Asked: _____ Questions Correct: _____ Total: _____ %

Examinee's Name: _____Date Performed: _____

Evaluator's Name: _____

Performance Checklist Comments:_____

_____

Approved by: _____Date:_____

Operations Senior Instructor

The examiner shall review the following with the examinee:

1. The examiner shall explain the JPM initial conditions and clarify as required.

2. The examiner may give CUES during a simulated JPM. These CUES shall be based on the expected plant response to examinee action that is correct (POSITIVE CUE) and examinee action/inaction that is NOT correct (NEGATIVE CUE).

3. The examinee may use any controlled references that are normally available. Procedures should be used as a follow-up to verify actions were correct.

4. The examinee shall indicate all required log entries, status board updates, chart recorder annotations and communications.

5. The examinee shall make oral reports for annunciators and any abnormal indications observed.

6. The examinee shall state aloud all verifications performed to the examiner.

JPM INITIAL TASK CONDITIONS: Unit startup in progress. Drum pressure greater than 1000 psig. Turbine speed greater than 3420 Both Field Breakers are CLOSED with Generator voltage greater than 16.6 volts. Exciter Amps are less than 1000 Amps. Both voltage regulators are in MANUAL.

TASK STANDARD: Unit synchronized to the system. Minimum load established on generator.

TASK PERFORMANCE AIDS: 4-IP-01, Rev. 5, Section 10.0

Directions to Candidate:

When I tell you to begin, you will become the Control Room Operator. You will be required to properly synchronize the generator to the system.

I will describe the initial conditions and provide you access to any tools required to complete this task. Before you start, I will state the task standards and initiating cues and answer any questions. To complete this task successfully, you must perform each critical element correctly. As you perform this JPM, please state aloud all verifications required. Make all notifications required for the task.

Conditions:

Unit startup is in progress. Drum pressure is greater than 1000 psig. Turbine speed is greater than 3420 rpm. Both field breakers are CLOSED with generator voltage greater than 16.6 volts. Exciter amps are less than 1000 amps. Both voltage regulators are in MANUAL.

Initiating Cue:

In accordance with Operating Procedure 4-IP-01, Unit Startup, the unit is ready to be synchronized to the system to continue the startup.

Standard:

Unit synchronized to the system. Minimum load established on the generator.

Initiating Cue:

The unit is ready to be synchronized to the system to continue startup in accordance with 4-IP-01, Unit Startup.

CRITICAL ELEMENTS (C): 7, 10, 11, 12, 13, 14, 18, 19, 21, 22, 25

PERFORMANCE CHECKLIST:		STANDARDS	N/A SAT UNSAT
1.	VERIFY turbine speed at 3603 rpm.	At turbine panel, turbine speed: 3603 rpm.	___ ___
2.	SHUT DOWN the auxiliary oil pump and PLACE in automatic.	At turbine panel, auxiliary oil pump: green light on and red light off. Control switch: in AUTO.	___ ___
3.	PLACE the HP and IP voltage regulator control switches in TEST.	At generator panel, HP and IP voltage regulator control switches: in TEST.	___ ___
4.	EXERCISE the AC voltage regulator adjusters by running the HP and IP volt regulators full scale up and down.	At generator panel, voltage regulators: exercised.	___ ___
5.	ZERO in (Null Out) the voltage regulators.	At Generator panel, voltage regulators: Zeroed.	___ ___
6.	PLACE the voltage regulator control switches in AUTOMATIC.	At generator panel, AC voltage regulators: in AUTOMATIC.	___ ___
(C) 7.	REQUEST and RECEIVE final approval from the system dispatcher to parallel the unit.	RECEIVED final approval from the system dispatcher.	___ ___
7A.	NOTIFY the transmission operator of the INTENT to parallel San Ramon Unit #4 to the system.	NOTIFIED T.O. of intent to parallel.	___ ___
8.	PLACE the OCB 630 synchroscope selector switch in the "ON" position.	At generator panel, OCB 630 synchroscope selector switch: in ON.	___ ___
9.	VERIFY HP and IP exciter volts are equal.	At generator panel, HP and IP exciter volts: equal.	___ ___
(C) 10.	VERIFY unit voltage is greater than 230 KV bus voltage.	At generator panel, unit voltage greater than 230 KV bus voltage.	___ ___
(C) 11.	VERIFY generator phase voltages equal.	At generator panel, generator phase voltages: equal.	___ ___
(C) 12.	VERIFY HP and IP megavars equal.	At generator panel, HP and IP megavars: equal.	___ ___
(C) 13.	VERIFY synchroscope lights pulsating slowly.	At generator panel, synchroscope lights: pulsating slowly.	___ ___
(C) 14.	VERIFY synchroscope rotating slowly in fast direction.	At generator panel, synchroscope: rotating slowly in fast direction.	___ ___

PERFORMANCE CHECKLIST:		STANDARDS	N/A SAT UNSAT
15.	VERIFY turbine speed equal to 3603 rpm.	At turbine panel, turbine speed: 3603 rpm.	___ ___
16.	VERIFY drum pressure between 1000 - 1200 psig and rising.	At boiler panel, drum pressure 1000 -1200 psig and rising.	___ ___
17.	VERIFY throttle pressure is approximately equal to drum pressure.	At boiler panel, throttle pressure approx. equal drum pressure.	___ ___
(C) 18.	WHEN the synchroscope indicates 5 till 12, then CLOSE the generator output breaker.	At generator panel, generator output breaker, oCB 630 control switch: in CLOSE.	___ ___
(C) 19.	VERIFY generator output breaker closed.	At generator panel, generator output breaker: Red light on and Green off.	___ ___
20.	VERIFY synchroscope hand at 12:00 position and lights out.	At generator panel, synchroscope: at 12:00 and lights out.	___ ___
(C) 21.	VERIFY voltage equal on all three phases.	On generator panel, voltage equal on all three phases.	___ ___
(C) 22.	VERIFY small current flow on all three phases.	On generator panel, small current flow on all three phases.	___ ___
23.	VERIFY HP and IP exciter voltage normal.	At generator panel, HP and IP exciter voltage normal.	___ ___
24.	VERIFY HP and IP generator megavars at approx. 10 out per shaft.	At generator panel, HP and IP generator megavars at approx. 10 out per shaft.	___ ___
24.	PLACE the synchroscope selector switch in "OFF".	On generator panel, synchroscope selector switch: OFF.	___ ___
(C) 25.	VERIFY turbine generator load greater than 20 MW.	On DEH panel, process indicator: greater than 20 MW.	___ ___
26.	NOTIFY the system dispatcher of the parallel time of the unit.	System dispatcher: notified of parallel time.	___ ___
	Instructor Cue:	Terminate JPM.	

Required Questions for the JPM

Question 1:

When synchronizing a generator to the system, why is it important for the generator voltage to be equal to or greater than that of the system?

Answer: This reduces the stress on the generator windings by minimizing the flow of VARS between the transmission system and the unit generator. It also ensures that if there is a slight voltage difference, the VAR current will flow from the generator to the transmission system.

Reference:

Satisfactory: _____ Unsatisfactory: _____

Comments:

Question 2:

When synchronizing the generator to the system, why is it important for the generator frequency to be slightly higher than the system frequency?

Answer: This ensures that the generator will pick up real load when the breaker is closed, which prevents a reverse power condition.

Reference:

Satisfactory: _____ Unsatisfactory: _____

Comments:

Required Questions for the JPM

Question 3:

If, upon closing the generator field breakers during unit start up, voltage is indicated on the IP field discharge resistor voltage meter, describe the correct operator response to this condition.

Answer: IF this condition exists, then immediately OPEN both field breakers. (241-G4HP & 241-G41IP)

Reference:

4-IP-01, Unit Startup, Step 8.6.6

Satisfactory: _____ Unsatisfactory: _____

Comments:

Question 4:

How long before the OCB trips on reverse power without a turbine trip?

Answer: 30 seconds

References:

Logic Diagram No. 4001600

Satisfactory: _____ Unsatisfactory: _____

Comments:

Required Questions for the JPM

Question 5:

How long before the OCB trips on reverse power due to the anti-motoring feature?

Answer: 2.5 minutes

References:

Logic Diagram No. 4001600

Satisfactory: _____ Unsatisfactory: _____

Comments:

Question 6:

Which of the three trips associated with a reverse power condition can be disabled by the anti-motoring cutout switch (262-G4)?

Answer: 15 second and 30 second reverse power trips only.

References:

Logic Diagram 4001600

Satisfactory: _____ Unsatisfactory: _____

Comments:

(NOTE: From here on is the handout for the trainee.)

Trainee's Job Performance Measure Direction Sheet

Directions to Candidate:

When I tell you to begin, you will become the Control Room Operator. You will be required to properly synchronize the generator to the system.

I will describe the initial conditions and provide you with access to any tools required to complete this task. Before you start, I will state the task standards and initiating cues and answer any questions. To complete this task successfully, you must perform each critical element correctly. As you perform this JPM, please state aloud all verifications required. Make all notifications required for the task.

Conditions:

Unit startup is in progress. Drum pressure is greater than 1000 psig. Turbine speed is greater than 3420 rpm. Both field breakers are CLOSED with generator voltage greater than 16.6 volts. Exciter amps are less than 1000 amps. Both voltage regulators are in MANUAL.

Initiating Cue:

In accordance with Operating Procedure 4-IP-01, Unit Startup, the unit is ready to be synchronized to the system to continue the startup.

Standard:

Unit synchronized to the system. Minimum load established on the generator.

Trainee's Questions

Question 1:

When synchronizing a generator to the system, why is it important for the generator voltage to be equal to or greater than that of the system.

Question 2:

When synchronizing the generator to the system, why is it important for the generator frequency to be slightly higher than the system frequency?

Question 3:

If, upon closing the generator field breakers during unit start up, voltage is indicated on the IP field discharge resistor voltage meter, describe the correct operator response to this condition.

Question 4:

How long before the OCB trips on reverse power without a turbine trip?

Question 5:

How long before the OCB trips on reverse power due to the anti-motoring feature?

Question 6:

Which of the three trips associated with a reverse power condition can be disabled by the anti-motoring cutout switch (262-G4)?

D
TRAINING SYSTEM – SELF TEST

Part I

Measure the trainee's reaction to the training system. This evaluation will show whether the training program met with the approval of the target population. It does not verify that the training met its objectives.

This evaluation should happen after each training event. The qualification guide and card includes a "trainee evaluation" form. Target audience appeal significantly improves the effectiveness of the training system. Listen and respond to advice from trainees. Discuss the review with each trainee to pinpoint the root-cause of any concerns so that an appropriate action plan can be developed. Let the trainee be a part of developing the action plan. Operator ownership in the training system is vital to its success.

Part II

Measure the effectiveness of the learning system. The purpose of this evaluation is to determine if learning actually did take place. To accomplish this, at a minimum, some sort of measurement needs to be made before and after the implementation of training.

Training Needs Assessment - Operator Questionnaire

What is the purpose of the boiler purge?
What will initiate a MFT?
Why is there a minimum air flow requirement for the boiler?
Why is it necessary to use ignition oil during a start up?
What signals primarily determine feedwater demand?
What signals primarily determine boiler firing rate demand?
How is throttle pressure controlled during normal unit operation?
If the control valves are wide open, and throttle pressure is still too high, what should you do?
During unit operation, what would be the most likely causes of a sudden rise in waterwall outlet temperature?
Why are main steam safety valves set to a lower pressure than the waterwall outlet or convection pass safety valves.?
Why is it important to monitor boiler water conductivity?
When increasing the firing rate manually, which should be raised first: fuel or air? Why?
Why does the appropriate amount of excess air change with unit load?
What should you do if the furnace becomes “fuel rich”?
During normal unit operations, name the steps operators can take to correct high main steam temperatures?
What is the difference between full arc and partial arc?
Why can exhaust temperatures be a problem during low load operation?
What is the maximum permissible steam-to-metal temperature mismatch during turbine start up?
What causes differential expansion in the steam turbine?
What is the purpose of the non-return check valves that are located on most of the extractions?
Outgoing or inductive vars are measured in which direction on the generator capability curve?
What happens if the amplidyne is out of service and you are on line and you have to change load?
What is the relationship between generator output voltage and reactive load?
What is the danger of high conductivity in the stator cooling water?
What is the purpose of the Nash vacuum pump units that are connected to the condenser when on-line?
At full load, which is responsible for producing more megawatts: main steam or reheat steam?

Part III: Measure Your Management System

Does your training program have a written purpose statement?	**Yes**	**No**	**N/A**
Does your training program have written program goals?	**Yes**	**No**	**N/A**
Does your training program have written objectives?	**Yes**	**No**	**N/A**
Does your training program have customers to be served by the program?	**Yes**	**No**	**N/A**
Does your training program have a written program policy statement?	**Yes**	**No**	**N/A**
Does your training program have a written program philosophy?	**Yes**	**No**	**N/A**
Does your training program have written program action plan?	**Yes**	**No**	**N/A**
Does your training program have a schedule of events from the action plan?	**Yes**	**No**	**N/A**
Does your training program have a person who is responsible for overseeing the program with the appropriate authority?	**Yes**	**No**	**N/A**
Does your training program provide incentives or rewards for those who conduct the OJT?	**Yes**	**No**	**N/A**
Does your training program provide incentives or rewards for training?	**Yes**	**No**	**N/A**
Does your training program have a means to budget for training?	**Yes**	**No**	**N/A**
Does your training program have a means to keep records for individuals participating in the training program?	**Yes**	**No**	**N/A**
Does your training program have training workshops for the trainers in support of program goals?	**Yes**	**No**	**N/A**
Does your training program have training workshops for the learners in support of program goals?	**Yes**	**No**	**N/A**
Does your Training Program have a means for discovering needs and new tasks that should be added to the Training program?	**Yes**	**No**	**N/A**
Does your training program analyze work, worker, and workplace?	**Yes**	**No**	**N/A**
Does your training program have a means to prepare training materials?	**Yes**	**No**	**N/A**
Does your training program present training material and evaluations?	**Yes**	**No**	**N/A**
Does your training program have a means to evaluate the results of the training program?	**Yes**	**No**	**N/A**
Does your training program have written procedures for selecting alternatives to, or supplements for, selected training segments?	**Yes**	**No**	**N/A**
Total Columns			

After you finish measuring your management system, score and interpret the results using the instructions that follow. Items scored as No identify possible management gaps in your training system. Gaps in the training system require changes in the training system design specification and implementation plan.

Scoring and Interpretation

Give your organization 1 point for each Yes and 0 points for each No or N/A answer. Enter your total in the Total Columns space at the bottom of the test. Interpret your score as follows:

Score	Interpretation
19 or more	Your organization is apparently using effective training practices. While improvement can be made, the critical success factors for a structured training system are already in place—assuming, of course, that you answered the pretest honestly and that the score does not merely represent wishful thinking.
15 to 18	Improvements could be made to your training practices. On the whole, however, your organization is proceeding on the right track.
12 to 14	Training practices in your organization do not appear to be as effective as they should be. Significant improvements should be made.
12 or less	Training practices are ineffective in your organization. They are probably a source of costly mistakes, productivity losses, and unnecessary employee turnover. Take immediate corrective action.

E
GENERIC JOB APPLICANT REQUIREMENTS AND BASIC SKILLS COURSES

Generic Job Applicant Requirements

The following table includes typical knowledge and skills found on Power Plant Operation type job notices. These items are not mandatory, simply a useful guideline. Items in **bold** are recommendations from the National Conference.

Type	Requirement
Education	**High School Diploma**
	Reading, writing, oral communication in English, basic math
	Associates Degree – Power Plant Technology
	Security Screening
Transportation	**Drivers License**
	Employee must arrange own transportation to assigned work location and may be reassigned to other work locations at the company's discretion.
Work Conditions	Rotating shift, working overtime, and responding to emergency call-outs (7 days a week/24 hours a day)
	Work outside and inside with noise, heat, cold, and humidity
	Work from platform heights of 25 feet (7.6 m) or greater and boiler structure up to 300 feet (91.4 m) in height
	Work with such chemicals and substances as asbestos, silica, fiberglass, ammonia, hydrazine, chlorine, PVC acetone, and PCBs.
Physical requirements	**Drug Test**
	OSHA Required Pulmonary Fit Test/Stress Test
	Physical Capability/Agility
	Ability to perform tasks while standing 20%, walking 80%, climb stairs 60%, squat, work with extended reach above head and in front of body
	Ability to discern and respond to verbal/auditory signals at control panel
Mechanical	Ability to use hand tools and power tools and equipment
Complete Plant Operator Training Program	OJT performance

	Use addition, subtraction, multiplication, and division to perform flow, pressure, and meter calculations
	Ability to perform conversions for equipment checks of gauge readings
	Ability to read and interpret plant equipment blueprints, schematic diagrams, procedures, and technical manuals
	Ability to apply knowledge of steam power plant operations and the principles of heat transfer and thermodynamics to daily decisions and work tasks
	Ability to communicate conditions of plant systems/equipment to others
	Must work without supervision or inspection while carrying out duties
	Ability to operate various switches and valves and apply knowledge of the effect each has on total operation
	Ability to take, record, and analyze readings of various electrical and mechanical meters

Basic Skills – Qualification Guideline for Courses or Apprenticeship

Plant Terminology

Course Description: Course lessons will study plant equipment and the proper terminology necessary for identification of the equipment. Lessons will cover steam and heat theory as related to plant operation, and basic physics calculations will be used.

Course Objectives: Students will describe names and function of plant equipment. They will be able to calculate area, flow rate, volume, pressure, and temperature conversions.

Competency 1: Identify all equipment in the condensate, feedwater, and steam systems.

Competency 2: Work math problems associated with plant operation.

Basic Math

Course Description: This course includes lesson plans and practice in basic mathematics without the benefit of a calculator when testing.

Course Objectives: Students completing this course will demonstrate the knowledge and use of numbers and number systems, powers, roots and measurements, algebra, and formulas.

Competency 1: Numbers and number systems.
Perform calculations including addition, subtraction, multiplication, division, signed numbers, fractions, ratios, decimals and percentages, scientific notation, rounding, and averaging.

Competency 2: Powers, roots, and measurements.
Calculate powers and roots, order of operations, units of measurement, and basic conversions.

Competency 3: Basic algebra.
Solve basic algebra problems, written both as regular and verbal problems allowing one unknown.

Safety

Course Description: This course will include lessons in industrial safety requirements. Safe work habits and applicable OSHA and EPA regulations will be covered.

Course Objectives: Students will demonstrate knowledge of government-mandated training and foundational aspects of apprentice technician safety training. Students will demonstrate ability to take responsibility for personal, operational, and co-worker safety.

Competency 1: Personal safety.
Identify and describe basic safety equipment required to work safely in an industrial environment.

Competency 2: Fire safety.
Demonstrate fire-prevention and fire-fighting techniques used in an industrial setting. Select and describe use of the correct equipment and precautions to take when involved in a fire emergency.

Competency 3: Respiratory protection.
Recognize when and how to use the various types of respiratory protective equipment.

Competency 4: Hazardous materials.
Identify hazardous materials, and describe how to work safely with and around hazardous materials.

Competency 5: Government regulations.
Define the various federal laws that govern and impact the industrial environment.

Additions per Utilities:
Demonstrate the purpose and method of lockout, confined space, and MSDS

Water Chemistry

Course Objectives: Students completing this course will understand the Periodic Table of Elements. They will be able to balance chemical equations and have an understanding of the proper treatment of boiler water.

Course Description: Study of chemistry concepts with special emphasis on knowledge of the Periodic Table and balancing of chemical equations. The course concentrates on the importance of proper water treatment and the operation of water treatment equipment.

Competency 1: Identify all equipment used in water treatment systems.

Competency 2: Understand why certain chemicals are injected into systems.

Competency 3: Obtain information from the periodic table.

Mechanical Fundamentals

Course Description: This course will cover basic operations of valves, pumps, fans, and heat exchangers. Topics to be covered are fluid flow and piping, auxiliaries, pumps and drives, compressors and fans, and heat exchangers/heat transfer concepts.

Course Objective: Students completing this course of study should have an understanding of the uses of mechanical components used in a power plant, how the equipment functions, and general operating guidelines.

Competency 1: Identifying equipment and discuss how it works.
The student should be able to follow the flow path through a system, understand how pumps and heat exchangers work, and know how to operate them efficiently.

Competency 2: Isolating equipment.
The student should be able to isolate equipment, change flow, and explain what he/she is doing to the process.

Piping and Instrument Diagrams

Course Description: Students will study symbols commonly used to identify components on plant schematics and to read and answer questions using actual plant drawings. Students will do a simplified drawing of a plant, based on schematics used in class.

Course Objectives: Students completing this course of study should have an understanding of the uses of schematics in a plant and the ability to read them and answer specified questions.

Competency 1: Common symbols.
The student should be able to identify and draw many symbols commonly used on plant operations schematics.

Competency 2: Process flow.
The student should be able to follow the flow of a fluid though a schematic.

Competency 3: Identifying and isolating equipment.
The student should be able to isolate equipment, change flow, and explain what he/she is doing, using the schematics as a guide.

Competency 4: Draw a piping and instrumentation drawing (P&ID).
The student should be able to draw a simplified version of a P&ID based on the schematics that he/she receives in class.

Plant Systems

Course Description: Students will study basic plant systems and equipment used in the process of water treatment.

Course Objectives: Students completing this course of study should have an understanding of many of the systems and support systems that are vital to the efficient operation of a power plant. In addition, they should know the major components and systems used to prepare water for plant use and especially boiler use.

Competency 1: Steam systems
The students should become familiar with the main steam systems associated with a typical plant.

Competency 2: Condensers, circulating water, and fire systems
The student should learn the function of the main condenser and the associated circulating water system and review the fire systems, which were covered first in safety. In addition, the student should become familiar with the condenser air removal system and proper condenser operation.

Competency 3: System functions and components.
The student should be able to follow the flow path through a system, understand how pumps and heat exchangers work, and know how to operate them efficiently.

Competency 4: Boiler water treatment
The student should understand and be able to explain the basics involved in the treatment of boiler water and understand how poorly treated water can damage equipment and decrease the efficiency of a plant.

Competency 5: Raw water treatment.
The student should understand and be able to describe the operation of a clarifier and filtering and reverse osmosis systems.

Competency 6: Ion exchange
The student should understand the basic construction and operation of an ion exchanger and be familiar with uses of these exchangers in plant water treatment. He/she should also understand the regeneration process.

Competency 7: Cooling water treatment
The student should become familiar several of the different cooling water systems found at a plant, problems that are common to all cooling water systems, and methods of treatment used to prevent these problems.

Power Principles

Course Description: This course will include lessons on power plant science and cycles in power generation, process plants, and refineries. This course will also describe the study of hydraulics and pneumatics as they are used in industry.

Course Objectives: The student will be able to describe in detail how water and steam flow through the plant cycle. Students will explain how the properties of water and steam are affected by changes in temperature and pressure. Students will use steam tables and calculate efficiency and heat rate.

Competency 1: Heat transfer:
Describe how heat moves. Explain how metal expansion and contraction are critical in efficient equipment operation.

Competency 2: Operation.
Follow a P&ID and be able to identify the components and their function.

Competency 3: Mathematics.
Calculate the heat content of a steam/water mixture. Calculate efficiency, heat rate, and start-up time.

Competency 4: Safety.
Recognize the dangers of working with steam, and choose what clothes and safety equipment to use when working with steam.

Fuels and Combustion

Course Description: This course concentrates on the purpose and operating principles of fuel handling equipment, such as conveyors, pulverizers, burners, and furnaces. Combustion theory and efficiency will be explored. Ash handling equipment operation will also be shared

Course Objectives: The student will be able to demonstrate knowledge/skill of safe fuel handling design and operation. Students will be able to apply concepts including: combustion theory, ash handling systems, burners, troubleshooting, and maintenance requirements.

Competency 1: Equipment.
Define the purpose and design of feeders, pulverizers, burners, and ash handling equipment.

Competency 2: Operations.
Describe operating practices under normal and emergency conditions. Explain troubleshooting techniques and maintenance procedures. Compare as-received and as-burned BTU value of coal. List the effects of coal condition on process equipment.

Competence 3: Safety.
Follow safety rules, and recognize safety hazards. Know when and how to wear/use safety equipment properly.

Additions per Utilities:

Purpose and operation of pulverizers and feeders. Effects of coal conditions on pulverizers. Difference between as-received and as-burned BTU value of coal.

Boilers

Course Description: This course provides lessons on boiler operating theories and practices augmented with tours of actual heating plants and a power plant. Students will experience first hand the safety requirements and potential hazards in the workplace. Basic operation of both high-pressure and low-pressure boilers will be discussed. Water tube and fire tube boiler classifications, as well as once-through and drum-type boilers, are described. Plant systems that relate to the boiler unit will be included: feedwater, combustion air and flue gas, fuel, sootblowing, and steam systems. Start-up, operating, shut-down, troubleshooting, maintenance, and emergency guidelines and techniques are all a part of the learning activity.

Course Objectives: The student will be able to demonstrate knowledge/skill of safe boiler design and operation for both high-pressure industrial boilers and low-pressure heating boilers. Students will be able to apply concepts including efficient operation, troubleshooting techniques, and plant systems related to the boiler and maintenance requirements.

Competency 1: Boilers.
Describe the different types of boilers and their function. Explain the purpose of major boiler components and boiler-related equipment. Describe required boiler valves (safety, relief, vents, drains, and blowdowns). Recognize basic boiler code issues and find boiler code requirements.

Competency 2: Auxiliary equipment.
Explain the purpose and fundamental operation of boiler-related systems: feedwater, combustion air and flue gas, fuel, sootblowing and steam.

Competency 3: Operation.
Be able to follow a diagram and tell how each component operates. Define the critical operating parameters, normal range, and emergency condition. Describe control schemes used and effects on boiler and related equipment. Identify an upset condition and describe actions to bring the unit to a safe condition. Describe boiler warm-up and identify temperature excursions (superheat/reheat).

Competency 4: Safety.
Recognize a hazard to personal safety, the work environment, or equipment. Know when and how to wear/use safety equipment properly.

Additions per Utilities

Boiler code – How to obtain regulations, read and find requirements, how to identify issues and correct.

Boiler components – Basic boiler design and valves (furnace, tube design, drums and headers, access doors, indicators, safety valves, vents, drains, blowdowns, and gas passages).

Operating parameters – Critical operating parameters, normal range and emergency conditions, operating ranges of a high-pressure boiler 860–4000 psi, temperature excursions (superheat and reheat), and how controls affect the operation of the boiler.

Plant systems – Combustion air: primary and secondary air purpose and flow, effects on furnace draft, fuel combustion, and environmental parameters. Sootblowing: purpose and basic system equipment and operation, effects on boiler efficiency.

Maintenance – Routine inspections and typical maintenance outages, routine cleaning, and preventive maintenance plans.

Turbines

Course Description: This course will include lessons in basic construction and operation of utility-size steam turbines.

Course Objectives: Students completing this course of study will demonstrate the knowledge of construction and classification of steam turbines. Students will identify the basic parts of a turbine and be familiar with many of the basic operational aspects of a steam turbine. They will also be familiar with many of the auxiliary systems associated with steam turbines.

Competency 1: Construction and principles of operation.
Identify many of the basic components of a typical steam turbine, and describe how they work.

Competency 2: Turbine valves and support systems.
Explain the function and operation of the major turbine valves and support systems.

Competency 3: Turbine controls, instrumentation, and protection.
Identify the major types of turbine control systems, both types of turbine instrumentation, and how these systems influence the safe operation of a unit.

Competency 4: Turbine operation
Recognize safe and efficient startup, operation, and shutdown of a unit.

Additions per Utilities:

Describe the function and operation of DEH control systems and extraction check valves to the feedwater heaters

Applied Math

Course Description: Students will study and practice basic mathematics and apply mathematics when solving plant-related problems.

Course Objectives: Students completing this course of study will have knowledge of numbers and number systems, powers, roots, measurements, algebra, and formulas and be familiar with the use of a calculator.

Competency 1: Numbers and number systems.
The student should become familiar with addition, subtraction, multiplication, division, signed numbers, fractions, ratios, decimals and percentages, scientific notation, rounding, and averaging.

Competency 2: Powers, roots, and measurements.
The student should learn to calculate powers and roots, order of operations, units of measurement, and basic conversions that apply to solving plant-related problems.

Competency 3: Basic algebra.
The student should be able to solve basic algebra problems, written both as math and verbal problems, allowing one unknown.

Gas Turbine and Diesel

Course Description: This course provides lessons on turbine construction and operation for water and gas turbines, as well as diesels.

Course Objectives: Students will be able to demonstrate basic knowledge of the design and operation of turbines in the power generation industry. Students will be able to apply concepts for water, gas, and diesel turbines.

Competency 1: Equipment.
Describe the parts of a gas and diesel turbines and their function.

Competency 2: Operation.
Describe basic startup checks and operational checks of operating diesel and gas turbines.

Competency 3: Safety.
Explain the safety checks during startup and operation of gas and diesel turbines.

Electrical Principles

Course Description: This course covers basic electricity, Ohm's Law, basic electrical circuits, and basic motor and generator theory.

Course Objectives: Students will be able to demonstrate basic knowledge of how voltage is produced, as well as how it is used and manipulated to do work. Students will be able to classify the various protection devices used to safeguard equipment and wiring from damage.

Competency 1: Electrical theory.
Explain the general principles of electrical flow and characteristics. Identify and state the purpose of general terms and symbols. Draw a one-line electrical diagram.

Competency 2: Electrical protection devices.
Identify and explain the purpose of solenoids, relays, fuses, and circuit breakers.

Competency 3: Ohm's Law and power.
Explain Ohm's Law and the different factors that affect power usage.

Additions per Utilities:

Identify and state the purpose of general terms and symbols. Draw a one-line electrical diagram

Power Generation

Course Description: This course includes lessons that explain the construction of motors and generators used in power plants.

Course Objectives: Students will be able to describe how generators produce electricity and how a generator fits into an overall power generation system. Students will be able to identify exciters, voltage regulation, cooling systems, and oil seal systems.

Competency 1: Generator principles.
Describe generator principles including excitation and voltage regulation.

Competency 2: AC power.
Describe ac circuits with inductive and capacitive characteristics.

Competency 3: Generator auxiliary systems.
Explain how cooling systems and seals work on a generator.

Additions per Utilities:

Describe the function and operation of the seal oil system. Explain the hydrogen system and how to purge the generator

Electrical Systems

Course Description: Students will acquire a knowledge of what electricity is, how electrical devices operate, and how people and equipment are protected from the effects of excessive current flowing through electrical circuits.

Course Objectives: The student will be able to read electrical diagrams and use them in solving practical problems on the job. Students will be able to describe basic principles of three-phase power generation and transmission.

Competency 1: Electrical diagrams.
Read electrical diagrams, and use them to solve practical problem. Describe the purpose of switchgear (480, 2400, 4160, 7200); define the general users.

Competency 2: Three-phase power.
Describe the basic principles of three-phase power generation and transmission. Define the function and operating procedures of the synchroscope. Explain what a transformer is and where they are used in the process. Compare incoming to running voltage.

Competency 3: Safety.
Explain general procedures and safety precautions. Describe power restoration emergency procedures (black start).

Additions per Utilities:

What is a synchroscope and how does it operate? What is the purpose of a transformer and where are they used in the process? What is the difference in incoming versus running voltage and when is it a concern? Describe the purpose of switchgear (480, 2400, 4160, 7200); define the general users. How is electricity supplied and distributed? Power restoration (black start).

Plant Protection

Course Description: This course will provide details of plant lockouts and safety devices. Protective devices and systems are discussed in detail. Simulator training in a power plant is included.

Course Objectives: Students will be able to demonstrate basic knowledge of protection devices and systems in a power plant. Students will identify what conditions can cause failure and how to prevent them.

Competency 1: Causes for failure.
Recognize what can cause failure in equipment.

Competency 2: Equipment.
Identify protection devices, their symbols, and how they function.

Competency 3: Systems.
Describe how the protection devices work together to protect the entire electrical generation system.

Additions per Utilities:

Describe the function and operation of components such as overspeed trips, vibration, differential expansion, effects of steam temperature on the rate of growth of the casing and rotor.

Plant Instrumentation

Course Description: This course will examine the application of concepts such as measurement of flow, temperature, pressure, and level in the modern-day power plant.

Course Objectives: Students will define how indicating instruments operate. The student will be able to read various types of gauges and demonstrate how the information is transmitted from one location to another. The student will also be able to interpret the symbols found on piping and instrumentation drawings.

Competency 1: Equipment.
Identify type of gauges and interpret the readings.

Competency 2: Sensors and variables.
Recognize the type of sensors used and how they operate.

Competency 3: Piping and instrumentation drawings (P&IDs).
Read a P&ID drawing with all associated instruments.

Instrumentation and Control

Course Description: This course covers lessons on design and operation of controllers and final control elements and their interaction in power generation systems. Students will participate in study and lab exercises on programmable controllers similar to those used in power generation.

Course Objectives: The student will be able to describe how automatic control systems are used in processes. Students will identify various types of sensing elements, measuring elements, controlling elements, and final control elements. Students will be able to apply concepts including control loops and how devices work together to maintain a process variable at a setpoint or within a range.

Competency 1: Equipment.
Identify and define each of the components used in control systems. Read an instrument drawing. Describe the air system and its purpose. Read a ladder logic diagram.

Competency 2: Control systems.
Describe how single and multiple element control systems work. Explain “how the valve will fail” on loss of power/air.

Competency 3: Simulator training.
Demonstrate knowledge of distributive control systems functions.

Additions per Utilities:

Read an instrument drawing. How to determine “how the valve will fail” on loss of air/power. Air system description and purpose, including air dryer. Read a ladder logic diagram. Define bias and setpoint; use in an example

F
SAMPLE JOB COMPETENCIES

Sample Job Competencies for Entry-Level Operators

SAT1001 - Orientation: Company Programs and Policies

001 Become acquainted with the following company policies and programs

- Smoking Policy
- Tornado Policy
- Injury Reporting
- Attendance Policy
- Code of Conduct
- Safety Glasses Policy/Program
- Emergency Operating Procedures/ORW
- Emergency Snow Removal

SAT1001 - Orientation: Safety Practices

001 Demonstrate your ability to successfully complete the following safety-related practices/requirements, but not limited to

- Safety manual familiarization
- Emergency response system
- Electrical equipment hazards
- Plant evacuation plan and exits
- Ladder safety/use
- Man-lift/elevator usage
- Rotating equipment hazards
- Used oil

SAT1002 - Hearing Protection

001 Demonstrate your ability to successfully complete the company's program on hearing protection.

SAT1003 - Introduction to MSDS

001 Given the name of a product by your evaluator, locate an MSDS sheet for that product and through using that MSDS sheet, explain the hazards that must be safeguarded against and the safety precautions that MUST be taken when using the product.

SAT1004 - Personal Protective Equipment

001 Demonstrate your ability to successfully complete the company's program on personal protective equipment.

SAT1005 - Respiratory Protection

001 Demonstrate your ability to successfully complete the company's program on respiratory protection.

SAT1006 - Clearance Permit System

001 Demonstrate your basic knowledge of the clearance permit system by explaining the following:

- What is the permit system and why is it used?
- When must a clearance permit be secured?
- Who should make out the request for a clearance permit?
- Who is authorized to issue a clearance permit?
- Who is responsible for checking out the clearance to ensure it is properly tagged?
- Identifying and stating the purpose of each type of tag used.

SAT1007 - Hazard Communication

001 Demonstrate your ability to successfully complete the company's hazard communication program.

SAT1008 - HAZWOPER

001 Demonstrate your ability to successfully complete the company's HAZWOPER program.

SAT1009 - SPCC – Spill Prevention Control and Countermeasures

001 Demonstrate your ability to successfully complete the company's program on SPCC - spill prevention control/countermeasures.

SAT1010 - Asbestos Awareness

001 Demonstrate your ability to collect a sample of material to be tested for asbestos, using all appropriate safety precautions.

002 Successfully complete the appropriate accredited training program to enable you to remove and dispose of asbestos insulation and other asbestos-containing materials.

SAT1011 - Introduction to Fire Protection

001 Demonstrate your basic knowledge of the plant fire protection system by:

- Stating the purpose and location of pumps and associated equipment
- Stating the purpose and use of all fixed and portable fire extinguishing equipment
- Identifying the different classifications of fires and the type of fire extinguisher used for each
- Properly operating the different types of portable fire extinguishers
- Properly set up and discharge a fire hose
- Properly donning self-contained breathing apparatus

002 Demonstrate your ability to make weekly fire checks.

SAT1012 - Boat/Water Safety/Maritime Requirements

001 Demonstrate your ability to successfully complete the company's program on boat/water safety and maritime requirements.

SAT1013 - Lubricants

001 Demonstrate your knowledge of lubricants by explaining the specific type of lubricants to be used on equipment to be identified by your evaluator, using the plant lubrication chart or manual.

002 Demonstrate your ability to properly use grease-dispensing equipment.

003 Demonstrate the proper procedure for using and adjusting oilers.

SAT1014 - Solvents and Cleaning Tools

001 Demonstrate your ability to identify and explain the purpose and safety precautions associated with the use of hand cleaning tools and equipment such as, but not limited to:

- PE
- Chemicals/solvents
- Mops/brooms/foxtails
- Squeegees
- High-pressure washers
- Cleaning vacuum
- Sweepers
- Buckets
- Buffers
- Wheelbarrow
- Sand blasters
- Cleaning solutions
- Brushes
- Dust mops/dust pans
- Scrubbers
- Buffers/scrubbers/strippers

002 When given parts to be cleaned, demonstrate your ability to properly use the solvent bath to clean them and properly dispose of solvents as necessary.

003 Explain the housekeeping responsibilities as a member of a team.

SAT1015 - Lead

001 Demonstrate your ability to successfully complete the company's program on lead.

SAT1016 - Arsenic

001 Demonstrate your ability to successfully complete the company's program on arsenic.

SAT1017 - Chlorine

001 Demonstrate your ability to successfully complete the company's program on chlorine.

SAT1018 - Confined Space

001 Demonstrate your ability to successfully complete the company's program on confined space.

002 Demonstrate your ability to fill out required confined space permit forms, to explain the proper procedures/ precautions associated with confined spaces, and to properly use a confined space monitor to check, prior to entry, a confined space for combustibles and O_2 concentrations.

SAT1019 - Hot Works/Burning/Fire Permit System

001 Demonstrate your ability to successfully complete the company's program on the hot works/burning/fire permit system.

SAT1020 - Bloodborne Pathogens

001 Demonstrate your ability to successfully complete the company's program on bloodborne pathogens.

BST1001 - Fossil Plant Fundamentals

001 Complete the interactive training units in the Power Plant series and the Plant Science series.

BST1002 - PIMS/MMS System Operation

001 Demonstrate your ability to perform the following using the PIMS/MMS systems, by:

- Logging into the maintenance management system (MMS) and navigate through the different screens
- Logging into the plant information management system (PIMS) and navigate through the different screens
- Locating parts using MMS
- Obtaining materials and supplies using MMS
- Properly completing an on-screen job order using PIMS

BST1003 - Basic Sketches and Simplified Flow Diagrams

001 Demonstrate your basic knowledge of and be able to:

- Perform basic sketching for design and fabrication of parts/equipment.
- Read and interpret simplified flow diagrams.
- Explain the process to be used to change/modify prints/flow diagrams.

002 Demonstrate your ability to correlate diagram symbols to actual plant equipment by physically locating equipment in the plant after being shown symbols on plant diagrams by your evaluator.

BST1004 - Hand Tools

001 Demonstrate your ability to identify, explain the purpose and safety precautions associated with, and use the following power tools:

- Scribers
- Straight edges
- Scales
- Measuring tapes
- Sledge hammers
- Soft face hammers
- Retaining ring pliers
- Combination pliers
- Side cutter pliers
- Socket wrench set
- Pipe wrench
- Torque wrench
- Stocks and dies
- Stud extractors
- C-clamps
- Packing tools
- Banding set
- Flat scraper
- Layout fluid
- Bevel protractors
- Lapping plates
- Punches
- Drifts
- Screwdrivers
- Vise grips
- Hacksaws
- Allen wrench set
- Putty knife
- Chisels
- Tap extractors
- Cable cutters
- Bolt cutters
- Sheet metal snips
- Plumb bobs
- Strap chain wrench
- Telescoping gauges
- Thread pitch gauges
- Ball peen hammers
- Carpenters hammers
- Torque wrench multipliers
- Files (flat/pillar/square/etc.)
- Needle nose pliers
- Channel lock pliers
- Combination wrench set
- Bearing scrapes
- Spanner wrenches
- Tap wrenches
- Stamp sets/etching pencils
- Gasket cutting tools
- Piston ring expanders
- Pullers (bearing/gear/coupling)

- Easy outs
- Pipe clamps
- Chain breaks
- Rodding devices
- Spud bar
- Grease dispensers
- Scrapers
- Pop rivet gun
- Stones/hones
- Staple guns
- Utility knives
- Post hole digger
- Picks/axes
- Reamers (straight, taper, expansion, adjustable)
- Piston ring compressors
- Valve seat refacing cutters
- Wire brushes (spiral/flat)
- Rakes/hoes/shovels/etc.
- Taps (plug/ taper/bottoming)
- Micrometers(in/outside, depth)

002 When given an assortment of hacksaw blades, demonstrate your ability to select the proper blade and method to cut the following types of steel:

- Flat steel
- Angle iron
- Round steel
- Galvanized tin

003 When given several different sizes of threaded fasteners by your evaluator, demonstrate your ability to measure and determine the size of the fasteners.

004 Demonstrate your ability to use a tape measure, machinist rule, and a micrometer to measure various lengths and diameters.

005 When given a specified size of hole to be tapped, demonstrate your ability to select the proper size twist drill, and then tap and drill the hole.

006 Demonstrate your ability to use the proper procedure to thread round stock using hand-threading dies. Use all of the various types of threading and dies in common use at your plant.

007 When given an adjustable wrench, demonstrate your ability to properly adjust the wrench on a nut and tighten it.

008 When given a ratchet wrench and several sockets, demonstrate your ability to select the proper size socket to loosen or tighten nuts of various sizes, as specified by your evaluator.

009 When given different size pipe wrenches, demonstrate your ability to select the proper size wrench to loosen a union from a section of pipe.

010 Secure a piece of flat stock in a bench vise and demonstrate your knowledge of the proper use of a vise by explaining to your evaluator which jaw should receive the shock if you were going to bend the strap to form a 90° angle.

- Demonstrate how to use blocking in a bench vise to prevent work from slipping down in the jaws from repeated blows.
- Demonstrate your ability to properly bend the strap, as specified by your evaluator, while it is mounted in a bench vise.

011 Demonstrate your ability to select the proper size and type of screwdriver, and properly use different screwdrivers for different applications as specified by your evaluator.

012 Demonstrate your ability to use a screw extractor (easy out) to remove a bolt or screw with a damaged head.

013 Demonstrate your ability to properly measure various openings selected by your evaluator using a thickness gauge (feeler gauge) to within the tolerances indicated by your evaluator.

014 Using a protractor, rule, and compass, demonstrate your ability to lay out bolt-hole centers for a 6- and an 8-hole flange. Hole punch using the appropriate punch.

BST1005 - Power Tools

001 Demonstrate your ability to identify and explain the purpose and safety precautions associated with the use of power tools such as, but not limited to:

- Reciprocating saws
- Vacuum cleaners
- Impact wrenches
- Parts washers
- Band saws
- Hydraulic shears
- Portable generators
- Porta-power
- Drill press
- Mortar mixer
- Chain saws
- Pneumatic and electric drills
- Air grinding machines
- Cylinder honing equipment
- Pipe threading machines
- Valve seat grinding machines
- Hand-held electric sanders
- Electric bolt heating equip.
- Sandblasting equipment
- Electric stud-torquing tools
- Portable abrasive cut-off saws
- Hydraulic stud-torquing tools
- Platform personnel lift
- Hand-held electric saws
- Die grinders
- Hydraulic presses
- Power scrubber
- Steam cleaners
- Drain cleaner (snake)
- Jack hammer
- Lawn tractor
- Needle scaler
- Hydraulic crimper
- Sky climber

002 Demonstrate your ability to obtain, set up, and use a portable sump pump.

003 Demonstrate your ability to properly use a jackhammer to break up pavement, refractory, etc.

004 Demonstrate your ability to properly use an air and/or electric impact wrench to tighten and/or remove fasteners.

005 When given a section of 1" (2.54 cm) schedule 40 pipe, demonstrate your ability to properly measure and cut a section to the length specified by your evaluator, using the power hacksaw and/or power band saw. Check the pipes for rough edges, and use a pedestal grinder to remove all rough edges. Thread one end using hand dies, and thread the opposite end using a threading machine.

006 When given a piece of sample material to be sand blasted, demonstrate your ability to properly use the sand blasting equipment to clean it.

007 When given a piece of metal to be drilled, demonstrate your ability to use the hand drill and drill press to drill holes in it as specified by your evaluator.

008 Demonstrate your ability to properly operate a hydraulic press to perform a task selected by your evaluator.

009 Demonstrate your ability to properly use a surface grinder to prepare a piece of metal/equipment for painting.

010 Demonstrate your ability to use a power/hydraulic crimper to make up hydraulic hoses for equipment such as tractors or coal handling equipment.

011 Demonstrate your ability to properly service/repair a die grinder

BST1006 - Basic Electricity

001 Demonstrate your ability to properly identify a low voltage circuit and to use a voltage tester to check for voltage on that low voltage circuit.

002 Demonstrate your ability to check fuses using a volt-ohmmeter.

BST1007 - Introduction to Motors

001 Complete the interactive training units associated with motor operation and control.

BST1008 - Introduction to Pumps

001 Demonstrate your ability to check a sleeve bearing oil ring for proper operation (explain to your evaluator what you are doing/checking as you complete this check).

002 Demonstrate your ability to properly adjust packing glands on pumps using basic hand tools.

BST1009 - Introduction to Valves

001 Demonstrate your ability to properly adjust packing glands on valves using basic hand tools.

BST1010 - Material Handling

001 Demonstrate your ability to properly secure welding cables or hoses in a safe manner where they cross stairways or traveled walkways.

002 Demonstrate your ability to use proper body positions and do the following:

- Lift a heavy object from the floor, carry it a short distance, and then place it back on the floor.
- Carry a flat piece of sheet metal or plywood from one location to another.
- Lift and carry a long piece of pipe, bar stock, or lumber from one location to another.

003 Demonstrate your ability to properly inspect and safely use a straight ladder, a stepladder, and an extension ladder. [Demonstration for the straight ladder is to include a check of the angular placement of the ladder.]

004 Demonstrate your ability to properly operate a pallet mule or a hand fork truck to move a pallet from one location to another.

005 Demonstrate your ability to properly transfer oil from a 55-gallon (208-liter) drum to an oil tank.

BST1011 - Forklift Operation

001 Demonstrate your ability to properly check out and operate a forklift truck by successfully completing the standard AEP -truck training program.

BST1012 - Automotive Equipment Operation

001 Demonstrate your ability to successfully complete the company's program on defensive driving.

002 Demonstrate, where applicable, your ability to qualify for a company driver's permit.

003 Demonstrate your ability to properly check out and operate a small end-loader or bobcat.

004 Demonstrate your ability to properly check out and operate a small tractor equipped with each type of attachment used at your plant.

005 Demonstrate your ability to properly use a tailgate lift to transport material.

006 Demonstrate your ability to properly check out and operate a truck with a standard transmission.

007 Demonstrate your ability to properly check out and operate various types of automotive equipment used at your plant (for example, vacuum truck, water truck, dump truck, etc.)

BST1013 - Rigging and Lifting

001 When given a section of fiber rope commonly used at your plant, demonstrate your ability to properly:

a) Inspect it for fatigue. During your inspection process, explain to your evaluator what you are looking for to determine the condition of the rope.
b) Coil and uncoil it as specified by your evaluator.
c) Seize or whip a fiber rope preparatory to cutting the rope.
d) Tie the following knots commonly used in rigging applications:

- Square knot
- Cats paw
- Choker hitch
- Basket hitch
- Timber hitch
- Clove hitch
- Rolling hitch
- Sheet bend
- Half hitch
- Bowline

002 When given a section of wire rope commonly used at your plant, demonstrate your ability to properly:

a) Inspect it for wear and fatigue. During your inspection process, explain to your evaluator what you are looking for to determine the condition of the rope.
b) Coil and uncoil it as specified by your evaluator.
c) Seize or whip a wire rope preparatory to cutting the rope.
d) Install wire rope clips to make an eye splice.

003 When given a selection of wire rope slings and nylon slings, demonstrate your ability to properly inspect them for wear and fatigue. During your inspection process, explain to your evaluator what you are looking for to determine their condition.

004 When given different eyebolts, hooks, shackles, turnbuckles, etc., demonstrate your ability to properly inspect them for hairline cracks, spreading, pin damage, etc. During your inspection process, explain to your evaluator what you are looking for to determine their condition.

005 Demonstrate your ability to properly:

a) Arrange blocking to support a piece of equipment [to be selected by your evaluator].
b) Install rollers under a heavy object that is to be moved.

006 When given an assignment to make a vertical lift of an object, demonstrate your ability to properly:

a) Block an I-beam to protect a sling when hanging a set of chain falls or come-alongs from the beam sling.
b) Shorten a sling on a hook.
c) Calculate safe lifting loads for slings, cable, shackles, hoists, and eyebolts.
d) Rig a set of come-alongs or pull-lifts for a vertical lift; make a lift of balanced material and of off-balance material, as selected by your evaluator.
e) Rig an object, lift it, and maneuver it to a point designated by your evaluator. You will use both chain falls and hoists (come-alongs) to make this lift.

BST1014 - Scaffolding 1

001 Demonstrate your ability to properly erect simple scaffolding, secure it as appropriate, and remove it upon completion of the job. This demonstration will include all safety items such as: proper bracing, installation of guardrails, installation of toe plates, and proper use of planking.

002 Demonstrate your ability to repair, properly set-up, and test ride a sky-climber.

BST1015 - Hydraulic Crane Operation

001 Demonstrate your ability to give proper hand signals for hydraulic crane operations/maneuvers.

BST1016 - Overhead Crane Operation

001 Demonstrate your ability to give proper hand signals for overhead crane operations/maneuvers.

ICT1008 - Pressure and Level Instrumentation

001 Demonstrate your ability to clean and repair a well-type and a U-tube manometer.

002 Demonstrate your ability to set up, valve in, and make static and differential pressure measurements with a manometer.

003 Demonstrate your ability using a dead weight tester to perform calibration of plant gauges.

004 Demonstrate your ability to properly blow down and vent a level column, such as one used for heater vessels, tanks, etc.

005 Demonstrate your ability to properly valve in/out a differential transmitter along with blowing it down.

006 Demonstrate your ability to properly blow down a drum-level measuring device.

007 Demonstrate your ability to blow back boiler and mill impulse lines and taps.

008 Demonstrate your ability to rod out boiler pressure taps.

MST1004 - General Maintenance 1

001 Demonstrate using the proper procedure for replacing a hinge on a door.

002 Demonstrate your ability to properly spackle dry wall joints and to properly repair holes in drywall.

003 Demonstrate your ability to open/close and to bolt/unbolt inspection doors.

004 Demonstrate your ability to disassemble/assemble inspection door components and to clean, recondition, and lubricate inspection door surfaces and components for doors such as, but not limited to, bricked doors.

005 Demonstrate your ability to do all of the following:

a) Select the proper painting equipment for selected painting jobs.
b) Properly clean and mask surfaces preparatory to painting.
c) Paint a surface using spray equipment.
d) Properly clean up and dispose of waste after completing a painting job.

OST1001 - Bottom Ash Removal Systems

001 Demonstrate your ability to draw from memory a simplified flow diagram containing all major components within the bottom ash removal system and to locate those same major components both on actual plant prints and physically within the plant.

002 Demonstrate your ability to set up and check bottom ash removal system pumps and motors for service. To successfully complete this demonstration, you will be asked to do the following:

- Identify the proper lubrication for each type of bottom ash removal equipment needing lubrication, using a lubrication chart.
- Locate and describe equipment at oil storage locations.
- Demonstrate how to check oil levels in bottom ash removal system motors/pumps.
- Demonstrate how to visually check oil for contaminates (water and dirt).
- Demonstrate how to visually check for excessive packing leakage and adjust as necessary.
- Demonstrate how to check the seal water supply to ensure that it is properly valved for operation.
- Demonstrate how to check pump basin seal water for proper drainage.
- Demonstrate how to check and vent pump casings.
- Demonstrate how to check intake screens on inboard and outboard ends of motors.
- Demonstrate how to visually check for overall safety on the bottom ash removal system.
- Demonstrate how to check for properly racked in breakers on the bottom ash removal system.
- Explain how to identify whether each type of valve (hand- and air-operated) in the system is open or closed and explain the operation of controls affecting the slag tanks and/or hoppers.

003 Demonstrate your ability to set up, check, and properly operate the clinker grinders or ash grinders.

004 Demonstrate your ability to unplug an ash line using techniques appropriate for the conditions.

005 Demonstrate using the proper procedure to break up and remove clinkers from the bottom ash hopper (doghouse).

OST1002 - Fly Ash Removal Systems

001 Demonstrate your ability to draw from memory a simplified flow diagram containing all major components within the flyash removal system and to locate those same major components both on actual plant prints and physically within the plant.

002 Demonstrate your ability to check out, set up, and operate the flyash removal system pumps and motors for service. To successfully complete this demonstration you will be asked to do the following:

- Identify the proper lubrication for each type of fly ash removal equipment needing lubrication, using a lubrication chart.
- Locate and describe equipment at oil storage locations.
- Demonstrate how to check oil levels in fly ash removal system motors/pumps.
- Demonstrate how to visually check oil for contaminates (water and dirt).
- Demonstrate how to visually check for excessive packing leakage and adjust as necessary.
- Demonstrate how to check the seal water supply to ensure that it is properly valved for operation.
- Demonstrate how to check pump basin seal water for proper drainage.
- Demonstrate how to check and vent pump casings.
- Demonstrate how to check intake screens on inboard and outboard ends of motors.
- Demonstrate how to visually check overall fly ash removal system safety (guards, etc.).
- Demonstrate how to check for properly racked in breakers on the fly ash removal system.

003 Demonstrate your ability to set up and operate (slurry/dry) vacuum systems. To successfully complete this demonstration you will be asked to do the following:

- Demonstrate your knowledge of system interlocks and controls by explaining high and low level trip conditions and pump startup sequences.
- Demonstrate your knowledge of valve operation (hand- and air-operated) by explaining how to identify whether each type of valve in the system is open or closed.
- Demonstrate your knowledge of hydroveyor and vacuum pump principles by explaining how a vacuum is created.
- Demonstrate your ability to check transport lines for leaks/pluggage and to repair leaks and remove plugs.

004 Demonstrate your ability to locate and verify proper operation of freeze protection for the flyash system.

OST1003 - Sootblowers

001 Demonstrate your ability to locate all sootblowers and associated equipment both physically and on respective flow diagrams and explain the operation of all system components/processes, including simulating how you would go about troubleshooting/identifying system problems.

002 Demonstrate using the proper procedure to hand-lance fly ash build-up in precipitators hoppers.

003 Demonstrate using the proper procedure to hand-lance slag in boilers.

004 Demonstrate your ability to deslag a boiler using the appropriate methods.

005 Demonstrate-using the proper procedure for operating a sootblower by hand and removing a slag blower that has become stuck from the boiler.

OST1004 - Electrostatic Precipitators

001 Demonstrate the proper procedure to check out, set up, and operate the electrostatic precipitators.

OST1005 - Circulating Water System

001 Demonstrate your ability to draw from memory a simplified flow diagram containing all major components within the circulating water system and to locate circulating water equipment both on actual plant prints and physically in the plant.

002 Demonstrate your ability to set up and check circulating water system pumps and motors, including cooling towers, for service. To successfully complete this demonstration, you will be asked to do the following:

a. Identify the proper lubrication for each type of circulating water equipment needing lubrication, using a lubrication chart.
b. Locate and describe equipment at oil storage locations.
c. Demonstrate how to check motor and pump oil levels in circulating water system motors/pumps.
d. Demonstrate how to visually check oil for contaminates (water and dirt).
e. Demonstrate how to visually check for excessive packing leakage and adjust as necessary.
f. Demonstrate how to check the seal water supply to ensure that it is properly valved for operation.
g. Demonstrate how to check pump basin seal water for proper drainage.
h. Demonstrate how to check and vent pump casings.
i. Demonstrate how to check intake screens on inboard and outboard ends of motors.
j. Demonstrate how to visually check for overall safety throughout circulating water system (guards, etc.).
k. Demonstrate how to check for properly racked-in breakers on the circulating water system.
l. Demonstrate how to identify whether each type valve in the system is open or closed and simulate how to manually operate a motor-operated valve.

003 Demonstrate your knowledge of cooling tower components (hot basin, cold basis, fill, distribution system, etc.) by explaining each components operation as you walk down the system.

004 Demonstrate your ability to perform both a general in-service operational check of the cooling towers and a fire check on an out-of-service cooling tower.

005 Demonstrate your knowledge of the intake water system by explaining the operation of the system through the grills and traveling screens.

006 Demonstrate using safe operating procedures to operate the trash rake.

007 Demonstrate the proper procedure for operating and cleaning the river intake revolving screens.

008 Demonstrate the proper procedure for replacing a broken shear pin on the river intake revolving screens.

OST1006 - Water Treatment System

001 Demonstrate the proper procedure for operating -and back washing filters.

OST1007 - Deep Wells and Sump Pumps

001 Demonstrate your ability to perform an operational check of the deep well pumps and sump pumps by:

a. Demonstrating how to identify and check sump pump controls and alarms for proper operation.
b. Demonstrating how to locate all sump pumps designated by your supervisor/instructor.
c. Demonstrating how to perform a running equipment check, including check valve operation.
d. Demonstrating how to locate all deep well pumps and check controls and equipment associated with the operation of the pumps and motors.

OST1008 - Fuel Supply System

001 Locate the fuel oil system equipment both physically and on the respective flow diagram.

002 Demonstrate your ability to change and clean a fuel oil pump suction strainer.

003 Demonstrate your ability to remove a torch, disassemble it, check the torch nozzle (or tip) for correct parts and plugs, repair as necessary, check for correct length, clean it, reassemble it, and check it for leaks.

004 Demonstrate your ability to remove an oil igniter, check and/or replace broken wires and/or insulators, check the gap, clean, test-fire, and reinstall.

005 Demonstrate your ability to clean an oil lighter supply oil strainer.

006 Demonstrate how to unload a load of fuel oil in any of the tanks and how to change the fuel oil pump suction from one tank to another.

007 Demonstrate using the procedure for checking proper operation of the pulverizers, coal feeders, and associated equipment.

008 Explain what to look for, and what actions to take when observing the conditions of fires in furnaces.

009 Demonstrate using the proper procedure to safely open an observation port/door.

OST1009 - Coal Handling Systems

Where the activity is nearly identical for outside and inside coal systems, the demonstrations can be completed using either outside or inside equipment. Where the activity involved is handled differently between outside and inside systems, the demonstration should be completed for both the inside system and the outside system.

001 Demonstrate your ability to draw from memory a simplified flow diagram containing all major components within the coal handling system and to locate coal-conveying equipment designated by your evaluator both on actual plant prints and physically in the plant.

002 Demonstrate using the proper procedure to inspect, unplug, and clean coal chutes, pipes, feeders, and/or crushers, removing refuse coal and tramp iron, and clearing alarms on coal conveying equipment (for example, coal chutes and crusher alarms).

003 Explain and demonstrate the proper procedure for operating and resetting the coal conveying emergency trip cord and for checking a side travel limit switch.

004 Demonstrate your ability to perform necessary operational checks and cleaning work on coal conveying system, such as, but not limited to :

- Bunker rooms
- Shut-off gates
- Grills/scrapers
- Silo room
- Tunnel system
- Diverter gates
- Feeders
- Crackers/crushers
- Decks, runways, stairs, etc.

005 Demonstrate how to check and operate the coal transfer station fuel oil heater (furnace).

006 Demonstrate how to unplug a tripper gate after a trip-out due to extreme high level.

007 Demonstrate using the accepted procedure to process and obtain a coal sample.

008 Demonstrate the proper procedure to be used in cleaning the primary sampler and how to check and reset a primary sampler after receiving a failure alarm.

009 Demonstrate the procedure to move a diversion/diverting gate from one position to another.

010 Demonstrate the procedure for reversing crushers and setting the cage bars.

011 Demonstrate the proper procedure to check the coal scales, blow off the coal scale weighbridge, and adjust the scales as appropriate for your plant.

012 Demonstrate the procedure for operating the emergency coal conveyors.

013 Demonstrate your knowledge of the clearance permit system by (1) noting the necessary tagging on simplified diagrams and (2) simulating the hanging of those tags on the system components themselves for the following:

a. Tagging out and setting up a limestone feeder for service.
b. Tagging out a conveyor for maintenance.
c. Tagging out the crushers for maintenance.
d. Tagging out a tripper for maintenance.
e. Tagging out a rotoclone for maintenance.

014 Demonstrate how to adjust a belt wiper/scraper/scalper.

015 Demonstrate the proper procedure for adjusting armorite/side belt skirts (seals).

016 Demonstrate your ability to properly perform a coal system lubrication per equipment PM sheet.

017 Demonstrate how to check the coal yard waste water system.

018 Demonstrate the procedure for checking the deluge valve enclosure for proper freeze protection during winter.

019 Demonstrate your ability to verify that all fixed fire suppression equipment is working and available for operation.

020 Perform an actual equipment check of the entire coal system while in operation.

021 Demonstrate using the proper procedure to replace a coal feeder shear pin and to adjust the drag chain.

022 Demonstrate using the proper procedure to vent a coal feeder after it was removed from service.

023 Demonstrate how to perform various methods of coal belt de-icing.

024 Demonstrate your ability to use the proper procedure for checking out, setting up, and operating the pyrites removal system, including unplugging a pyrite box using the appropriate safety gear and describing the proper actions to be taken upon determining that a pyrite box fire exists.

OST1010 - Boiler Setup Practices

001 Demonstrate your ability to work as a member of a team to tag out a gas-side and water-side clearance.

002 Demonstrate using the proper procedure to prepare the bottom ash hopper and seal trough for service.

003 Demonstrate using the proper procedure to set up forced/induced draft fans for service.

004 Demonstrate using the proper procedure to set up regenerative air heaters for service.

005 Demonstrate using the proper procedure to clear a gas-side and water-side clearance on an aux. boiler.

006 Demonstrate using the proper procedure to tag out a turbine-side clearance.

007 Demonstrate using the proper procedure to prepare a pulverizer for service.

OST1012 - Introduction to Heat Rate

001 Successfully compete the interactive learning module on heat, heat transfer, and plant performance.

PHT1002 - Collect and Prepare Samples

001 Demonstrate your ability to properly analyze coal samples for:

- Grindability
- Sieve analysis
- Fineness

002 Demonstrate your ability to obtain a sample from a crusher.

003 Demonstrate your ability to obtain a bulk sample.

004 Demonstrate your ability to assist in three-way moisture analysis for large bulk coal samples.

PHT1004 - Bulk Chemical Handling

001 Demonstrate your ability to properly check level/inventory:

- Anhydrous ammonia storage bulk tank
- Sulfur dioxide storage bulk tank
- Sodium hydroxide bulk tanks
- Coagulator/precipitator polymer tank
- Cooling water biocide tank
- Clearwater pond acid tote tanks
- Elemental sulfur storage bulk tank
- Gasoline tanks
- Aqua ammonia bulk tank
- Sulfuric acid bulk tanks
- Cooling water dispersant tank
- Chlorine cylinders
- Salt tanks and pits
- Diesel tanks

002 Demonstrate your ability to unload and document bulk shipments of:

- Aqua ammonia
- Sodium hydroxide - polishing
- Sulfuric acid - cooling tower
- Coagulator polymer
- Cooling water dispersant
- Anhydrous ammonia
- Salt
- Sodium hydroxide - pretreatment
- Sulfuric acid - pretreatment
- Chlorine
- Cooling water biocide
- Elemental sulfur
- Sulfur dioxide

003 Demonstrate your ability to comply with DOT requirements of bulk chemical unloading.

PHT1005 - Water Treatment Equipment

001 Demonstrate your ability to sample and assist with analysis of river intake water for:

- pH
- Chlorides
- Temperature
- Total suspended solids
- Hardness
- Sulfate
- Turbidity
- Total dissolved solids
- Alkalinity
- Conductivity
- Total solids

002 Demonstrate your ability to perform a turbidity analysis of coagulator discharge and blowdown.

003 Demonstrate your ability to adjust the chemical feed to coagulator/precipitator for turbidity control.

004 Demonstrate your ability to perform an oxidant concentration analysis of coagulator discharge.

005 Demonstrate your ability to add biocide to the coagulator/precipitator biocide system.

006 Demonstrate your ability to sample and measure the coagulator pH and to regulate the coagulator's caustic feed.

007 Demonstrate your ability to dilute and measure sodium hydroxide solution for coagulator feed.

008 Demonstrate your ability to prepare and mix ferric sulfate solutions for coagulator feed.

009 Demonstrate your ability to sample the coagulator blowdown sludge density and regulate chemical additions and blowdown frequency.

010 Demonstrate your ability to sample and measure the coagulator blanket swing level and regulate the blowdown frequency.

011 Be familiar with and assist in the backwashing of carbon filters.

012 Be familiar with and assist in the regeneration of softeners.

013 Demonstrate your ability to set up and measure brine solutions for softener regeneration.

014 Be familiar with and assist in the regeneration of pretreatment demineralizer trains.

015 Be familiar with and assist in the regeneration of pretreatment mixed beds.

016 Be familiar with and assist in testing for the concentration of caustic or acid during regeneration.

017 Be familiar with and assist in rinsing down and placing pretreatment trains in service.

018 Be familiar with and assist in the operation and isolation of:

- Ferrosand filter
- Clearwell pumps
- Mixed bed acid pump
- Softeners
- Carbon filters
- Chemical mix tanks
- Reverse osmosis system
- Mixed bed caustic pump
- Hot water tank softener
- Cation tank acid pump
- Coagulator biocide system
- Circulating water chlorination system
- Coagulators/split boxes
- Coagulator/precipitator oxidant system
- Anion tank caustic pump

019 Demonstrate your ability to inspect integrity of, clean, and perform minor repairs to outlet strainers of various water treatment equipment.

020 Demonstrate your ability to perform lubrication of required water-treating equipment:

- Demineralizer valves
- Caustic pumps
- Chemical feed pumps
- Chlorination equipment
- Sulfuric acid pumps
- Coagulator agitator bearings

021 Demonstrate your ability to collect appropriate water makeup streams and analyze for:

- Turbidity
- pH
- Oxidant
- Conductivity
- Sludge density
- Brine density
- Temperature
- Total suspended solids
- Hardness

022 Be familiar with and assist in performing chemical tests, properly selecting and cleaning sample bottles for each of the parameters; and properly preserving samples when necessary:

- Biocide test
- Total solids test
- Sulfate test
- Inhibitor test
- Chlorine
- Hardness test
- Bacteriological test
- Calcium sulfate test
- Polymer test
- Total dissolved solids test
- Nitrite test
- Calcium hardness test
- Sludge density

023 Be familiar with and assist in the adjustment of the disinfection rate to circulating water for desired results.

024 Be familiar with and assist in the response to a chlorine detector alarm.

025 Demonstrate knowledge of pretreatment/water makeup area equipment to assure Quality Control and preventive maintenance.

026 Be familiar with and assist in closed cycle cooling water chemical control.

PHT1006 - Boiler Water Equipment

001 Assist in preparation and standardization of:

- Acid solutions in normal, molar, and percentage solutions
- Caustic solutions in normal, molar, and percentage solutions
- Erlich's reagent
- Antimony potassium titrate
- Ascorbic acid
- ANSA
- 4, 7, 10, pH buffers
- 0.025N barium chloride
- Antipyrene
- Ammonium molybdate
- Oxalic acid
- Orthophenanthrolene
- Mercuric nitrate
- Silver nitrate

002 Be familiar with and assist in performing chemical tests, properly selecting and cleaning sample bottles of each of the parameters and properly preserving samples when necessary.

- Silica test
- Phosphate test
- Chloride test
- Temperature test
- Hydroxide alkalinity test
- Iron test
- Dissolved oxygen test
- Iron-millipore test
- Solids - millipore test
- Conductivity test
- pH test
- Methyl orange alkalinity test
- Ammonia test
- Copper test
- Free acid test

003 Assist with operating, maintaining, and repairing:

- Spectrophotometers
- Atomic absorption unit
- pH meters
- Amperometric titrators

- Conductivity meters
- Analytical balances
- Ion chromatographs
- Specific ion analyzers

PHT1007 - Drinking Water Equipment

001 Demonstrate knowledge of drinking water system and operation.

002 Explain the operation of the drinking water chlorination system.

003 Be familiar with and assist in analysis/transmittal of drinking water samples for:

- Hardness
- pH
- Coliform
- Alkalinity
- Temperature
- Copper
- Lead
- VOCs
- Pesticides
- Chlorine

004 Obtain necessary drinking water treatment licenses.

PHT1008 - Wastewater Treatment Equipment

001 Explain the operation of a sewage plant.

002 Demonstrate your ability to scrape the clarifier for proper sludge settling.

003 Demonstrate your ability to add oxidant disinfection to the discharge of the sewage plant.

004 Demonstrate your ability to assist in the proper operation of:

- Sewage treatment systems
- Sludge trap
- Communitor
- Surge tank
- Aeration tank
- Sludge return piping
- Clarifier
- Tertiary filter
- Sludge holding tank
- Chlorination/equipment dechlorination

005 Demonstrate your ability to operate copper reduction wastewater plant equipment.

PHT1009 - Lubricating Equipment

001 Demonstrate your ability to locate sample points and collect samples of various lubrication streams:

- Turbine oil
- EHC fluid
- Pulverizer oil

002 Demonstrate your ability to properly perform the following oil tests:

- Viscosity
- Neutralization number
- Water content
- Sludge content
- Interfacial tension
- Dielectric constant
- Mineral oil
- Specific gravity

003 Demonstrate your ability to properly select and clean sample bottles for the samples/tests identified in PHT1009-002.

PHT1016 – OSHA Compliance

001 Demonstrate your ability to locate the process safety manual.

002 Be familiar with process hazard analysis.

003 Be familiar with process safety procedures.

004 Be familiar with and assist in the components of emergency response plans.

005 Be familiar with and assist with the following HAZWOPER elements:

- Emergency assistance
- Containment techniques
- Clean-up procedures
- Decontamination procedures
- Spill/response notification procedures
- Selection and use of personal protective equipment
- Disposal procedures and requirements

006 Demonstrate your ability to select the appropriate respiratory protection including quantitative/qualitative fit-testing, as applicable.

007 Demonstrate your ability to conduct routine safety shower/eyewash inspections.

008 Be familiar with and assist with industrial hygiene evaluations of the following equipment for hazardous chemicals, air quality, heat, and/or contaminants:

- Steam generator and auxiliaries
- Heat cycle
- Coal handling
- Condensers
- Feedwater systems
- Service water systems
- Turbine oil storage systems
- Station drainage systems
- Hydrogen systems
- Fly ash system
- Main turbine and auxiliaries
- Feed pumps and drives
- Electrical equipment
- Circulating water system
- Condensate systems
- Closed cooling water systems
- Compressed air systems
- Fire protection systems
- Nitrogen systems
- River water makeup and treatment system

Sample Job Competencies for Auxiliary Operators

SAT1021 - Maintenance Recordkeeping

001 When given a blank copy of the following forms, demonstrate your ability to properly complete them:

- Material Issue Ticket
- Job Order
- PM Check Sheet Form

002 Demonstrate your ability to log into the material management system (MMS) and navigate through the different screens to locate parts and obtain materials/supplies.

003 Demonstrate your ability to log into the plant information management system (PIMS) and navigate through the different screens to generate an on-screen job order.

SAT1022 - Communications

001 Complete or test out of NUSIO062 (Operator Responsibilities - Communication) with a score ≥ 80%.

002 Complete or test out of NUSIO061 (Operator Responsibilities - Trends, Maintenance and Emergencies) with a score of 80% or better.

SAT1024 - On-the-Job Training

001 Complete the computer-based training modules covering on-the-job training.

002 Properly prepare for and conduct an on-the-job learning activity for another employee.

BST2002 - Hand Tools 2

001 Demonstrate the proper use of the combination square by performing the following:

- Lay out a 90° angle.
- Lay out a 45° angle.
- Using a combination square or protractor, lay out a 65° angle.
- Use the center head to find the center of a round object such as round steel stock, etc.

002 Demonstrate your ability to plumb objects selected by your evaluator using a carpenter's level

BST2003 - Precision Tools

001 Demonstrate your ability to use the proper procedure to take both inside and outside micrometer measurements of objects selected by your supervisor/instructor.

002 Demonstrate your ability to use the proper procedure to measure small hole diameters, using a hole gauge and outside micrometers.

003 Demonstrate your ability to use the proper procedure to set up dial indicators to make a run-out check of a spindle or shaft. Take dial indicator readings as directed by your evaluator.

BST2004 - Machine Tools

001 Demonstrate your ability to use the proper procedure to sharpen a twist drill freehand and to use a drill-sharpening gauge to determine the correct angles.

002 Demonstrate your ability to properly set up a drilling operation on a sensitive drill press. Determine feeds and speeds from charts, and proceed to safely clamp work to the drill table in a manner that meets all safety requirements. Drill the hole (parameters to be specified by your evaluator), observing ALL necessary safety precautions.

003 Demonstrate your ability to thread pipe using hand-threading dies.

004 Demonstrate your ability to use the proper procedure to cut, ream, and thread rigid conduit, using hand tools.

005 Demonstrate your ability to cut pipe and bolt threads using a threading machine. (The size of the material will be provided by your supervisor/instructor.)

006 Demonstrate your ability to identify lathe parts (such as feed selector, feed controls including cross-feed, RPM selector dial, compound rest, carriage hand-wheel, tailstock, etc.), install equipment on the lathe (such as collet chuck, three-jaw chuck, four-jaw chuck, face plate, dog, steady rest, etc.), and properly grind the following lathe tools:

- Right-hand turning tool
- Right-hand facing tool
- Cut-off tool
- V-groove form threading tool

007 Perform the following operation on the lathe, using a piece of round stock 1–1.5" (2.54–3.8 cm) in diameter, and 15–18" (38.1–45.7 cm) long:

a. Install the above length of stock in the three-jaw chuck, and proceed to square up the face by taking a face cut with the facing tools.
b. Proceed to drill the center with the center drill mounted in the tailstock. Reverse the stock and center drill the other end.
c. Remove the three-jaw chuck; install the faceplate and dog and center the stock in the lathe.
d. Take a diameter cut to a predetermined size to later chase threads for a nut.
e. Remove the stock from the centers. Remove yjr faceplate and dog. Install the three-jaw chuck.
f. Install the work in the three-jaw chuck and drill and tap the end of stock for a 1/2” bolt, using tailstock.
g. Take a 45° cut on the end of shaft using the compound.
h. Cut off a 45° taper with the cut-off tool.
i. Set up the taper attachment or set-over the tailstock, and cut a taper 6–10" (15.2–25.4 cm) in length to a predetermined taper per foot (meter).
j. Remove the three-jaw chuck and install the faceplate. Mount the dog on the tapered end of the stock and center the stock in the lathe to chase threads.
k. Proceed to chase the single "V” form threads to a predetermined nut size.

NOTE: The sequence of the above demonstration can be altered in any manner that you desire; however, all of the operations are to be included in the demonstration.

008 Demonstrate how to set the stroke of a shaper for a given distance.

009 Demonstrate your ability to properly grind the following shaper tools:

- Roughing tool
- Finishing tool
- Slotting tool

010 Demonstrate your ability to set up a simple cross feed job on the shaper, and proceed to cut 0.050" (1.3 mm) from the piece of flat stock.

011 If applicable, demonstrate using the proper procedure to shape a keyway in a shaft to a blind hole. Also shape/broach a keyway in a hub.

012 Demonstrate how to take care of the shaper and the cleanup work that should be done before the end of each work shift.

013 Demonstrate your knowledge of the operating controls of the milling machine by identifying (pointing out) and explaining the function of each control.

014 Demonstrate your ability to safely use a horizontal band saw by cutting specific lengths of material using the proper blade and cutting speed. Your evaluator will provide you with the size of material and the length to be cut

- Round stock
- Flat steel
- Angle steel
- Pipe

015 Demonstrate your ability to safely use a vertical band saw by cutting specific shapes out of material with proper blades and speeds. Your evaluator will provide you with the size and dimensions of the shape to be cut out.

- Flat steel plate
- Plexiglas
- Aluminum
- Wood

016 Demonstrate your ability to safely use a radial arm saw by:

- Cutting stock to length
- Making an angle cut
- Ripping material

017 Demonstrate your ability to lay out a guideline for cutting a piece of pipe, using a wrap-around.

018 Demonstrate your ability to prepare a boiler tube end for a "V" groove weld, using:

- Hand grinder for a heliarc root pass
- Hand grinder for a back-up ring. Fit ring after grinding.
- Air-operated chamfering tools

019 Demonstrate the proper positioning of a slip-on welding flange on the end of a piece of pipe, preparatory to welding the flange to the pipe.

BST2005 - AC/DC Electrical Maintenance

001 Demonstrate how to service a 6- or 12-volt lead acid battery. This demonstration to include taking a hydrometer specific gravity reading, checking the water level, adding water (if needed), visual inspection of cables, etc.

002 Demonstrate your ability to make up a trouble light using color-coded electric cable.

003 Demonstrate your ability to tape electrical connections on circuits up to 260 volts.

004 Demonstrate proper procedure for setting up a temporary lighting system, using a ground fault interrupter (GFI)

005 Demonstrate how to make up a three-way lighting circuit. When completed, explain to your evaluator the current path that enables the circuit to be closed and opened at either switch.

006 Demonstrate how to properly change a switch in a de-energized lighting circuit.

007 Demonstrate the proper use of some of the standard plant electrical connectors (types used most often at your plant for making low voltage terminal and splice connections).

008 Demonstrate your ability to properly use a voltmeter to check the voltage in a low voltage circuit specified by your evaluator.

009 Demonstrate your ability to use a clamp-on (tong) ammeter to check the current flow in a circuit.

010 Demonstrate your ability to properly cut, bend, and install EMT conduit, using the necessary tools for the application. Pull cable, wire through it, and terminate it to a designated source.

011 Demonstrate your ability to properly use a megger to measure insulation resistance on a motor selected by your evaluator.

012 Demonstrate your knowledge of lubricants by explaining what type of lubricants can be used on contact points.

013 Demonstrate your ability to isolate a fractional motor, remove the end bells, and blow out windings. Complete a full inspection of the motor, explaining to your evaluator what you are checking throughout the inspection.

BST2006 - Introduction to Arc Welding

001 Demonstrate your ability to identify welding rods by the information provided on the welding rod shipping container label: size, type of material, tensile strength, position, and coatings. Your evaluator will select commonly used rod sizes and types for this demonstration.

002 Demonstrate your ability to properly identify ferrous and nonferrous metals by using a magnet.

003 Demonstrate your ability to properly set up a welding machine for operation and make cable connection, polarity check, amperage selection, and, if the machine is an MG set, check for the proper fan rotation.

004 Demonstrate your ability to set up a welding area that provides protection from fire hazards and safety to other persons working in the immediate area.

005 Demonstrate your ability to run stringer beads to a specified buildup of weld metal. In conjunction, demonstrate the proper use of the chipping hammer, wire brush, and hand grinder (only where needed) to clean welds.

006 Demonstrate your ability to perform the following weld applications:

- V-groove joint
- Corner joint
- Lap joint
- T-joint
- V-groove with backup strap
- Butt joint

BST2007 - Introduction to Oxyfuel Welding

001 Demonstrate the proper method of transporting compressed gas cylinders and demonstrate your knowledge of cylinder safety applications.

002 Perform the proper procedure for:

- Installing regulators, hose, and cutting torch to the oxygen and acetylene cylinders
- Selecting the tip size and regulator pressure setting to cut a given thickness of steel
- Lighting and adjusting the torch for a neutral flame

003 Demonstrate your ability to burn holes through 1" (2.54 cm) or thicker steel plate to conform to a preselected hole diameter.

004 Demonstrate cutting steel plate of various thicknesses, where tip changes and regulator pressure changes are necessary for a good clean cut. After some degree of proficiency of cutting steel plate is achieved, practice cutting to a scribed line or pattern.

005 Demonstrate your ability to bevel cut carbon steel pipe using a hand torch so that a minimum amount of grinding will be necessary to prepare it for welding.

006 Demonstrate the proper procedure to properly clean a burning tip using the tip cleaner.

007 Demonstrate your ability to cut a nut from a bolt without undue damage to the bolt threads. The bolt size should be 1/2" (1.3 cm) or larger.

008 Demonstrate your ability to cut weld beads from a surface without undue damage to the surface. If discarded seal welded bonnet valves are available, practice cutting the seal weld without undue damage to the valve body or bonnet.

009 Demonstrate your ability to gas weld using brazing rod/solder to join copper tubing.

010 Demonstrate your ability to install a heating tip (rosebud), set the regulator pressures, and adjust the flame for a large heating job. Form a U-clamp. It would be desirable that you practice your torch movement while bringing the part up to the desired temperature using temp sticks/pyrometers.

BST2008 - Rigging 2

001 Demonstrate your ability to use a sling angle-loading chart to determine the angle loading and wire rope size for a given job.

- Using a sling angle-loading chart, determine the maximum load that can be placed on each leg of a 1/2" (1.3 cm), two-leg bridle sling where conditions require that the legs can be spread 80° Assume that the load is balanced with each leg carrying 50% of the load. The load rating of this particular sling is 2,675 lb (1213.4 kg) each leg for a vertical lift.
- Using a sling angle-loading chart, determine what diameter of two-leg bridle sling must be used to handle 12,000 lb (5443 kg) when the legs are spread 70°.

002 Demonstrate your ability to use the proper procedure for turning a load over onto its side using a single line hitch.

003 Demonstrate using the proper rigging procedure to lift loads of various configurations. (This demonstration can be performed during a session for overhead crane and cherry

picker operation training since the training in those two modules requires the picking and transporting of loads.)

004 Demonstrate your ability to inspect and make necessary repairs to a sky climber, boatswain chair, and perform a repair while working from such items.

BST2009 - Scaffolding 2

001 As a member of a team, demonstrate your ability to assemble and remove extensive/complicated scaffolding for a project identified by your supervisor/trainer. [Scaffolding installation is to include handrails, toe boards, planking, etc.]

MST2001 - Gauges, Switches, Manometers, and Sight Glasses

001 Demonstrate your knowledge of gauges/level switches/ manometers/ pressure switches (to be developed by I&C team).

002 Demonstrate your ability to properly remove a gauge glass from service, renew a port or dismantle a gauge glass, ”wash down” (clean a gauge glass), and overhaul a gauge glass color screen, if applicable.

NOTE: If it is not practical to perform these demonstrations on gauge glasses in service, the trainee must be able to explain the procedure for removing a gauge glass from service, cutting a gauge glass back into service, and washing down a gauge glass from plant flow diagrams. A spare gauge glass can be used to demonstrate the changing of ports.

003 Demonstrate your ability to change a broken sight glass. Cut and properly fit the glass. (If the job is not required during the training term, the trainee may be asked to fully explain this process in detail.)

MST2002 - V-Belts and Chain Drives

001 Demonstrate the proper procedure for installing a V-belt or set of V-belts on a selected piece of equipment. Set the proper tension using a tension gage. Check the groove to find excessive wear to sheave. [Explain the differences in multi-belt and single-belt installation adjustments.]

002 Demonstrate your ability to remove a chain drive from the equipment. Clean the chain, and reinstall the chain on drive. (As a part of this demonstration, demonstrate how to remove a link from a selected drive chain and how to install a half link.)

MST2004 - Sootblower Maintenance

001 Demonstrate your ability to select the proper size and pressure-rated flexitallic gasket to be installed with a poppet valve of a sootblower.

002 Demonstrate the proper procedure for removing and installing a set of gears in a gearbox. (A sootblower drive gearbox makes a good demonstration although any type can be used.)

003 Demonstrate your ability to properly disassemble, inspect, and reassemble an IR sootblower.

004 Demonstrate how to calculate the gear ratio and RPM of the driven gear in a gearbox.

005 Demonstrate your ability to clean the contacts of an electrically-driven IK Sootblower.

MST2005 - Coal Handling Maintenance

001 Demonstrate your ability to replace a pyrite plow/pyrite swing gate on a pulverizer. (If the job is not required during the training term, the trainee may be asked to fully explain this process in detail.)

002 Demonstrate your ability to change out a coal feeder scraper blade. (If the job is not required during the training term, the trainee may be asked to fully explain this process in detail.)

003 Demonstrate your ability to assist in a feeder coal belt change out and to make proper belt adjustments. (If a belt change-out job is not required during the training term, the trainee may be asked to fully explain this process in detail.)

004 Demonstrate the temporary patching of pulverizer raw coal pipes and burner lines.

005 Demonstrate the gathering of oil samples from pulverizer gearboxes as preventive maintenance.

006 Demonstrate the cleaning of the outside of the pulverizers with various cleaning agents to keep the area free of fire hazards and provide good house keeping.

007 Demonstrate the procedure for changing gaskets on a coal pipe, flat flange, or a metallic-type coupling gasket.

MST2006 - Bearing and Coupling Maintenance

001 Demonstrate your ability to tighten a sleeve bearing cap. (If the job is not required during the training term, the trainee may be asked to fully explain this process in detail.)

002 Demonstrate your ability to change the oil seals on a babbitt bearing.

003 Demonstrate your ability to perform a PM to a grid or gear-type coupling. Disassemble; clean and inspect; check the seals, gasket, and bolting; and lubricate.

MST2007 - Coupling Alignment

001 Demonstrate your ability to properly find the magnetic center, set the coupling gap, and make up couplings to a motor. The type of couplings will be determined by your supervisor/instructor.

002 Demonstrate your ability to properly align a pair of flexible couplings, as specified, using a dial indicator. This should be accomplished to within 0.001" (0.0254 mm) for all readings. Included in this demonstration will be the use of the formula for determining shim adjustment.

003 Demonstrate your ability to set up and use computer-assisted alignment equipment.

004 Demonstrate your ability to measure a shaft and coupling to check for proper clearances or fit. Demonstrate ability to heat a coupling and install it on a shaft.

MST2008 - Pump Maintenance

001 Demonstrate your ability to select the proper size and type of packing for a given pump. Measure and cut the packing for the pump. Proceed to remove the old packing from the packing gland, and repack. If possible, select a pump with a lantern ring. After repacking, if the pump can be operated, demonstrate your ability to adjust the packing to ensure the best packing performance.

002 From a group of spare centrifugal pump impellers in stock, demonstrate your ability to determine which direction the impeller should turn to pump water.

003 Demonstrate your ability to properly identify the location of the keyed sleeve on a pump assembly.

004 Demonstrate your ability to dismantle (strip to shaft), inspect, check clearances, and reassemble a horizontal split-flange single-stage centrifugal pump.

005 Demonstrate how to test for a bent shaft with the shaft in bearing brackets or V-blocks.

MST2009 - Valve Maintenance

001 Demonstrate your ability to dismantle and inspect a 2" or 3" (5.1 or 7.6 cm) valve. If practical, demonstrate your ability to set up a lapping operating for lapping the seat and plug.

002 Demonstrate your ability to dismantle and inspect a check valve.

003 Demonstrate your ability to properly set poppet valve pressures.

004 Demonstrate your knowledge and ability to repack a valve using proper procedure. Items to be included in your explanation are:

- Positioning of joint
- Proper cleaning of stuffing box/stem
- Angle of cut
- Proper tightening of nuts

MST2010 - Steam Trap Maintenance

001 Demonstrate your ability to dismantle, inspect, and reassemble a steam trap. The design of the trap to be selected by the instructor, based on the type most used at the plant.

MST2011 - Precipitator Maintenance

001 Demonstrate your knowledge of precipitators by explaining the difference between swinging and dead grounds in a precipitator bus section as seen from the panel board gauges in a control room.

002 Demonstrate your ability to change out a rapper and replace/rebuild an electromagnet coil.

MST2012 - Insulation and Refractory Maintenance

001 Demonstrate your ability to properly install two or more lengths of pipe insulation. The pipe diameter should be over 2" (5.1 cm). Complete the job by properly sealing one section with lagging and sizing cement. The other section can be covered with aluminum and banded.

002 Demonstrate your ability to properly miter straight pipe insulation for covering an elbow. Complete the job demonstration by fitting pieces on the elbow, wiring, sealing, and sizing. (If desirable, the demonstration can include the fitting of aluminum covering around the elbow.)

003 Demonstrate your ability to properly remove insulation from a pipe flange or a valve with the intent of re-using it. Upon completion of the repair, re-install the insulation that was removed.

004 Using sheet steel placed in the vertical position, demonstrate your ability to install pins for block or blanket insulation. When the pins have been installed at the proper locations, install the blanket and block insulation. Finish coat the same.

005 At plants where blanket-type insulation is used, demonstrate using the proper method to install and remove this insulation.

MST2014 - Lighters, Igniters, and Nozzles

001 Demonstrate your knowledge of oil lighters by describing, in detail, the operation of an oil lighter prior to making a repair or rebuild.

002 Demonstrate your ability to properly disassemble and repair an oil lighter.

- Check and/or replace the torch nozzle.
- Check and repair oil igniters, replace broken wires, insulators, check electrode gap, and test fire.
- Check the gasket and gasket surfaces
- Reinstall the torch and check for leaks.
- Check and repair the torch drives.

MST2016 - General Maintenance 2

001 Demonstrate your ability to replace a door hinge.

002 Demonstrate your ability to properly spackle dry wall joints and to properly repair holes in drywall.

MST2017 - Packing

001 Demonstrate securing gland follower placement for out the way and show proper use of the packing hooks.

002 Demonstrate how to properly apply packing for a designated valve to be packed.

MST2018 - Pulverizer Maintenance

001 Demonstrate your ability to inspect and complete repairs associated with the pulverizer grinding section:

- Demonstrate how to complete roll/wheel profiles.
- Demonstrate the ability to complete periodic checks (4000 hr.). Apply the recommended pressure to the roll/wheel assembly for proper grinding.
- Explain and demonstrate how to replace pulverizer table segments if available.
- Inspect and demonstrate the ability to change the oil and lubricate roll/wheel assemblies
- Demonstrate the ability to inspect drive keys in roll wheel assemblies. (MPS)
- Explain and complete the blocking of roll/wheels, the raising of the spring cage, and the removal of roll/wheels from the pulverizer.

002 Demonstrate your ability to inspect and complete repairs associated with the pulverizer pyrite section:

- Inspect and explain the use of the pyrite scraper and how to replace it.
- Inspect and explain the use of the pyrite chute and how to repair it.
- Inspect and the use of air ports in this section, what is to be inspected and repaired.

003 Demonstrate your ability to inspect and complete repairs associated with the Pulverizer turret section:

- Inspect and recommend repairs to tension cable/spring attachment points.
- Inspect and complete necessary repairs to burner shutoff valves
- Inspect and repair the inside of the turret/cone section for wear. Properly select the use of refractory, ceramic, and wear plates for this section.
- Inspect and recommend the disposition of tension springs.

004 Demonstrate your ability to inspect and complete repairs associated with the pulverizer gearbox:

- Explain how to raise the pulverizer table to gain access to the gearbox.
- Explain the removal of the air seal piping.
- Explain how to install yoke jacking system.
- Explain the process involved to remove the gearbox and install the replacement.
- Inspect the oil nozzles as required
- Align the couplings as required.

005 Demonstrate the temporary patching of the pulverizer raw coal pipes and burner lines.

006 Demonstrate the gathering of oil samples from the pulverizer gearboxes as preventive maintenance

007 Demonstrate the cleaning of the outside of the pulverizers with various cleaning agents to keep the area free of fire hazards and provide good housekeeping.

PHT1001 - Coal Sampling

001 Demonstrate your ability to collect and prepare for shipment an ASTM coal sample from:

- Coal receiving stations
- Coal as-burned stations

002 Demonstrate your ability to remove the coal sampler receiving receptacle, such as milk cans, and to reinstall empty cans.

003 Demonstrate your ability to properly seal and label the sample cans.

004 Demonstrate your ability to properly seal and label the transport container if the sample is transported to the prep room.

005 Demonstrate your ability to operate the following equipment for coal sample preparation:

- Drying oven
- Eight-mesh crusher
- Coal grinder
- Gilson shaker
- Top scales
- Coal rifflers
- Coal sample pulverizer

006 Demonstrate your ability to perform riffling procedures on coal samples to reduce the sample size to proper working size.

007 Demonstrate your ability to operate the truck auto sampler and associated equipment.

008 Demonstrate your ability to prepare coal samples as follows:

- Properly identify the samples.
- Crush the sample to eight-mesh.
- Riffle to reduce to two 1/2 gallon (1.9 liter) samples.
- Label the sample containers for lab pickup.

009 Demonstrate your ability to prepare coal samples for final proximate analysis as follows:

- Pick up the samples from the coal yard.
- Crush the sample to 60 mesh.
- Properly label and identify.
- Transport the sample to the laboratory
- Riffle the sample to 100-gram lab sample.
- Air-dry the sample and record weights (before and after air drying).

010 Assist in obtaining unit pulverizer coal samples.

PHT1003 - Coal Handling Equipment

001 Demonstrate your ability to locate and inspect each component of a coal sampling system:

- Samplers
- Conveyors
- Sample bins
- Crushers

002 Demonstrate your ability to visually inspect and perform minor repairs on equipment, that is, hydraulics, sampling system, conveyors, etc.

003 Demonstrate your ability to operate coal sampling equipment, such as:

- Secondary samplers
- Tertiary samplers
- Quaternary samplers

004 Demonstrate your ability to adjust cutter bar speed and/or travel.

005 Demonstrate your ability to inspect and specify changing hammers, bars, or screens to improve sample size consistency.

006 Demonstrate your ability to assist in coal sampler performance testing and reports:

- Describe the coal sampling system
- Measure traverse cutters travel distances
- Time the traverse and rotating sample cutter speeds
- Inspect coal sampling equipment for improper seals, such as doors, gaskets, etc.
- Record data during inspections performance testing.

007 Demonstrate your ability to assist in coal sampler bias testing and reports

- Installing the coal sample take-off chute
- Collecting sample increment from both the reject and save portions of samples
- Using a platform scale to weigh sample increments

008 Demonstrate your ability to inspect pulverizer classifier vanes.

009 Demonstrate your ability to measure and adjust the pulverizer classifier vane spacing to specifications.

PHT2005 - Water Treatment Systems

001 Demonstrate your ability to operate, isolate, and troubleshoot water treating equipment as directed:

- Anion tank caustic pump
- Anion tanks
- Carbon filters
- Cation tank acid pump
- Cation tanks
- Distribution piping
- Softeners
- Coagulators
- Split boxes
- Chemical mix systems
- Evaporators
- Ferrosand filter
- Flash mixing tank
- Flowmeters
- Gravity filters
- Hot water oftener
- Mixed bed acid pump
- Mixed bed tanks
- Clearwell pumps & Clearwell
- 3-bed regeneration systems
- Mixed bed regeneration systems
- Coagulator chemical addition
- Mixed bed caustic pump

002 Demonstrate your ability to backwash carbon filters.

003 Demonstrate your ability to regenerate softeners.

004 Demonstrate your ability to regenerate pretreatment trains.

005 Demonstrate your ability to regenerate pretreatment mixed beds.

006 Demonstrate your ability to test concentration of caustic or acid during regeneration.

007 Demonstrate your ability to rinse down and place a treatment train in service.

008 Demonstrate your ability to adjust chemical feeds to the coagulator/precipitator for turbidity control.

009 Demonstrate your ability to change the filter media in:

- Gravity carbon filters
- Pressure carbon filters
- Pretreatment carbon filters

010 Demonstrate your ability to operate and troubleshoot bulk chemical storage tanks as directed:

- AD II phosphate
- Ammonia
- Brine
- Chlorine
- Ferri floc
- Polymers
- Potassium permangenate
- Sodium bisulfate
- Sodium bromide
- Sodium hydroxide
- Sodium hypochlorite
- Sulfuric acid

011 Demonstrate your ability to operate and troubleshoot circulating water chemical equipment as directed:

- Biocide addition equipment
- Bromination addition equipment
- Chlorination addition equipment
- Dechlorination equipment
- Dispersant/polymer addition equipment
- Sulfuric acid addition equipment

012 Demonstrate your ability to adjust disinfection rate of circulating water for desired control.

013 Demonstrate your ability to operate and perform minor maintenance on the following systems:

- Circulating water chlorination
- Coagulator/precipitator oxidant

014 Demonstrate your ability to assist operation and troubleshooting fire protection water systems:

- Biocide addition equipment as directed

015 Demonstrate your ability to operate and troubleshoot the reverse osmosis system:

- Change the bag filters.
- Change the cartridge filters.
- Manually backwash the multi-media filters.
- Reset the alarms and troubleshoot such programs as:
  - Low suction pressure
  - High product pressure
  - High/Low pH
- Set flow rates for the first and second reject passes.
- Set the system flow rate and the percent reject flow.
- Set the system pH and conductivity set points.
- Shut down the reverse osmosis system.
- Startup the reverse osmosis system.

016 Have a working knowledge of closed cycle cooling water chemical control.

017 Demonstrate your ability to assist in reading and interpreting data from:

- Silica recorders
- Turbidity recorders

PHT2006 - Boiler Water Analyses

001 Demonstrate your ability to perform the following chemical tests and assist with interpreting data and generating reports:

- Ammonia
- Conductivity
- Copper
- Dissolved oxygen
- Free acid
- Hydrazine
- Hydroxide alkalinity
- Iron
- Iron-millipore
- pH
- Phosphate
- Silica
- Solids - millipore
- Temperature
- Inhibitor

002 Demonstrate your ability to make adjustments to control:

- Condensate chemistry
- Cycle chemistry feedwater chemistry

003 Demonstrate your ability to assist in reading and interpreting:

- Condensate make-up flow
- Condensate flow
- Feedwater flow
- Flow recorders
- Temperature recorders associated with cycle chemistry or boiler chemical cleanings

PHT2007 - Boiler Water Systems

001 Demonstrate your ability to operate and troubleshoot feedwater chemical addition equipment as directed:

- Ammonia
- Bulk chemical tank systems
- Chemical feed pumps
- Chemical feed distribution systems
- Chemical feed/mix tanks
- Hydrazine
- Phosphate
- Sulfite

002 Demonstrate your ability to operate and troubleshoot condensate polishing equipment.

- Acid/caustic chemical pumps
- Anion regeneration tanks
- Cation regeneration tanks
- Clarite filter operation
- Control panels
- Floc mixing tank & cooling system
- Mixed bed demineralizers

003 Demonstrate your ability to rinse condensate polishers and place into service.

004 Demonstrate your ability to perform transfer in/out operations on condensate polishers.

005 Demonstrate your ability to regenerate condensate polisher resin.

006 Demonstrate your ability to test and adjust the concentration of acid and caustic during regeneration.

007 Demonstrate your ability to operate and maintain sampling pumps and change-out low-range

Auxiliary boiler samples • Hotwell samples • Steam cycle samples

008 Demonstrate your ability to regenerate cation column resin.

009 Demonstrate your ability to assist in reading and interpreting data from:

- Chemical analyzer recorders
- Chloride recorders
- Conductivity recorders
- High range conductivity recorders
- Low range conductivity recorders
- Oxygen recorders
- pH recorders
- Sodium recorders

PHT2008 - Drinking Water

001 Demonstrate your ability to operate and troubleshoot drinking water equipment:

- Chemical feed systems
- Chlorination system
- Control panels
- Distribution system
- Flow meters manganese
- Green sand filter
- Potassium permangenate system
- Well pump operation

002 Demonstrate your ability to operate and perform minor maintenance on the drinking water chlorination system.

003 Demonstrate your ability to inspect the drinking water system for cross connections.

004 Demonstrate your ability to collect and analyze/transmit drinking water samples for:

- Alkalinity
- Chlorine
- Coliform
- Copper
- Hardness
- Lead
- Pesticides
- pH
- Temperature
- VOC

005 Demonstrate your ability to operate, maintain, standardize, and repair:

- Amperometric titrator
- Turbidimeters

YST2004 – Sampling Systems 2

001 Explain the major importance and the processes used to collect coal samples.

002 Demonstrate the proper procedure to check and clean the sampling system.

003 Demonstrate how to properly operate the sample system.

004 Demonstrate your ability to record the coal sample collection, proper identification of sample, etc.

OST2001 - Boiler Startup/Shutdown

001 Demonstrate your ability to tag out a forced draft fan, remove the clearance tags, and place the FD fan in service.

002 Demonstrate your ability to tag out an induced draft fan, remove the clearance tags, and place the ID fan in service.

003 Demonstrate your ability to tag out a primary air fan, remove the clearance tags, and place the PA fan in service.

004 Demonstrate your ability to tag out a gas recirculation fan, remove the clearance tags, and place the gas recirculating fan in service.

005 Demonstrate your ability to tag out a mill seal air fan, detag the fan, and place it in service.

006 Demonstrate your ability to tag out a flame scanner cooling fan, detag the fan, and place it in service.

007 Demonstrate your ability to tag out an igniter air cooling fan, detag the fan, and place it in service.

008 Demonstrate your ability to check out and place into service the air heaters. Explain why you blow the air heater sootblowers continuously while firing with fuel oil during startup.

009 Demonstrate your ability to place into service the combustion air preheat coil system.

010 Demonstrate your ability to change fan dampers from manual to automatic operation at the damper drive.

011 Demonstrate your ability to line up the burner deck equipment and place it in service (for example, atomizing air/steam, burner tilts, fuel/air dampers, etc.).

012 Demonstrate your ability to tag and detag the precipitator system and place the precipitators in service. Explain the operation of the key interlock system.

013 Demonstrate your ability to detag and place into service the precipitator ammonia injection system.

014 Demonstrate your ability to detag a coal feeder and coal mill and place them in service.

015 Demonstrate your ability to detag and place in service the fuel oil or gas igniters.

016 Demonstrate your ability to line up and place into service the condensate system to fill the deaerator to its normal operating level. Using a system flow diagram, locate and explain the major components of the condensate system.

017 Demonstrate your ability to detag a boiler feed pump/turbine; prepare and place the boiler feed pump into service. Using a system flow diagram, locate and explain the major components of the boiler feed system.

018 Demonstrate your ability using system flow diagrams to locate and identify to your supervisor or trainer on the diagram and also on the boiler the superheat and reheat superheater vents and drains. Explain the use of the superheat vents and drains during unit startup.

019 Demonstrate your ability to purge and fill the boiler circulating water pumps.

020 Demonstrate your ability to detag and place a sootblowing air compressor in service.

021 Demonstrate your ability to line up and place into service the chemical pumps used in the condensate and feedwater systems. Identify to your supervisor or trainer any special precautions that need to be taken with these pumping systems.

022 Demonstrate your ability to detag and place into service a condensate/hotwell pump

023 Demonstrate your ability to detag and place into service a condensate booster pump

024 Demonstrate your ability to detag and place into service an injection water pump.

025 Demonstrate your ability to properly detag , warm up, and place into service the boiler drum gauge glass.

026 Demonstrate your ability to properly perform the necessary valving to blowdown the boiler.

OST2002 - Breakers/Batteries/Switchyards

001 Demonstrate your ability to operate low voltage circuit breakers.

002 Demonstrate your ability to operate high voltage circuit breakers.

003 Demonstrate your ability to use electrical one-line diagrams to isolate sections of an electrical system.

004 Demonstrate your ability to change plant batteries to standby supply (tie together if applicable.

005 Demonstrate your ability to set up and operate inverters-battery chargers.

006 Demonstrate your ability to set plant lighting to normal and standby service.

007 Demonstrate your ability to change from normal to back-up supply of critical control power for the control room

008 Demonstrate your ability to list all normal and reserve power supplies associated with your unit.

009 Demonstrate your ability to perform a complete switchyard check at your plant.

010 Demonstrate your ability to use hot sticks to open or close a de-energized disconnect.

011 Demonstrate your ability to place grounds on cleared electrical equipment.

012 Demonstrate your ability to remove grounds from electrical equipment.

013 Demonstrate your ability to service a battery system using plant-specific practices and procedures. Checks include but not limited to

- Individual cell voltage readings.
- Overall cell voltage at battery & charger.
- Positive voltage to ground readings.
- Negative voltage to ground readings.
- Overall voltage to ground readings
- Check and adjust water levels.
- Check specific gravity.
- Check cable connections and clean if necessary.

014 Demonstrate your ability to place the batteries on equalizing charge if applicable.

OST2003 - Mills/Feeders

001 Demonstrate your ability to replace a pyrite plow/pyrite swing gate on a pulverizer. (If the job is not required during the training term, the trainee may be asked to fully explain this process in detail.)

002 Demonstrate your ability to change out a coal feeder scraper blade. (If the job is not required during the training term, the trainee may be asked to fully explain this process in detail.)

003 Demonstrate the cleaning of the feeder and table; then test run.

004 Demonstrate your ability to assist in a feeder coal belt change out and to make the proper belt adjustments. (If a belt change-out job is not required during the training term, the trainee may be asked to fully explain this process in detail.)

005 Demonstrate your ability to gag or block the belt and lift the counter weight.

006 Demonstrate your ability to position a new belt with a belt winder and take up winder.

007 Demonstrate your ability to take up belt as old belt is taken off.

008 Demonstrate your knowledge of the belt splicing of a belt that is being vulcanized.

009 Demonstrate the operation of the conveyor belt.

010 Demonstrate your ability to perform a complete check of coal feeders and explain the different trip points and alarms:

- No coal flow (pipe)
- Over/under weight
- No coal flow (feeder)
- Coal pipe to pulverizer plugged trip
- Seal air system

OST2004 - Turbine Systems

001 Demonstrate your ability to perform a complete turbine check.

002 Demonstrate your ability to setup and maintain proper turbine lubrication system, including setting up the:

- Main oil supply and auxiliary systems
- Oil cooler setup main cooling water and alternate supply
- Oil return temperature and flows, keeping logs and graphs as necessary
- Oil cooler venting of the oil and waterside of the coolers
- Thrust bearing alarm and trip setting and explain the thrust bearing trip, its function, and purpose
- Check stand-by oil pumps for auto start

003 Demonstrate your ability to locate and explain turbine supervisory instruments including but not limited to:

- Shaft position indicator
- Vibration pickup
- Shaft eccentricity
- Shaft speed
- Thrust bearing trip device
- Differential expansion
- Absolute expansion

004 Demonstrate your ability to locate and explain the turbine control system.

- Control fluid/oil supply pumps and filters
- Control oil system
- Local valve test
- IP regulator

005 Demonstrate your ability to locate and explain local turbine controls

- Load motor
- Local trip devices

006 Demonstrate your ability to locate and explain the exhaust hood spray system:

- Control valve
- Manual isolation valve**s**

007 Demonstrate your ability to locate and explain the turbine extraction points:

- Check the extraction valve for positive closing.
- Locate all bleed steam valves and understand the interlocks.
- Locate all associated steam traps and check their operation.

008 Demonstrate your ability to locate and explain all turbine drain valves:

- Read and understand Circular Letters (water induction).
- Know how to check drain valves for leaking through.

009 Demonstrate your ability to place the turbine on turning gear:

- Read and understand the Circular Letter on turning gear operation.

010 Demonstrate your ability to locate and explain the turbine steam seal system.

011 Demonstrate your ability to set-up the seal oil system for operation:

- Describe pumps, valves, and related equipment
- Check for proper pressures and flows
- Know the seal oil backup system.

012 Demonstrate your ability to perform a complete boiler feed pump and boiler feed pump turbine check

- Feed pump coupling check
- Local valve test
- Local trip checks
- Check of the injection water system
- Lube oil system check
- Locate/explain operation of supervisory instrumentation

OST 2005 - Generator Systems

001 Demonstrate your ability to locate and set up the generator hydrogen system:

- Perform a purge of the generator with CO_2.
- Check hydrogen usage and purge generator.
- Set up the hydrogen cooling system.

002 Demonstrate your ability to set up the stator cooling water system:

- Locate all pumps, strainers, filters, and demineralizers.
- Be able to perform auto start test of standby pumps.
- Check pressure differential for filter/strainer pluggage.
- Understand flow rates and flow/pressure trips.

003 Demonstrate your ability to make proper checks of the generator core monitoring system (for example, be able to reset alarms, change charts, and adjust flow rates).

004 Demonstrate your ability to perform a complete exciter check

- Perform visual brush check.
- Clean the compartment ventilation system.
- Describe rectifiers and/or PMGs.
- Locate and understand all remote controls, breakers and reserve exciters.
- Describe breakers, removable links, and standby rectifiers.

005 Demonstrate your ability to locate and explain the exciter field ground relay.

006 Demonstrate your ability to locate and explain the generator liquid level alarms and detectors.

007 Demonstrate your ability to check the generator bus duct cooling system:

- Check motor, fans and belts.
- Check airflow monitor.

OST2006 - Oil Lighters and Oil Filtering

001 Demonstrate using the proper procedure for operating both fixed and portable oil filtering and purifying equipment.

002 Demonstrate your ability to properly transfer oil from a 55-gallon (208.2-liter) drum to an oil tank.

003 Demonstrate your ability to set up the lube oil centrifuge from the main oil tank using the loop seal piping.

004 Demonstrate your ability to set up and place in service the Alsop oil filter system.

005 Demonstrate your ability to name and identify the different parts of an oil lighter.

006 Demonstrate your knowledge of the retractor system and its function.

007 Demonstrate your knowledge of lubricants that can be used on contacts points of electrical systems.

OST2007 - Heat Exchangers

001 Demonstrate your ability to isolate a heat exchanger.

002 Demonstrate your ability to test the heat exchanger for leaks and make repairs:

- Test with air.
- Test with water.

003 Demonstrate your ability to choose the proper material to replace the heat exchanger head gasket and install the head.

OST2008CV - Flue Gas Scrubbers (Gavin)

001 Demonstrate the procedure to locate the equipment listed below:

- Centrifuge feed pumps
- Centrifuges
- Station F2 air compressor
- TUFS tank transfer sump
- Cake conveyors
- Venturi scrubbers
- Pugmills
- Station F2 sump
- Waste handling sumps
- Station F1 sump
- Collecting conveyors F1 east and F1 west
- Waste handling conveyors fire isolation valves
- Conveyors F12N and F12S (overland conveyors)
- Conveyors F2E and F2W (shuttle conveyors)
- Radial stackers north and south
- Thickener underflow surge tank agitator
- Centrifuge polymer feed stations
- Overflow collection pond sump
- Waste handling motor control centers

002 Demonstrate the procedure for checking all waste handling conveyors.

003 Demonstrate the procedure of how to properly reset a conveyor trip cord that was tripped.

004 Demonstrate the procedure to locate and take scale readings on F12 North and South conveyors.

005 Demonstrate the proper procedure for flushing out a pugmill.

006 Demonstrate the procedure for collecting cake conveyor samples.

007 Demonstrate the procedure for collecting a centrate sample.

008 Demonstrate the procedure for cleaning a venturi scrubber.

009 Demonstrate the procedure for performing routine checks on the centrifuges.

010 Demonstrate the procedure for running the cake conveyors in local control.

011 Why is it important that we keep all trash picked up off the floor?

012 Demonstrate the proper procedure for resetting the VFD (variable frequency drive) on a centrifuge feed pump.

013 Demonstrate the proper procedure for restarting the collecting conveyors after they have tripped out on an overload condition.

014 Demonstrate the procedure for changing charts and setting for correct time.

015 Demonstrate the procedure to check a ball mill prior to placing it in service

016 Demonstrate the procedure for tracing the lime prep. and lime feed system flow paths.

017 Demonstrate the procedure to bump the ball mill prior to starting after an extended outage.

018 Demonstrate the procedure to unplug a ball mill classifier cyclone separator.

019 Demonstrate the procedure for switching a mist eliminator strainer that is plugged.

020 Demonstrate the procedure for inspecting and cleaning the mist eliminator spray nozzles.

021 Demonstrate the procedure to flush the P.H. probes.

022 Demonstrate the procedure to flush the stack drain.

023 Demonstrate the procedure to clean the absorber reaction tank level probes.

OST2008CV - Flue Gas Scrubbers (Conesville)

024 Demonstrate your ability to properly fill the recycle tanks with raw plant reclaim water (duck pond water).

025 Demonstrate your ability to properly fill the thickener with duck pond water.

026 Demonstrate your ability to properly follow a procedure that would trip out a scrubber module and bring in the emergency deluge pump.

027 Demonstrate your ability to properly drain the emergency deluge system for freeze protection.

028 Demonstrate your ability to properly put a floor sump pump in service that has been out for an overhaul.

029 Demonstrate your ability to properly start the lime feed system to supply lime from the lime silos to the scrubber lime feed bins.

030 Demonstrate your ability to properly switch lime silos.

031 Demonstrate your ability to properly switch lime compressors.

032 Demonstrate your ability to properly tag out and drain a lime-blowing compressor.

033 Demonstrate your ability to properly check lime blow tanks for proper valving operation when blowing lime to feed bins.

034 Demonstrate your ability to properly check the operation of the bag shakers on the lime feed bin dust collectors.

035 Demonstrate your ability to properly check out the differential pressure (magnahelic gauge) across the bags.

036 Demonstrate your ability to properly prepare slurry for a scrubber start and fill the transfer and storage tanks.

037 Demonstrate your ability to properly remove a lime slaker from service.

038 Demonstrate your ability to properly clean a lime slaker that is to be left out of service.

039 Demonstrate your ability to properly drain the transfer tank.

040 Demonstrate your ability to properly start a make-up pump to feed a module.

041 Demonstrate your ability to back flush a slurry make-up pump.

042 Demonstrate your ability to properly flush the draw-off line with reclaim water. Back flush the pump to the recycle tank.

043 Demonstrate your ability to properly drain the draw-off line.

044 Demonstrate your ability to properly start the scrubber reclaimed water system and establish flow through the lower loop

045 Demonstrate your ability to properly start up a scrubber module from dead start to having liquid and gas flow through it. All of the liquid tanks are full and ready; seal water and oil levels are okay on the pumps.

046 Demonstrate the proper procedure for starting a draw-off system that has been drained.

047 Demonstrate your ability to properly remove the scrubber modules from service.

048 Demonstrate your ability to put in the demister system.

049 Demonstrate your ability to close the scrubber module outlet damper by hand. Also the inlet damper.

050 Demonstrate your ability to properly open and close the by-pass louver damper from the control room.

051 Demonstrate your ability to properly open and close the by-pass louver damper manually at a drive unit.

052 Demonstrate your ability to properly open a scrubber module that is under pressure.

053 Demonstrate your ability to properly use an air blaster to clear throat pluggage at the discharge of a blow tank on a lime silo.

054 Demonstrate your ability to properly line up a reclaim pump

055 Demonstrate your ability to properly pull grit from the grit holding tank.

056 Demonstrate your ability to properly rack out a demister pump breaker.

057 Demonstrate your ability to properly rack in a demister pump breaker

058 Demonstrate your ability to properly explain the purpose of and how the 4160-volt bus tie works.

059 Demonstrate your ability to properly make a scrubber round.

060 Demonstrate your ability to follow lube oil procedures to perform the necessary lubrication of scrubber equipment.

061 Demonstrate your ability to transfer slurry from between units.

062 Demonstrate your ability to properly line up a transfer pump for service.

063 Demonstrate your ability to properly mix flocculant.

064 Demonstrate your ability to transfer flocculant between units.

065 Demonstrate your ability to calculate the amount of flocculant feed, in gallons (liters) per hour, to thickener.

066 Demonstrate your ability to properly check the density of the thickener sludge.

067 Demonstrate your ability to properly take the thickener rake and sludge pumps out of service for maintenance on the downcomer lines.

068 Demonstrate your ability to properly put the sludge pump and thickener rake back in service.

069 Demonstrate your ability to properly feed sludge to the sludge treatment plant.

070 Demonstrate your ability to properly recirculate sludge back to the thickener.

071 Demonstrate your ability to properly open a plugged sludge pump suction line.

072 Demonstrate your ability to properly to freeze protect the F/F lines at the thickeners and at STP.

073 Demonstrate your ability to properly make an equipment check of the thickeners, reclaim tanks, and thickener building.

074 Demonstrate your ability to properly operate the thickener building pumps and seal water and cooling water equipment on the reclaim water system.

075 Demonstrate your ability to unplug the main or auxiliary feed line.

076 Demonstrate your ability to flush the solids from the main and auxiliary F/F lines.

077 Demonstrate your ability to clean up a vat when it is taken out of service.

078 Demonstrate your ability to clean the vat of an accumulation of grit (degritting).

079 Demonstrate your ability to valve PSA vacuum pump to ME-48 filter.

080 Demonstrate your ability to valve the filtrate return system to the pads or thickener.

081 Demonstrate your ability to route F/A to a silo.

082 Demonstrate your ability to properly isolate a baghouse for maintenance work.

083 Demonstrate your ability to check the operation of the baghouse on a silo.

084 Demonstrate your ability to track a conveyor belt by using the tracking idlers and by using the tail pulley bearing adjusters.

085 Demonstrate your ability to properly start the ME-82 air compressor and '83 air dryers.

086 Demonstrate your ability to properly start and stop the new service water booster pump p-1.

087 Demonstrate your ability to operate the tie breaker to supply to a bus.

088 Demonstrate your ability to make a proper equipment check at the STP building, including the pump pad.

089 Demonstrate your ability to emergency trip the plant using three different devices.

090 Demonstrate your ability to properly put the plant in service with one filter vat.

091 Demonstrate your ability to put a second filter vat in service.

092 Demonstrate your ability to collect F/C and S/S samples for lab tests and run the test for percent solids.

093 Demonstrate your ability to run the lab test showing the lime and F/A content of the S/S.

094 Demonstrate your ability to properly adjust the lime and F/A feed rates based on the test results.

095 Demonstrate your ability to switch between pugmills.

096 Demonstrate your ability to switch from between conveyors.

097 Demonstrate your ability to properly shut down STP.

098 Demonstrate your ability to restart the plant after an emergency trip. An emergency trip being a cord trip, tilt probe, etc.

099 Demonstrate your ability to properly freeze the wash water booster pump and the wash water lime in a conveyor.

100 Demonstrate your ability to put the wash water booster pump in service.

101 Demonstrate your ability to properly put the large propane heater in service in the automatic temperature control mode.

102 Demonstrate your ability to properly shut down STP.

Sample Job Competencies for Control Room Operators

SAT1024 - On-the-Job Training

001 Complete the computer-based training modules covering on-the-job training.

002 Properly prepare for and conduct an on-the-job learning activity for another employee.

SAT1027 - Fire Protection Systems

001 Demonstrate your ability to select and use the proper personal protective equipment in accordance with OSHA regulations.

002 Demonstrate your ability to locate the emergency fire water pumps and explain the fire protection system interlocks.

003 Demonstrate your ability to properly respond to and verify alarms on the emergency fire annunciator panel.

004 Demonstrate your ability to properly use the fire truck and all of its equipment.

005 Demonstrate your ability to locate the CO_2 storage tank and CO_2 fire hose reels. Explain all interlocks and controls associated with this fire protection system.

006 Demonstrate your ability to properly respond to an emergency first aid situation.

007 Demonstrate your ability to properly respond to an emergency condition that requires you to contact outside emergency personnel.

OST3001 - Coal Handling Systems

001 Demonstrate your ability to properly operate the coal handling control panel to fill the coal silos on your unit. Explain, by using electrical elementary diagrams, logic diagrams, and coal flow diagrams, the flow of coal through all of the coal handling equipment; also explain the trips associated with the coal handling equipment.

002 Demonstrate your ability to properly operate the coal handling control panel to periodically sag the coal silos on your units and check for coal hang up and hot coal. Also, explain the plant-specific procedures and practices used to check for and remove coal hang up and hot coal.

OST3002 - Mills/Feeders

001 Demonstrate your ability to properly start a coal mill and coal feeder. Explain, by using electrical elementary diagrams or logic diagrams, the starting, stopping, and trip logic of the coal mill and coal feeder.

002 Demonstrate your ability to properly perform a coal mill discharge pipe airflow check/individual coal burner line purge. Explain using plant-specific materials and Circular Letters when to run this burner line airflow check and the limits of the readings taken during the check.

003 Demonstrate your ability to properly respond to a mill fire or a burner coal pipe fire.

004 Demonstrate your ability to properly shut down a coal mill and coal feeder in preparation for scheduled mill maintenance. Explain the steps involved in mill cool down, grind out, and purge.

005 Demonstrate your ability to properly respond to a coal mill that has stopped grinding coal (chugged up). Also, explain in detail the steps involved in identifying and correcting the problems.

006 Demonstrate your ability to properly respond to a mill/cyclone coal feeder trip. Also, explain in detail the steps involved in identifying and correcting the problems.

007 Demonstrate your ability to change a mill hot air/tempering air damper controls from auto to manual; change the mill outlet temperature; and then return the hot air/tempering air damper controls to auto operation.

OST3003 - Control Rooms/Control Systems

001 Demonstrate your ability to check all annunciator alarm panels, indicator lights, recording charts, printers, keyboards, and all control panel recording instruments for proper operation.

002 Demonstrate your ability to properly interpret control room instrumentation relating to condensate, feedwater, and steam cycle chemistry and to direct plant personnel's duties to maintain the chemistry within operating limits.

003 Demonstrate your ability to properly monitor control room instrumentation and direct the activities of plant personnel in the operation of the following systems: flyash disposal, bottom ash disposal, pyrites removal, oil filtering, water treatment, oil coolers, and heat exchangers.

004 Demonstrate your ability to properly record the necessary readings from indicating and recording instruments pertaining to the operation of your unit as directed by your supervisor.

005 Demonstrate your ability to properly change the charts on the recorders in your control room.

006 Demonstrate your ability to properly perform or direct the activities of plant personnel in operating, regulating, and adjusting *local controls*, which may include controls for pumps; valves; screens; strainers; water treating plant equipment; filters and demineralizers for condensate clean-up; oil purifying and filtering equipment; and similar equipment.

007 Demonstrate your ability to properly explain the emergency trip push button trip interlocks using plant-specific electrical elementary prints and unit trip logic diagrams.

008 Demonstrate your ability to properly respond to emergency alarms and fire alarms such as:

- Pulverizer fire
- Air heater fire
- Air heater trip
- Boiler drum level low
- Boiler feed pump trip
- Main turbine high vibration

009 Demonstrate your ability to properly maintain all tools, equipment, and work areas in a clean and orderly condition.

010 Demonstrate your ability to properly use and follow all unit-specific operating procedures, operating practices, and state and federal regulations associated with the operation of your units.

011 Demonstrate your ability to properly fill out and submit a safety job order to correct an unsafe condition.

012 Demonstrate your ability to properly conduct a job safety briefing concerning possible unsafe conditions reviewing in detail the proper safety practices for the unsafe conditions.

013 Demonstrate your ability to properly monitor and interpret control room instrumentation relating to abnormal cycle water loss and to set up and conduct a cycle water loss test.

014 Demonstrate your ability to properly place your unit controls on automatic generation control.

OST3004 - Breakers/Batteries/Switchyards

001 Demonstrate your ability to properly perform a routine inspection of the high and low voltage transformers on your units. Explain by using transformer manuals and electrical one-line diagrams what you are checking on each transformer.

002 Demonstrate your ability to unload and electrically isolate a low voltage motor control center. Explain, by using electrical one-line diagrams, the clearance points used.

003 Demonstrate your ability to unload and electrically isolate a high voltage bus assuming a stuck circuit breaker that will not trip electrically. Explain, by using electrical one-line diagrams, the clearance points used.

004 Demonstrate your ability to properly receive and carry out a switching order from the load dispatcher to isolate a generator from the switchyard. Explain, by using Electrical 1-Line diagrams, the clearance points used.

005 Demonstrate your ability to properly receive and carry out a switching order to isolate a line breaker in the switchyard. Explain, by using electrical one-line diagrams, the clearance points used.

006 Demonstrate your ability to properly check the plant battery for grounds, tracing the ground to a specific circuit, and then tracing the ground to a specific piece of equipment in that circuit.

007 Demonstrate your ability to properly locate and clear a ground on a 600 (470, 490, 550, 575) VAC auxiliary power bus, tracing the ground to a specific piece of equipment on that bus.

008 Demonstrate your ability to properly restore auxiliary power after a unit black trip-out.

OST3005 - Boiler Systems

001 Demonstrate your ability to properly start the air preheat coil pumps. Explain by using plant-specific electrical elementary diagrams or logic diagrams the starting, stopping, and trip logic of the pumps.

002 Demonstrate your ability to monitor cycle water chemistry on your units and take proper corrective action when needed. Explain, using your knowledge of cycle water chemistry and control panel instrumentation, the control and operating limits of conductivity, pH, sodium, chlorides, etc., in the condensate, feedwater, and steam cycles of your units.

003 Demonstrate your ability to change the forced draft fan controls/total air flow controls from auto to manual; change the total air flow to the boiler; and then return the fan controls/total air flow controls to auto operation.

004 Demonstrate your ability to properly transfer the boiler feedwater flow/boiler drum level controls from auto to manual, change boiler feedwater flow, and then transfer the controls back to auto.

005 Demonstrate your ability to properly follow all boiler-firing procedures for safe furnace combustion.

006 Demonstrate your ability, by using the superheat temperature controller in either automatic or manual, to properly control the superheater outlet temperatures within operating limits for maximum unit efficiency.

007 Demonstrate your ability to properly issue a clearance on a boiler for a tube repair. Explain by using the prepared standardized clearance forms, flow diagrams, electrical one-line diagrams, electrical elementary diagrams, and control diagrams the clearance points that will used to isolate and clear the gas side and water side of the boiler.

008 Demonstrate your ability to read and understand electrical elementary diagrams and electrical wiring diagrams by reading and explaining in detail the electrical control circuits for the starting, stopping, and tripping of a forced draft fan.

009 Demonstrate your ability to make revisions to the forced draft fan electrical elementary prints and electrical wiring prints in accordance with your plant-specific revision procedures, and be able to submit these revisions for processing.

010 Demonstrate your ability to properly change the total fuel flow controls from auto to manual; change the total fuel flow to the boiler; and then return the total fuel flow controls to auto operation.

011 Demonstrate your ability to properly monitor and control boiler slagging, explaining in detail the methods used to monitor boiler slagging conditions on your units and the steps taken to properly control boiler slagging.

OST3006 - Boiler Startup/Shutdown

001 Demonstrate your ability to line-up and place in service the auxiliary boiler for your unit (if applicable).

002 Demonstrate your ability to properly start a condensate/hotwell pump. Explain by using plant-specific electrical elementary diagrams or logic diagrams the starting, stopping, and trip logic of the pump.

003 Demonstrate your ability to properly start a boiler feed pump. Explain by using electrical elementary diagrams or logic diagrams the starting, stopping, and trip logic of the pump.

004 Demonstrate your ability to fill the boiler/steam generator to its normal operating level for startup of the unit. Name all chemicals used during the fill process and explain their intended purpose.

005 Demonstrate your ability to start the air heaters. Explain by using electrical elementary diagrams or logic diagrams the starting, stopping, and trip logic of the air heaters.

006 Demonstrate your ability to start a forced draft fan. Explain, by using electrical elementary or logic diagrams, the starting, stopping, and trip logic of the fan. Refer to the Circular Letter on precipitator in service before starting the FD fan.

007 Demonstrate your ability to start an induced draft fan. Explain, by using electrical elementary or logic diagrams, the starting, stopping, and trip logic of the fan.

008 Demonstrate your ability to start a primary air fan. Explain, by using electrical elementary or logic diagrams, the starting, stopping, and trip logic of the fan.

009 Demonstrate your ability to properly start the following fans if they apply to your unit startup: gas recirculation fan, mill seal air fan, flame scanner cooling fan, igniter cooling air fan, etc. Explain by using electrical elementary diagrams or logic diagrams the starting, stopping, and trip logic of each of the fans.

010 Demonstrate your ability to properly start each of the following pumps if they apply to your unit startup: ash handling water pumps, auxiliary cooling water pumps, gland seal float pumps, etc. Explain, by using electrical elementary or logic diagrams, the starting, stopping, and trip logic of each pump.

011 Demonstrate your ability to properly purge the boiler/steam generator in preparation for light off. Explain, by using electrical elementaries or logic diagrams, the boiler/steam generator purge permissives.

012 Demonstrate your ability to properly line up a boiler for an oil or gas fire, and then light off the boiler.

013 Demonstrate your ability to properly place the electrostatic precipitators in service. Explain, by using electrical elementaries, Circular Letters, and logic diagrams, the starting, stopping, and trip logic of the electrostatic precipitators and their auxiliary equipment.

014 Demonstrate your ability to properly place the boiler circulating water pumps in service. Explain by using electrical elementaries, Circular Letters, and logic diagrams, the starting, stopping, and trip logic of the boiler circulating water pumps.

015 Demonstrate your ability to properly perform an interlock check of the forced draft fans` start, stop, and trip logic.

016 Demonstrate your ability to properly perform and explain the boiler permissive and trip interlocks.

017 Demonstrate your ability to properly direct the duties of plant personnel during unit startups and shutdowns.

018 Demonstrate your ability to properly fire the boiler/steam generator from initial light off to minimum load while observing all heating/cooling temperature ramp rates applicable to your units. Explain in detail all temperature ramp rates applicable to you units including startup gas temperature limits.

019 Demonstrate your ability to properly set up and perform a boiler/steam generator hydrostatic pressure test.

OST3007 - Turbine Systems

001 Demonstrate your ability to properly start the circulating water pumps. Explain by using plant-specific electrical elementary diagrams or logic diagrams the starting, stopping, and trip logic of the pumps.

002 Demonstrate your ability to properly determine a *hot* or *cold* start of your turbine. Explain by using plant-specific materials and the turbine manufacturer's starting and loading instructions and charts how you determined a *hot* or *cold* start.

003 Demonstrate your ability to properly place a turbine on turning gear. Explain the proper procedure using plant-specific materials and Circular Letters.

004 Demonstrate your ability to properly place a condenser in service and to explain the operation of the condenser and its auxiliary equipment.

005 Demonstrate your ability to properly seal the turbine shaft seals in preparation for turbine roll. Also to explain in detail the operation of the turbine steam seal system including its temperature and pressure limits.

006 Demonstrate your ability to properly pull vacuum on the condenser in preparation for turbine roll. Also to explain in detail the operation of the condenser air removal system and all auxiliary equipment needed to pull vacuum.

007 Demonstrate your ability to properly place the turbine bearing lift/jacking oil pumps in service. Explain by using plant- and turbine-specific materials the purpose and operation of the bearing lift/jacking oil pumps.

008 Demonstrate your ability to properly roll a turbine from turning gear to synchronizing speed, observing all turbine acceleration rates, turbine criticals, hold points, soak times, valve transfer points, etc. Explain in detail all operations involved in rolling the turbine to speed and how to use the turbine supervisory instruments to monitor critical turbine parameters.

009 Demonstrate your ability to properly test the following turbine valves:

- Main turbine stop (throttle) valves
- Main turbine control (governor) valves
- Reheat turbine stop valves
- Reheat turbine intercept (interceptor) valves

010 Demonstrate your ability to properly test the turbine protective trip devices on your units, such as

- Turbine overspeed trip test
- Turbine low vacuum trip test
- Turbine thrust bearing trip test
- Turbine low bearing oil header pressure trip test
- Turbine minimum oil trip test
- Turbine pre-emergency governor test
- Turbine pre-emergency cut-out governor test

011 Demonstrate your ability to properly perform an actual turbine overspeed trip test.

012 Demonstrate your ability to properly perform an overspeed protection controller test of the turbine controls.

013 Demonstrate your ability to properly perform and explain the turbine permissive and trip interlocks on your units.

014 Demonstrate your ability to properly set up and place the high pressure and low pressure feedwater heaters in service during a unit startup.

015 Demonstrate your ability to properly remove a high-pressure feedwater heater from service for maintenance repairs and then return the heater to service.

016 Demonstrate your ability to properly perform a feedwater heater “high level alarms and interlocks” check on your units.

017 Demonstrate your ability to properly transfer the deaerator level control from auto to manual, change the deaerator level, and then transfer the deaerator level control back to auto operation.

018 Demonstrate your ability to properly transfer the condenser hotwell level control from auto to manual, change the condenser hotwell level, and then transfer the condenser hotwell level control back to auto operation.

OST3008 - Generator Systems

001 Demonstrate your ability to properly place a generator automatic voltage regulator in service. Explain by using plant-specific materials, manufacturer's manuals, and Circular Letters the proper operation of the voltage regulator.

002 Demonstrate your ability to properly synchronize/parallel a generator with the system. Explain by using plant-specific materials, manufacturer's manuals, and Circular Letters the proper procedures used for synchronizing the generator.

003 Demonstrate your ability to properly explain the HEA trip interlocks and trip lockout relays using plant-specific materials.

004 Demonstrate your ability to properly test and reset the generator field ground relay. Also, to explain the purpose of the generator field ground relay and the steps to be taken if the generator field ground alarm is received during unit operation.

005 Demonstrate your ability to properly respond to a generator negative-sequence current alarm. Also, explain in detail the cause and effects of high generator-negative-sequence current flow during unit operation.

006 Demonstrate your ability to properly respond to a generator volts/hertz alarm. Also, explain in detail the cause and effects of high generator volts/hertz during unit on line and off line operation.

007 Demonstrate your ability to properly respond to a generator slipping poles. Also, explain in detail the cause and effects of generator pole slippage.

008 Demonstrate your ability to properly adjust the generator automatic voltage regulators to maintain system voltage schedules. Also, explain in detail the use of generator reactive power capability in the maintenance of system voltage levels.

G
JOB KNOWLEDGE AND SKILL MATRIX

Use this matrix to customize your job knowledge and skill task list. When you have defined what tasks will be included in the training program, then you can determine who will earn qualification and what training methods will be used. This is a generic list of items you might include in your final task list. The sample is divided by systems.

Boiler	Who to Train	Training Method
Steam Generator		
Perform filling and venting of boiler.		
Perform boiler circ pump bump.		
Perform boiler hydro.		
Start electric boiler feed pump.		
Perform shutdown corrosion procedure.		
Operate drum level instruments.		
Perform fire side line-ups.		
Satisfy purge permissives.		
Perform boiler light off.		
Perform steam generator boil out.		
Perform hot restart operation.		
Perform air heater sootblowing operation.		
Perform coal firing (startup).		
Perform boiler/turbine mismatch (temps).		
Operate control room.		
Operate plant.		
Monitor control room.		
Monitor plant.		

Perform low load operation.		
Perform boiler air test.		
Operate under tube failure condition.		
Perform boiler sootblowing operation.		
Operate SH/RH spray control.		
Correct flue rich condition.		
Operate under various coal blend conditions.		
Perform boiler shutdown.		
Operate under environmental guidelines.		
Isolate boiler fire side (master).		
Isolate boiler water side (master).		
High Pressure and Reheat Steam		
Perform valve line-up.		
Perform prewarm procedure.		
Perform boil out operation.		
Perform hydro operation.		
Operate hot restart valves.		
Operate drip leg.		
Operate stop valves.		
Operate control valves.		
Operate reheat bypass valves.		
Operate intercept valves.		
Operate reheat sprays.		
Operate superheat sprays.		
Operate pilot valve.		
Monitor plant.		
Operate control room.		
Operate plant.		

Perform tube leak check.		
Sootblowing		
Perform valve line-up.		
Perform pressurizing/depressurizing.		
Perform valve line-up for thermal drains.		
Operate thermal traps and drains.		
Set up pressure controls.		
Operate system.		
Monitor system (control room).		
Monitor system (plant).		
Operate wall blowers.		
Operate retracts.		
Operate air heater sootblowers.		
Operate scrubber sootblowers.		
Operate air heater sootblowers startup.		
Isolate sootblowers.		
Isolate system.		
Troubleshoot system.		
Boiler Circulating Water Pumps		
Perform valve line-up.		
Fill up vent and drain pump.		
Perform pump purge (hot).		
Perform pump purge (cold).		
Perform high-pressure fill valve line-up.		
Perform low-pressure fill valve line-up.		
Perform pump bump and startup.		
Perform prestart checks.		
Perform pump rotation check.		

Operate under chem clean condition.		
Perform hot stand-by valve line-up.		
Perform pump shutdown during accelerated cooldown.		
Perform hot pump removal for maintenance.		
Perform pump start, boiler hot, pump cold.		
Perform starting of hot stand-by pump.		
Operate with loss of closed cooling water.		
Operate with loss of all cooling water.		
Operate under severe loss of boiler water.		
Isolate hot pump.		
Isolate cold pump.		
Perform cooling water supply reset.		
Isolate purge fill and cooling system.		
Isolate DP switches.		

Condensate and Boiler Water Systems	Who to Train	Training Method
Boiler Feedwater Pumps (BFP)		
Perform valve line-up/pump.		
Perform fill and vent pump.		
Perform valve lineup/BFP.		
Perform valve lineup electric BFP.		
Perform prewarm procedure of electric BFP.		
Fill and vent electric BFP.		
Operate electric BFP LO package.		
Operate electric BFP injection water.		
Start electric BFP.		
Operate electric BFP (control room).		
Isolate electric BFP.		

Perform turbine BFP (BFPT) prewarm procedure.		
Perform BFPT (high pressure).		
Perform BFPT (low pressure).		
Operate BFPT injection water skid.		
Operate BFP lube oil system.		
Perform steam seal operation.		
Perform exhaust valve operation/vacuum.		
Isolate BFPT on line.		
Isolate BFPT off line.		
Isolate BFPT (waterside).		
Operate BFPT on aux steam (low pressure).		
Operate BFPT on main steam (high pressure).		
Operate with limited feed pumps.		
Reset BFPT trip local/remote.		
Operate BFPT (control room).		
Monitor BFPT (control room).		
Perform stand-by pump tests.		
Perform overspeed tests.		
Operate BFPT fire protection.		
Boiler Feedwater Pump Lube Oil		
Perform valve line-up.		
Fill and drain reservoir.		
Fill and drain system.		
Operate transfer/conditioning pump.		
Fill and vent coolers.		
Perform bulk unloading.		
Monitor system (control room).		
Monitor system (plant)		

Operate system (control room)		
Operate system (plant).		
Operate aux pumps.		
Perform stand-by pump tests.		
Perform BFP turbine lube oil cooler swap.		
Operate aux equipment.		
Operate full flow filter cabinets.		
Operate BFP turbine filter system.		
Perform oil storage transfer.		
Perform turbine lube oil centrifuge cleaning.		
Perform lube oil reservoir cleaning.		
Isolate system.		
Perform oil flush.		
Isolate pumps.		
Isolate centrifuge.		
Isolate filters.		
Perform filter changeout.		
Perform centrifuge swap.		
Condenser		
Perform valve line-up.		
Perform pre-op checks.		
Valve in the flash tank.		
Fill hotwell.		
Monitor system (control room).		
Monitor system (plant).		
Operate system (plant).		
Operate system (control room).		
Perform tube leak checks.		

Perform hydro operation.		
Perform air leakage test.		
Operate condenser exhausters.		
Operate condenser exhausters in single loop operation.		
Operate condenser in single loop operation.		
Isolate condenser.		
Isolate exhauster.		
Perform PM.		
Operate steam traps on/off line.		
Condensate		
Perform valve line-up.		
Perform system startup.		
Fill hotwell.		
Fill and drain system.		
Fill and drain LP heaters (tube side).		
Perform LP heater prewarm.		
Start condensate pump.		
Operate condensate in fill mode.		
Fill and drain LP heaters (shell side).		
Perform cold clean-up procedure.		
Operate system recirc.		
Perform LP heater bypass operation.		
Operate dumps to normal and emergency.		
Perform hotwell level control.		
Isolate condensate pump.		
Isolate LP heaters.		
Isolate system.		

Perform heater tube leak check.		
Monitor water chemistry.		
High-Pressure Heaters		
Perform valve line-up system.		
Perform valve line-up HP heaters.		
Perform fill and drain system.		
Perform fill and drain HP heaters.		
Perform prewarming procedure.		
Monitor control room.		
Monitor system (plant).		
Operate system (control room).		
Operate plant.		
Perform heater bypass operation.		
Isolate HP heaters.		
Perform tube leak checks.		
Apply N_2 blanket.		
Heater Vents and Drains		
Perform system line-up.		
Perform heater warming and pressurizing.		
Perform system traps and drains line-up.		
Perform extraction line warming.		
Monitor system (control room).		
Monitor system (plant).		
Perform heater level control (manual to auto cont).		
Perform tube leak check.		
Perform normal emergency drip operation.		
Isolate LP heater extraction.		
Isolate HP heater extraction.		

Isolate misc. drains receiver.		
Perform eye/hye energize and de-energize.		
Prewarm heater drain pump.		
Isolate heater drain pump.		
Operate heater extraction.		
Condensate Make-Up		
Perform valve line-up.		
Perform fill/drain procedure.		
Monitor system (control room).		
Monitor system (plant).		
Operate system.		
Operate demin. booster pump.		
Operate condensate make-up pump.		
Operate condensate dumps normal/waste.		
Operate normal/emergency make-up.		
Isolate system.		
Operate aux DA make-up pump.		
Perform pump isolation.		

Air and Flue Gas	Who to Train	Training Method
Air PreHeater		
Perform valve line-up (hot water coil system).		
Perform valve line-up (auxiliary heater).		
Perform valve line-up (SK-reheat).		
Fill and vent primary system.		
Fill and vent secondary system (water coils).		
Monitor preheat system (control room).		

Monitor system (plant).		
Isolate pump primary, secondary.		
Operate pumps primary, secondary.		
Operate system.		
Operate under freeze-up conditions.		
Drain and purge coils in freeze condition.		
Operate system on manual.		
Identify if coil has a leak.		
Isolate one set of coils.		
Boiler Draft		
Line up gas path.		
Perform boiler purge.		
Operate interlocks (start/stop/excessive damper).		
Start/operate igniter fan.		
Start/operate seal air fan.		
Start/operate penthouse fan.		
Start/operate air heaters.		
Monitor boiler draft (control room).		
Operate boiler draft (control room).		
Perform normal fan shutdown.		
Perform accelerated cooldown.		
Perform mill cold air damper.		
Operate O_2 analyzer.		
Perform PA duct fan pressure control.		
Perform FD fan duct pressure control.		
Perform furnace pressure control.		
Perform O_2 air trim operation.		
Operate CO analyzer.		

Operate within environmental guidelines.		
Operate under limited fan conditions.		
Boiler Draft PA Fans		
Perform prestart checklist.		
Perform PA fan line-up.		
Operate interlocks (start/stop/excessive damper).		
Start PA fan.		
Operate PA fan (control room).		
Monitor PA fan (control room).		
Operate PA fan under fan curve limitations.		
Perform PA fan shutdown.		
Operate PA fan at low loads.		
Isolate PA fan.		
Boiler Draft FD Fans		
Perform FD fan prestart check list.		
Perform FD fan line-up.		
Start first FD fan operation.		
Start second FD fan operation.		
Operate FD fan (control room).		
Monitor FD fan (control room).		
Operate FD fan under fan curve limitations.		
Perform FD fan shutdown.		
Operate FD fan at low loads.		
Isolate FD fan.		
Boiler Draft ID Fans		
Perform ID fan prestart checklist.		
Perform ID fan line-up.		
Start first ID fan operation.		

Start second ID fan operation as needed.		
Operate ID fan (control room).		
Monitor ID fan (control room).		
Operate ID fan under fan curve limitations.		
Perform ID fan shutdown.		
Operate ID fan at low loads.		
Isolate ID fan.		

Coal Feed and Pulverizer System	Who to Train	Training Method
Coal Mills		
Perform coal mill permissive prestart checklist.		
Start coal mill.		
Operate coal mills (control room).		
Operate coal mills (plant).		
Monitor coal mills (control room).		
Perform coal mill loading/unloading.		
Perform coal mill desanding.		
Perform coal mill purge.		
Perform coal silo emptying.		
Perform transport line clearing.		
Operate under coal mill fire condition.		
Perform mill fitness test.		
Perform mill shutdown.		
Isolate coal mill.		
Isolate coal feeder.		
Bottom Ash		
Perform valve line-up.		

Perform fill and drain operation.		
Start bottom ash system.		
Monitor bottom ash system.		
Operate under environmental guidelines.		

Turbine and Subsystems	**Who to Train**	**Training Method**
Turbine		
Perform prestart checklist.		
Prewarm main line steam/steam chest.		
Prewarm main turbine.		
Operate TSI equipment.		
Operate turbine controls (EHC panel).		
Perform turbine startup/cold.		
Perform mechanical trip test.		
Perform overspeed test.		
Perform oil trip test.		
Perform load soak (sali/turbine and starting loading chart).		
Perform turbine startup/hot.		
Operate turbine (plant).		
Monitor turbine (control room).		
Monitor turbine (plant).		
Operate full to partial arc transfer.		
Operate hood sprays.		
Perform accelerated cooldown.		
Perform thrust bearing wear test.		
Operate under high back pressure.		
Operate with limited extractions.		

Operate/line-up turbine drain valves.		
Start/stop turbine aux equipment.		
Operate under various temps/pressures.		
Operate under water induction conditions.		
Perform valve tightness test.		
Operate turning gear.		
Operate under load runbacks.		
Shut down turbine.		
Operate fire protection equipment.		
Turbine Lube Oil		
Perform valve line-up.		
Fill and drain reservoir.		
Fill and drain system.		
Operate transfer/conditioning pump.		
Fill and vent coolers.		
Perform bulk unloading.		
Monitor system (control room).		
Monitor system (plant).		
Operate system (control room).		
Operate system (plant).		
Operate aux pumps.		
Perform stand-by pump tests.		
Operate pumps unit startup/shutdown.		
Perform turbine lube oil cooler swap.		
Operate aux equipment.		
Operate full flow filter cabinets.		
Operate main turbine filter system/TurboToc.		
Perform oil storage transfer.		

Perform turbine lube oil centrifuge cleaning.		
Perform lube oil reservoir cleaning.		
Perform turbine lube oil reservoir screen cleaning.		
Isolate system.		
Perform oil flush.		
Isolate pumps.		
Isolate centrifuge/TurboToc.		
Isolate filters/TurboToc.		
Perform filter changeout.		
EHC Hydraulic Oil System		
Perform valve line-up.		
Perform system filling.		
Perform system draining.		
Operate in bypass mode.		
Perform system startup.		
Operate filter/transfer pump.		
Perform stand-by pump test.		
Charge accumulators.		
Isolate pumps.		
Isolate system.		
Isolate an accumulator.		
Perform system flush.		
Operate under environmental/safety concerns.		
Shut down system.		
MHC Hydraulic System		
Perform valve line-up.		
Perform system filling.		
Perform system draining.		

Perform system startup.		
Perform stand-by pump test.		
Isolate system.		
Perform system flush.		
Operate under environmental/safety concerns.		
Shut down system.		
IC Turbine		
Perform prestart checks.		
Perform valve line-up (instrument air and fuel oil).		
Perform switchgear line-up.		
Perform electrical line-up MCC.		
Operate air compressor/dryers.		
Operate auxiliary equipment.		
Operate battery charger system.		
Operate lube oil system.		
Perform diesel engine start.		
Perform unit start.		
Perform unit sync auto/man.		
Perform unit loading base/peak.		
Perform var control.		
Operate diesel fuel system.		
Perform daily/weekly log operation.		
Monitor system plant/fire protection.		
Perform unit shutdown.		
Steam Seals		
Perform valve line-up.		
Prewarm/pressurize system.		
Monitor system control room.		

Operate system (control room).		
Perform system startup/shutdown.		
Perform temp/pressure control.		
Operate steam seal diverting valve.		
Operate from different steam sources.		
Operate heating steam pressurization valve.		
Operate seal steam pressurization valve.		
Operate heating steam feed valve.		
Operate seal steam aux feed valve.		
Operate seal steam feed valve.		
Line up BFP steam seals.		
Isolate system (turbine).		
Isolate system (BFP).		

Generator	Who to Train	Training Method
Stator Cooling		
Perform valve line-up.		
Fill and drain system.		
Start system.		
Monitor system control room.		
Monitor system plant.		
Operate system control room.		
Operate system plant.		
Perform cooler leak checks.		
Isolate pumps.		
Isolate system.		
Perform stand-by pump test.		

Perform valve line-up.		
Emergency Generator		
Perform system line-up.		
Complete prestart checklist.		
Perform startup in remote.		
Perform startup in local.		
Operate in remote.		
Operate in local.		
Operate system auxiliary equipment.		
Monitor auxiliary equipment.		
Synchronize generator on line.		
Operate aux equipment without em. power.		
Monitor system operation (control room).		
Monitor system operation (plant).		
Perform loading and unloading operation.		
Isolate emergency generator.		
Monitor and reset protection relays.		
Perform shutdown in local.		
Perform shutdown in remote.		
Perform system PM.		
Generator Excitation System		
Perform prestart checklist.		
Perform stator cooling valve in.		
Operate core monitor.		
Energize field breaker (flash field).		
Install primary, secondary, meter, relay fuses.		
Operate bus duct coolers.		
Synchronize generator.		

Perform manual/auto voltage regulator transfer.		
Monitor system (plant).		
Operate system (control room).		
Operate system (plant).		
Perform VAR correction.		
Operate with limited rectifier service.		
Perform main generator loading.		
Perform ground detection.		
Isolate generator.		
Isolate alterex. cabinet.		
Isolate rectifier.		
Isolate exciter.		
Isolate bus duct coolers.		
Verify generator grounding.		
Operate/monitor fire protection system.		
Operate 24 kV disconnects.		
Operate neutral disconnects.		
Perform black start procedure.		
Generator Seal Oil		
Perform valve line-up.		
Perform system fill and drain.		
Perform system startup.		
Monitor control room.		
Monitor plant.		
Operate control room.		
Operate plant.		
Perform float trap operation.		
Perform regulator bypass operation.		

Perform system shutdown.		
Isolate system pumps.		
Isolate system filters.		
Isolate system.		
Operate from bearing oil system supply.		
Perform stand-by pump test.		
Generator Hydrogen Cooling		
Perform system line-up.		
Perform hydrogen fill/purge line-up.		
Perform CO_2 purge/fill line-up.		
Perform O_2 purge/fill line-up.		
Operate portable analyzer.		
Operate core monitor.		
Operate hydrogen purity panel on line.		
Operate hydrogen purity panel off line.		
Swap hydrogen bank.		
Monitor plant.		
Operate hydrogen storage tank.		
Operate vaporizer.		
Perform safety precautions/checks.		
Operate buildup coil.		
Isolate system.		
Isolate hydrogen storage tank.		
Isolate hydrogen bottles.		

Electrical Distribution	Who to Train	Training Method
Substation		
Perform system line-up.		
Monitor system (control room).		
Monitor system (plant).		
Respond to annunciator alarms.		
Interface with system dispatch.		
Perform equipment reset/system dispatch.		
Perform request for outage review.		
Perform switching operation generator breaker.		
Perform switching operation line breaker.		
Perform switching operation disconnect.		
Perform switching procedure.		
Isolate generator breakers.		
Isolate line breakers.		
Isolate disconnect.		
Isolate high voltage bus.		
Perform high voltage clearance procedure.		
Operate GCSs in local/remote.		
Operate GCBs manually.		
Perform one bus isolation.		
Perform one bus operation.		
Perform line isolation.		
Perform line operation.		
Perform and verify ability to locate ground.		
Perform safety checks/precautions.		
Monitor substation DC power/batteries.		

Perform GCBs aux. equipment checks.		
4160/6900 VAC		
Perform system line-up.		
Monitor system (control room).		
Monitor system (plant).		
Operate system.		
Respond to protective relay operations.		
Isolate bus.		.
Rack in/out breaker.		
Energize bus from emergency source.		
Energize A bus normal supply.		
Energize B bus normal supply.		
Energize A and B bus from auxiliary transformer.		
Operate bus with various sources, (Res, Main).		
Perform safety precautions/check/PM.		
Perform loading and unloading.		
Perform and verify ability to locate ground.		
Review P&ID/auxiliary one-line diagram review.		
480 VAC		
Perform system line-up.		
Monitor system (control room).		
Monitor system (plant).		
Operate system.		
Respond to protective devices.		
Isolate a motor control center (MCC).		
Operate with alt. sources.		
Rack in/out breakers.		
Perform man. operation of auto transfer switch.		

Perform safety precautions/checks.		
Perform loading/unloading of a MCC.		
Perform and verify ability to locate ground.		
Perform P&ID/480 switchgear review.		
Perform system line-up.		
Monitor system (control room).		
Monitor system (plant).		
Operate system.		
Operate system breakers.		
Respond to protective devices.		
Isolate a static inverter.		
Operate under tie breaker closed conditions.		
Operate essential bus with various sources.		
Rack in/out breakers.		
Perform safety precautions and checks.		
Perform loading and unloading of a static inverter.		
Perform and verify ability to locate ground.		
Perform P&ID/ one-line diagram review.		
DC Power		
Perform system line-up.		
Operate battery chargers.		
Swap chargers.		
Isolate chargers.		
Isolate batteries.		
Isolate DC breakers to plant equipment.		
Isolate system.		
Monitor DC system (control room).		
Transfer AC source.		

Static converter.		
Perform system line-up.		
Perform inverter startup/shutdown.		
Isolate an inverter.		
Monitor inverter system (control room).		
Monitor inverter system (plant).		
Operate bypass switch in all modes.		
Swap inverters.		
Isolate breakers from power panels.		
Operate transfer switch.		
Review AC operation theory.		
Operate battery chargers.		
Swap battery chargers.		
Isolate a battery charger.		
Isolate batteries.		

Controls	**Who to Train**	**Training Method**
Unit Master		
Operate in manual.		
Operate in boiler base turbine follow.		
Operate in DEB.		
Operate in boiler base.		
Operate in boiler increase.		
Operate in boiler decrease.		
Operate in turbine base.		
Operate in turbine increase.		
Operate in turbine decrease.		

Operate in manual turbine follow.		
Operate load rate setter.		
Operate high and low load setters.		
Operate in EMS.		
Monitor pressure ratio.		

Water Treatment	Who to Train	Training Method
Boiler Chemical Feed		
Perform valve lineup /hydrozine.		
Perform valve lineup /ammonia.		
Perform fill/drain hydrozine.		
Perform fill/drain ammonia.		
Start/stop pumps.		
Swap pumps.		
Adjust pump stroke.		
Operate plant.		
Operate cont blowdown for silica control.		
Observe safety precautions.		
Operate drum pressure limited.		
Perform chem. Clean procedure.		
Demin Water		
Perform valve line-up.		
Perform fill and drain operation.		
Perform system startup.		
Perform concurrent series regen.		
Perform series regen.		
Perform single vessel regen.		

Monitor system operation (plant).		
Operate system.		
Perform chemical unloading.		
Operate caustic/acid feed pumps.		
Operate degasifier transfer pump.		
Perform limiting/bypass vessel operation.		
Operate regen pump.		
Operate storage tanks.		
Operate degasifier vacuum pump.		
Perform water tanker loading/unloading.		
Chemical Feed		
Perform valve line-up (chlorine).		
Monitor chlorine system (outplant).		
Perform product loading and unloading.		
Perform emergency response.		

Plant Auxiliaries	Who to Train	Training Method
Instrument & Station Air		
Perform system line-up.		
Perform system pressurizing and depressurizing.		
Start/stop air compressor.		
Monitor system (control room).		
Monitor system (plant).		
Operate air dryers.		
Operate compressors in various modes.		
Swap air compressors.		
Verify cooling water supply/return line-up.		

Respond to compressor surge.		
Perform compressor loading/unloading.		
Respond to system low pressure.		
Operate under unit crosstie conditions.		
Isolate compressor.		
Isolate dryers.		
Isolate branch systems.		
Perform traps and drains checks.		
Operate diesel air compressor.		
Perform inter/after cooler leak checks.		
Operate air heater drive system.		
Fire Protection		
Perform system valve line-up.		
Fill and drain system.		
Operate electric fire water pumps.		
Operate diesel fire water pump.		
Monitor fire protection system (control room).		
Perform system PM.		
Perform deluge valve reset operation.		
Operate dry pipe fire protection system.		
Operate wet pipe fire protection system.		
Operate transformer deluge system.		
Operate fire fighting equipment.		
Operate CO_2 hose reels.		
Operate control room fire protection system.		
Operate FP system in winter mode.		
Isolate pressurization tanks.		
Isolate fire pumps.		

Isolate fire protection branch systems.		
Isolate ring headers.		
Monitor fire protection system (plant).		
Monitor CO_2 bottle systems.		
Auxiliary Fuel System		
Operate igniter troubleshoot/test prove.		
Adjust blr outage igniter.		
Monitor/control atomizing air.		
Monitor igniter windbox air.		
Operate FO storage equipment.		
Isolate FO system.		
Perform system fill/drain.		
Monitor FO system (control room).		
Operate FO system (plant).		
Operate FO system (control room).		
Monitor coal silo operation.		
Operate burner tilts.		
Monitor frame scanners (FO/coal).		
Perform wet coal operation.		
Perform master fuel trip reset.		
Operate mill air flow control.		
Operate under environmental guidelines.		
HVAC		
Perform valve line-up.		
Operate control room/computer AHU.		
Operate relay room AHU.		
Operate I&C maint shop.		
Operate plant admin. AHU.		

Operate room AHU.		
Operate boiler and turbine remote room AHU.		
Operate temp control panels.		
Operate chiller.		
Monitor control room.		
Operate chiller pumps.		
Isolate chillers/pumps.		
Isolate duct heaters.		
Isolate AHU.		
Shutdown Corrosion		
Perform valve line-up.		
Pressurize and depressurize system.		
Monitor system (plant).		
Operate N_2 storage tank.		
Perform N_2 blanket operation for boiler.		
Perform N_2 blanket operation for FW heaters.		
Perform system isolations.		
Operator Miscellaneous		
Perform emergency response.		
Perform waste oil management.		
Perform personnel scheduling.		
Perform confined space entry/exit logs.		
Perform log book entries.		
Operate mapper /PC.		
Operate max 1.		
Review MSDS.		
Review P&IDS.		
Review hazmat.		

Review SCBA procedures.		
Review plant warning system.		
Attend safety meetings.		
Complete round sheets.		
Auxiliary Steam		
Pressurize/prewarm system.		
Perform steam trap line-up.		
Perform unit crosstie.		
Monitor PFGD AS system (plant).		
Depressurize system.		
Isolate system.		
Isolate aux feeds.		
Perform BFP prewarm.		
Operate BFP on aux steam.		
Operate system drains.		
Prewarm turbine.		
Plant Drains		
Operate dust suppression system.		
Monitor control room operation.		
Monitor plant operation.		
Perform bottom ash pond level control.		
Perform recycle basin level control.		
Perform holding basin level control.		
Perform fly ash pond level control.		
Operate plant effluent sampling system.		
Operate plant effluent flow.		
Operate blowdown system.		

River Water		
Perform valve line-up.		
Perform sluice and air backwash operation.		
Perform equipment isolation.		
Perform electrical system transfer.		
Perform system startup operation.		
Perform de-icing operation.		
Cooling Towers		
Start/stop cooling tower fans.		
Start/stop water make-up pump.		
Start/stop booster water pump.		
Monitor control room operation.		
Operate system (control room).		
Perform system fill drain and flush.		
Operate in winter/summer conditions.		
Operate under environmental guidelines.		
Perform system shutdown.		
Service Water		
Perform system fill and drain operation.		
Perform service water pump startup/shutdown.		
Monitor system operation (control room).		
Monitor system operation (plant).		
Operate service water system.		
Operate PLC control loops.		
Operate water treatment equipment.		
Perform unit crosstie operation.		
Perform system isolations.		
Perform electric well pump startup/shutdown.		
Operate system under winter conditions.		

Ash Water		
Perform valve line-up for system.		
Perform fill and drain operation for system.		
Start system.		
Operate system.		
Monitor system.		
Operate weir system.		
Operate 40 psi (275.8 kPa) system for the refractory cooling filling system.		
Perform valve lineup for ash water pumps.		
Isolate ash sluice pump.		
Isolate weir water booster pump.		
Circulating Water		
Perform green house valve line-up.		
Perform CT cell distribution operation.		
Fill/drain CW water boxes.		
Perform tube leak checks.		
Perform CW system fill/drain operation.		
Perform CW system valve line-up.		
Perform CW blowdown operation.		
Perform single loop condenser operation.		
Address environmental concerns.		
Perform CW waterbox isolation.		
Perform CW pump isolation.		
Closed Cooling Water		
Perform valve line-up.		
Perform system fill and drain operation.		
Perform system startup.		

Monitor system (control room).		
Monitor system (plant).		
Perform common equipment operation.		
Operate unit under crosstie operation.		
Perform single heat exchanger operation.		
Operate equipment coolers.		
Operate temp/pressure control system.		
Isolate equipment.		
Isolate a closed cooling water pump.		
Perform cooler tube leak checks.		
Operate closed cooling water pump.		

Target:

Training and Simulators for
Human Performance Enhancement

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