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DOE STANDARD

FACILITY REPRESENTATIVE FUNCTIONAL AREA QUALIFICATION STANDARD

DOE Defense Nuclear Facilities Technical Personnel



U.S. Department of Energy
Washington, D.C. 20585

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APPROVAL

The Federal Technical Capability Panel consists of senior Department of Energy managers responsible for overseeing the Federal Technical Capability Program. This Panel is responsible for reviewing and approving the Qualification Standard for Department-wide application. Approval of this Qualification Standard by the Federal Technical Capability Panel is indicated by signature below.


Roy J. Schepens
Chairman
Federal Technical Capability Panel

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ACKNOWLEDGMENT

The Facility Representative Program Manager is the Sponsor for the Facility Representative Qualification Standard. The Sponsor is responsible for coordinating the development and/or review of the Functional Area Qualification Standard by subject matter experts to ensure that the technical content of the standard is accurate and adequate for Department-wide application for those involved in the Facility Representative Program. The Sponsor, in coordination with the Federal Technical Capability Panel, is also responsible for ensuring that the Functional Area Qualification Standard is maintained current.

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FUNCTIONAL AREA

FACILITY REPRESENTATIVE

PURPOSE

The Department's Federal Technical Capability Program Policy for Defense Nuclear Facilities, DOE P 426.1, issued by the Secretary in December 1998, commits the Department to continuously strive for technical excellence. The Federal Technical Capability Manual, DOE M 426.1-1, describes the Technical Qualification Program, and includes the development and revision of Qualification Standards. In support of this goal, the competency requirements defined in the Technical Qualification Standards should be aligned with and integrated into the recruitment and staffing processes for technical positions. The Technical Qualification Standards should form the primary basis for developing vacancy announcements, qualification requirements, crediting plans, interviewing questions, and other criteria associated with the recruitment, selection, and internal placement of technical personnel. Office of Personnel Management (OPM) minimum qualifications standards will be greatly enhanced by application of appropriate materials from the Functional Area Qualification Standards.

This Technical Standard provides criteria and information specific to Facility Representative Functional Area Qualification as defined in the Federal Technical Capability Manual, DOE M 426.1-1. Facility Representative Program specific information is identified in *Facility Representatives*, DOE-STD-1063-2000.

This Technical Qualification Standard is not intended to replace the OPM Qualifications Standards or other Departmental personnel standards, rules, plans, or processes. The primary purpose of the Technical Qualification Program is to ensure that employees have the requisite technical competency to support the mission of the Department. The Technical Qualification Program forms the basis for the development and assignment of DOE personnel responsible for ensuring the safe operation of defense nuclear facilities.

APPLICABILITY

The Facility Representative Functional Area Qualification Standard establishes common functional area competency requirements for Department of Energy Facility Representative personnel who provide assistance, direction, guidance, oversight, or evaluation of contractor technical activities impacting the safe operation of DOE's most hazardous facilities. The Facility Representative Functional Area Qualification Standard has been developed as a tool to assist DOE Program and Field offices in the development and implementation of the Technical Qualification Program in their organization. Program and Field Offices with Defense Nuclear Facilities are expected to use this Functional Area Qualification Standard as-is. Program and Field Offices with hazardous facilities that are not Defense Nuclear Facilities are encouraged to use this Functional Area Qualification Standard as is, but may modify or eliminate competencies as necessary. Satisfactory and documented attainment of the competency requirements contained in this Functional Area Qualification Standard ensures that Facility Representative

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personnel possess the requisite competence to fulfill their functional area duties and responsibilities. Office/Facility-Specific Qualification Standards supplement this Facility Representative Functional Area Qualification Standard and establish unique operational competency requirements at the Field Element, site, or facility level.

IMPLEMENTATION

This Functional Area Qualification Standard identifies the technical competency requirements for Facility Representative personnel. Although there are other competency requirements associated with the positions held by Facility Representative personnel, this Functional Area Qualification Standard is limited to identifying the specific technical competencies. The competency statements define the expected knowledge and/or skill that an individual must meet. Each of the competency statements is further explained by a listing of supporting knowledge and/or skill statements. The Federal Employee Training Manual, DOE M 360.1-1B, describes that the supporting knowledge and/or skill statements are provided as guidance to describe the intent of the competency statements. They are not requirements and they do not necessarily have to be fulfilled to meet the intent of the competency. However, to maintain consistency across the DOE complex, all Facility Representative candidates at Defense Nuclear Facilities should demonstrate the knowledge/skill statements in this Standard.

The competencies identify a familiarity level, a working level, or an expert level of knowledge; or they require the individual to demonstrate the ability to perform a task or activity. These levels are defined as follows:

Familiarity level is defined as basic knowledge of or exposure to the subject or process adequate to discuss the subject or process with individuals of greater knowledge.

Working level is defined as the knowledge required to monitor and assess operations/activities, to apply standards of acceptable performance, and to reference appropriate materials and/or expert advice as required to ensure the safety of Departmental activities.

Expert level is defined as a comprehensive, intensive knowledge of the subject or process sufficient to provide advice in the absence of procedural guidance.

Demonstrate the ability is defined as the actual performance of a task or activity in accordance with policy, procedures, guidelines, and/or accepted industry or Department practices.

Headquarters and Field Elements shall establish a program and process to ensure that Facility Representative personnel possess the competencies required of their position. That includes the competencies identified in this Functional Area Qualification Standard or similar Standards developed by the organization. Documentation of the completion of the requirements of the Standard shall be included in the employee's training and qualification record.

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Equivalencies may be granted for individual competencies based upon an objective evaluation of the employee's prior education, experience, and/or training. Equivalencies shall be granted in accordance with the policies and procedures of the Program or Field Office. The supporting knowledge and/or skill statements, while not requirements, should be considered before granting equivalency for a competency.

Training shall be provided to employees in the Technical Qualification Program who do not meet the competencies contained in this Functional Area Qualification Standard. Departmental training will be based upon appropriate supporting knowledge and/or skill statements similar to the ones listed for each of the competency statements. Headquarters and Field Elements should use the supporting knowledge and/or skill statements as a basis for evaluating the content of any training courses used to provide individuals with the requisite knowledge and/or skill required to meet the Functional Area Qualification Standard competency statements.

EVALUATION REQUIREMENTS

Attainment of the competencies listed in this Functional Area Qualification Standard should be documented by a qualifying official, immediate supervisor, or the team leader of Facility Representative personnel using any of the following methods:

- Documented evaluation of equivalencies
- Written examination
- Documented oral evaluation
- Documented observation of performance

REQUALIFICATION, PROFICIENCY, AND CONTINUING TRAINING

The guidance and requirements associated with Facility Representative Requalification, Proficiency, and Continuing Training are found in *Facility Representatives*, DOE-STD-1063-2000, Section 5.10.

DUTIES AND RESPONSIBILITIES

The typical duties and responsibilities expected of personnel assigned to the Facility Representative Functional Area are found in *Facility Representatives*, DOE-STD-1063-2000, Section 5.2.

Position-specific duties and responsibilities for Facility Representative personnel are contained in their Office/Facility-Specific Qualification Standard or Position Description, or other appropriate documentation.

EDUCATION AND EXPERIENCE

The education and experience requirements for entry into the Facility Representative Program are found in *Facility Representatives*, DOE-STD-1063-2000, Section 5.8.

REQUIRED TECHNICAL COMPETENCIES

The competencies contained in this Standard are distinct from those competencies contained in the General Technical Base Qualification Standard. All Facility Representatives must satisfy the competency requirements of the General Technical Base Qualification Standard prior to or in parallel with the competency requirements contained in this Standard. Each of the competency statements defines the level of expected knowledge and or skill that an individual must possess to meet the intent of this Standard. The supporting knowledge and/or skill statements further describe the intent of the competency statements.

Note: When regulations or Department of Energy directives or other industry standards are referenced in the Qualification Standard, the most recent revision should be used.

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1. GENERAL TECHNICAL

1.1 A Facility Representative shall demonstrate a familiarity level knowledge of principles of steam system operation including theory and component design.

Supporting Knowledge and/or Skills

- a. Explain the application of the following concepts to steam systems:
 - Enthalpy
 - Saturation
 - Superheat
 - Steam quality
 - Moisture content
 - Condensation
 - Sensible heat
 - Carryover
 - Thermal expansion
 - Thermal contraction
- b. Explain the use of Steam Tables and the Mollier Diagram and demonstrate their use.
- c. Explain the function/application of the following steam system components and describe how the components contribute to steam system operation:
 - Isolation Valves
 - Isolation Valve Bypass Valves
 - Vent Valves
 - Drain Valves
 - Safety/Relief Valves
 - Flow Control Valves
 - Steam Trap Bypass Valves
 - Expansion Joints
 - Pressure Control Valves
 - Moisture Separators
 - Pipe Hangers/Supports
 - Mist Eliminators
 - Evaporators
 - Condensers
 - Boilers
 - Reboilers
 - Steam Traps (mechanical, impulse, thermostatic)

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1.2 A Facility Representative shall demonstrate a working level knowledge of steam system operation including startup, normal and off-normal operation, and shutdown.

Supporting Knowledge and/or Skills

- a. Describe the following steam system evolutions and associated precautions:
 - Pressurization and warm-up of a cold steam system
 - Initiation of steam flow in a stagnant, but pressurized steam system
 - Isolation of a portion of a steam system
 - Pressurization and warm-up of an isolated portion of a steam system
 - Isolation and de-pressurization of an in-service steam system
- b. Describe condensation-induced water hammer and its potential impact on steam systems.
- c. Describe the expected operator response to, and where possible, how to prevent the following steam system abnormal conditions. Include a discussion of associated hazards:
 - Water hammer during pressurization/warm-up of a cold steam system
 - Water hammer during initiation of flow in an in-service steam system
 - Seat leakage of an isolation valve
 - Steam leakage to atmosphere
 - Steam header rupture

1.3 Personnel shall demonstrate familiarity level knowledge of basic pneumatic and hydraulic systems in the area of theory.

Supporting Knowledge and/or Skills

- a. Define the following and discuss their relationship:
 - Force
 - Pressure
 - Pneumatic
 - Hydraulic

1.4 Personnel shall demonstrate working level knowledge of pneumatic and hydraulic systems operations in the following areas.

Supporting Knowledge and/or Skills

- a. Describe the following pneumatic and hydraulic system evolutions and associated precautions and hazards:
 - Start-up and shutdown
 - Normal operation
 - System rupture or leakage

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1.5 Personnel shall demonstrate familiarity level knowledge of heat exchanger construction, operations, and theory.

Supporting Knowledge and/or Skills

- a. Describe the two types of heat exchanger construction.
- b. Describe hot and cold fluid flow in parallel flow, counter flow, and cross flow heat exchangers.
- c. Discuss the following heat exchanger applications:
 - Air conditioner evaporator
 - Preheater
 - Radiator
 - Air conditioner condenser
 - Cooling tower

1.6 Personnel shall demonstrate working level knowledge of heat exchanger systems operations in the following areas.

Supporting Knowledge and/or Skills

- a. Describe the following heat exchanger system evolutions and associated precautions and hazards:
 - Start-up and shutdown
 - Normal operation
 - System rupture or leakage

1.7 Personnel shall demonstrate familiarity level knowledge of pump construction, operations, and theory.

Supporting Knowledge and/or Skills

- a. Describe the principles of operation for centrifugal pumps.
- b. Describe the principles of operations for positive displacement pumps.
- c. Define the following terms and explain their relationship:
 - Net Positive Suction Head
 - Cavitation

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1.8 Personnel shall demonstrate familiarity level knowledge of valve construction, operations, and theory.

Supporting Knowledge and/or Skills

- a. Given a drawing of a valve, identify the major component parts.
- b. Given a drawing of a valve, identify which of the following type of valve it is:
 - Gate/Globe
 - Relief/Safety
 - Ball
 - Check
- c. Describe the construction and principle of operation for the following types of valve actuators:
 - Manual
 - Electric
 - Solenoid
 - Pneumatic
 - Hydraulic
- d. Describe the four basic types of flow control elements employed in valve design.
- e. Given the bridge wall markings from a valve be able to explain:
 - The type of valve (gate/globe, ball, check, etc.)
 - Direction of flow
 - Application

1.9 Personnel shall demonstrate familiarity level knowledge of basic air compressor, strainer, and filter construction, operations, and theory.

Supporting Knowledge and/or Skills

- a. Describe the basic operation of an air compressor.
- b. Describe the following types of strainers and filters, including an example of typical use:
 - Cartridge filters
 - Precoated filters
 - Bucket strainer
 - Deep-bed filters
 - HEPA filters
 - Duplex strainer

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1.10 Personnel shall demonstrate familiarity level knowledge of basic heating, ventilation, and air conditioning system construction, operations, and theory.

Supporting Knowledge and/or Skills

- a. Given a one-line diagram of an HVAC system identify and discuss the purpose of the following components:
 - Compressors
 - Blowers
 - Dampers
 - Chillers
 - Filters
 - Heat exchangers
 - Scrubbers
 - Hoods
 - Glove Boxes
 - Pressure sensors
- b. Discuss the relationships between the following in HVAC systems:
 - Supply Ventilation
 - Flow
 - Exhaust Ventilation
- c. Describe the types of refrigerants used in air conditioning systems.
- d. Discuss the hazards associated with these refrigerants.
- e. Describe the purpose of the HVAC system in the following applications:
 - Hoods
 - Glove boxes
 - Hot Cells
 - Confinement systems
- f. Discuss the reason for and significance of the following system parameters:
 - Positive vs. Negative system pressure
 - Differential pressure across filters
 - Differential pressure across components

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1.11 Personnel shall demonstrate working level knowledge of heating, ventilation, and air conditioning system operations in the following areas.

Supporting Knowledge and/or Skills

- a. Describe the following heating, ventilation, and air conditioning system evolutions and associated precautions and hazards:
 - Start-up and shutdown
 - Normal operation
- b. HEPA filter maintenance and testing
- c. Ventilation system balancing

1.12 Personnel shall demonstrate familiarity level knowledge of basic electrical fundamentals in the areas of terminology and theory.

Supporting Knowledge and/or Skills

- a. Discuss the following terms:
 - Electrostatic force
 - Electrostatic field
 - Conductor
 - Insulator
 - Resistor
- b. Describe the following parameters and discuss their relationship:
 - Voltage
 - Current
 - Resistance
 - Ohm's Law
 - Power
 - Inductance
 - Capacitance

1.13 Personnel shall demonstrate familiarity level knowledge of basic electrical fundamentals in the area of direct current (DC).

Supporting Knowledge and/or Skills

- a. Discuss the basic principle by which the following components produce DC:
 - Battery
 - DC Generator
 - Thermocouple
- b. Discuss the purpose of a rectifier.

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- c. Discuss the following terms:
 - Resistivity
 - Electric circuit
 - Series circuit
 - Parallel circuit
- d. Discuss the following terms:
 - Battery
 - Electrode
 - Electrolyte
 - Specific-Gravity
 - Ampere-Hour
- e. Describe in basic terms what happens when a lead-acid battery is charged and discharged.
- f. Describe the relationship between voltage and current-carrying capacity for series-connected versus parallel-connected batteries.
- g. Other than lead-acid batteries, list three additional types of batteries.
- h. Describe the hazards associated with lead-acid storage batteries.

1.14 Personnel shall demonstrate familiarity level knowledge of basic electrical fundamentals in the area of alternating current (AC).

Supporting Knowledge and/or Skills

- a. Discuss the basic theory of operation of an AC generator.
- b. Discuss the reasons that three phase power systems are used in industry.
- c. Discuss the basic theory of operation of an AC motor.
- d. Discuss the purposes of a transformer.
- e. Explain the theory of operation of a transformer.

1.15 Personnel shall demonstrate working level knowledge of basic electrical fundamentals in the area of electrical distribution systems.

Supporting Knowledge and/or Skills

- a. Explain the following terms as they apply to electrical distribution systems:
 - Single-line diagram
 - Diesel power

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- Neutral grounding
 - Protective relays
- b. Describe the protection provided by fuses and circuit breakers.
 - c. Describe the purpose and functions of a motor controller.

1.16 Personnel shall demonstrate working level knowledge of electrical system and components in the area of safety.

Supporting Knowledge and/or Skills

- a. Discuss the hazards associated with operations and maintenance of electrical systems and components.
- b. Describe the general safety precautions for operations and maintenance of electrical systems and components.
- c. Discuss the safety precautions specific to batteries.

1.17 Personnel shall demonstrate familiarity level knowledge of process instrumentation principles of operation, purpose and uses.

Supporting Knowledge and/or Skills

- a. Explain the reason for measuring temperature, pressure, flow, and fluid level.
- b. List the three basic functions that temperature, pressure, flow, and fluid level detectors provide.
- c. For the temperature detection devices listed, explain how the instrument provides an output representative of the temperature being measured:
 - Thermocouple (TC)
 - Resistance Temperature Detector (RTD)
- d. For the pressure detection devices listed, explain how the instrument provides an output representative of the pressure being measured:
 - Bellows type
 - Bourdon tube type
- e. For the fluid level detection devices listed, Explain how the instrument provides an output representative of the level being measured:
 - Gauge-glass type
 - Conductive probe type
 - Magnetic bond type

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- Differential pressure type
 - Ball float type
- f. For the flow detection devices listed, explain how the instrument provides an output representative of the flow being measured:
- Orifice plate type
 - Venturi tube type
 - Pitot tube type
 - Displacement type
 - Dall flow tube type
 - Ultrasonic type
 - Electromagnetic
- g. For the position detection devices listed, explain how the detector provides an output representative of the position being represented:
- Synchronous type
 - Limit switches
 - Reed switches
 - Potentiometer
 - Linear Variable Differential Transformer Types
- h. Referring to a basic block diagram of the above detection systems, explain the function of the key elements.

1.18 Personnel shall demonstrate familiarity level knowledge of control system principles of operation and uses.

Supporting Knowledge and/or Skills

- a. Define and Discuss the application of each of the following:
- Control system
 - Control system input
 - Control system output
 - Open-loop control system
 - Control system feedback
 - Closed-loop control system
- b. Describe an automatic control system, including the four functions required for an automatic control system to operate.
- c. Referring to a basic block diagram of a control system, explain the function of the elements.

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1.19 Personnel shall demonstrate familiarity level knowledge of chemistry fundamentals in the areas of theory and the periodic table.

Supporting Knowledge and/or Skills

- a. Describe the four possible states of matter.
- b. Explain the structure of an atom.
- c. Discuss the following terms:
 - Element
 - Molecule
 - Avogadro's Number
 - Mole
- d. Given a periodic table, identify and explain the significance of the arrangement of elements to include the following:
 - Periods of the table
 - Classes of the table
 - Group characteristics

1.20 Personnel shall demonstrate familiarity level knowledge of chemistry fundamentals in the areas of chemical bonding and chemical reactions.

Supporting Knowledge and/or Skills

- a. Discuss the following types of chemical bonds:
 - Ionic
 - Covalent
 - Metallic
- b. Explain each of the following as they relate to the basic laws of chemical reactions:
 - The Law of Conservation of Mass
 - The Law of Definite Proportions
 - The Law of Multiple Proportions
- c. Discuss how elements combine to form chemical compounds.
- d. Discuss the following terms:
 - Mixture
 - Solvent
 - Solubility
 - Solute
 - Solution
 - Equilibrium

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- e. With regard to chemical reactions, state Le Chatelier's principle.
- f. Discuss the following terms:
 - Density
 - Molarity
 - Parts per million (ppm)
- g. Given an unbalanced chemical equation, explain how to balance the equation.
- h. Define the following terms:
 - Acid
 - Base
 - pOH
 - Salt
 - pH

1.21 Personnel shall demonstrate familiarity level knowledge of chemistry fundamentals in the areas of corrosion and water treatment.

Supporting Knowledge and/or Skills

- a. Explain the process of general corrosion of iron and steel when exposed to water.
- b. Discuss the two conditions that can cause galvanic corrosion.
- c. Discuss the following types of specialized corrosion:
 - Pitting corrosion
 - Stress corrosion cracking
 - Crevice corrosion
- d. Discuss the reasons for removing impurities from water prior to use in nuclear and non-nuclear systems.
- e. Explain the ion exchange process.

1.22 Personnel shall demonstrate working level knowledge of chemistry fundamentals in the area of safety.

Supporting Knowledge and/or Skills

- a. Discuss the hazards associated with the use of corrosives (acids and alkalies).
- b. Describe the general safety precautions necessary for the handling, storage, and disposal of corrosives.
- c. Discuss the general safety precautions regarding toxic compounds.

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- d. Describe the criteria used to determine if a compound is a health hazard and discuss the methods by which toxic compounds may enter the body.
- e. Discuss the general safety precautions regarding the use, handling, and storage of compressed gases, including specifically hydrogen, oxygen, and nitrogen.
- f. Discuss the safety precautions for working with cryogenic liquids.
- g. Explain the difference between a flammable liquid and a combustible liquid.
- h. Describe the general safety precautions regarding the use, handling, and storage of flammable and combustible liquids.

1.23 Personnel shall demonstrate familiarity level knowledge of basic thermodynamics concepts and theories.

Supporting Knowledge and/or Skills

- a. Define the following terms:
 - Specific volume
 - Density
 - Specific gravity
 - Mass
 - Weight
- b. Describe the thermodynamic properties of temperature and pressure.
- c. Compare and contrast the Fahrenheit, Celsius, Kelvin, and Rankine temperature scales, and discuss the concept of absolute zero.
- d. Describe the relationship between absolute pressure, gauge pressure, and vacuum.

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- e. Define the following and describe their relationship:
 - Energy
 - Potential Energy
 - Kinetic Energy
 - Work
 - Heat
- f. Describe the following types of thermodynamic systems:
 - Isolated system
 - Open system
 - Closed system
- g. Describe the following terms concerning thermodynamic processes:
 - Thermodynamic process
 - Cyclic process
 - Reversible process
 - Irreversible process
 - Adiabatic process
 - Isentropic process
 - Throttling process
 - Polytropic process
- h. Discuss the First Law of Thermodynamics.
- i. Discuss the Second Law of Thermodynamics.

1.24 Personnel shall demonstrate familiarity level knowledge of basic heat transfer and fluid flow concepts and theories.

Supporting Knowledge and/or Skills

- a. Using the ideal gas law discuss the relationship between pressure, temperature, and volume.
- b. Describe when a fluid may be considered to be incompressible.
- c. Describe the effects of pressure and temperature changes on confined fluids.
- d. Describe the difference between heat and temperature, and heat and work.
- e. Describe the three modes of heat transfer.
- f. Describe how the density of a fluid varies with temperature.
- g. Define the term buoyancy.

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- h. Describe the relationship between the pressure in a fluid column and the density and depth of the fluid.
- i. Define the terms mass flow rate and volumetric flow rate.
- j. Describe the characteristics and flow velocity profiles of laminar flow and turbulent flow.
- k. Define the property of viscosity.
- l. Define the term head, head loss, and frictional loss, with respect to its use in fluid flow.
- m. Describe the phenomenon of water hammer, pressure spike, and steam hammer.

1.25 Personnel shall demonstrate familiarity level knowledge of basic material science in the areas of concepts, theories, and principles.

Supporting Knowledge and/or Skills

- a. State the five types of bonding that occur in materials and their characteristics.
- b. Describe the characteristics of the following crystal structures:
 - Body-centered cubic structure
 - Face-centered cubic structure
 - Hexagonal close-packed structure
- c. Identify and describe the crystalline structure of a metal.
- d. Define the following terms:
 - Grain structure
 - Creep
 - Polymorphism
 - Grain boundary
 - Alloy
 - Grain
- e. Describe the three possible alloy microstructures and their two main characteristics as compared to pure metals.
- f. Compare and contrast the properties, characteristics and applications of stainless steel to those of carbon steel.
- g. Identify the three types of microscopic imperfections found in crystalline structures.

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- h. Discuss the following terms:
 - Compressibility
 - Stress
 - Shear stress
 - Tensile Stress
 - Compressive stress
- i. Define the following terms:
 - Strain
 - Proportional limit
 - Plastic deformation
- j. Identify the two common forms of strain and discuss the differences.
- k. Discuss Hooke's Law.
- l. Discuss what is meant by the terms bulk modulus and fracture point.
- m. Given the stress-strain curves for ductile and brittle material, identify the following points on a stress-strain curve:
 - Proportional limit
 - Ultimate strength
 - Yield point
 - Fracture point
- n. Discuss the following terms:
 - Strength
 - Malleability
 - Ductility
 - Toughness
 - Yield Strength
 - Hardness
 - Ultimate Tensile Strength
- o. Describe the adverse effects of welding on metal including the types of stress.
- p. Discuss the phenomenon of thermal shock.
- q. Discuss the following terms and discuss their relationship to material failure:
 - Ductile fracture
 - Brittle fracture
 - Nil-ductility transition (NDT) temperature
- r. Discuss the phenomenon of brittle fracture.
- s. Explain fatigue failure and work hardening with respect to material failure.

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- t. Discuss the affects of the following types of radiation on the structural integrity of metals.
 - Alpha
 - Beta
 - Gamma
 - Fast neutron
 - Slow neutron

1.26 Personnel shall demonstrate a working level knowledge of engineering prints and drawings.

Supporting Knowledge and/or Skills

- a. Given an engineering print, read and interpret the following information:
 - Title block
 - Notes
 - Legend
 - Revision block
 - Drawing grid
- b. Given an engineering piping and instrument drawing, identify the symbols used for:
 - Types of valves
 - Types of valve operators
 - Types of eductors and ejectors
 - Basic types of instrumentation
 - Types of instrument signal controllers and modifiers
 - Types of system components (pumps, etc.)
 - Types of lines
- c. Identify the symbols used on engineering P&IDs to denote the location of instruments, indicators, and controllers.
- d. Identify how valve conditions are depicted.
- e. Determine system flowpath(s) for a given valve lineup.
- f. Given a fluid power type drawing, determine the operation or resultant action of the stated component when hydraulic pressure is applied/removed.

1.27 Personnel shall demonstrate a working level knowledge of electrical prints, diagrams and schematics.

Supporting Knowledge and/or Skills

- a. Identify the symbols used on engineering electrical drawings.

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- b. Identify the symbols and/or codes used on engineering electrical drawings to depict the relationship between components.
- c. State the condition in which all electrical devices are shown, unless otherwise noted on the diagram or schematic.
- d. Given a simple electrical schematic and initial conditions, identify the power sources and/or loads and their status.

1.28 Personnel shall demonstrate a working level knowledge of electronic/logic block diagrams, prints, and schematics.

Supporting Knowledge and/or Skills

- a. Identify basic component symbols and explain their functions.
- b. Identify the symbols used on logic diagrams to represent the components.
- c. Explain the operation of the three types of time delay devices.
- d. Identify the symbols used to denote a logical "1" (or high) and a logical "0" (or low) as used in logic diagrams.
- e. Given a logic diagram and appropriate information, determine the output of each component and the logic circuit.

1.29 Personnel shall demonstrate a working level knowledge of engineering fabrication, construction, and architectural drawings.

Supporting Knowledge and/or Skills

- a. Given one of each of the above drawings, read and interpret:
 - Basic dimensional and tolerance symbology
 - Basic fabrication symbology
 - Basic construction symbology
 - Basic architectural symbology

1.30 Personnel shall demonstrate familiarity level knowledge of lasers in the area of safety.

Supporting Knowledge and/or Skills

- a. Describe principle hazards associated with non-ionizing radiation
- b. Describe types and classifications of lasers (ANSI Z136.1-2000)

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- c. Describe engineering controls and use of personnel protective equipment for laser safety.
 - Laser Control Area
 - Protective housing, barriers and curtains
 - Beam attenuators and stops
 - Interlocks
 - Key control
 - Eyewear
- d. Discuss administrative controls and role of the Laser Safety Officer
 - Training
 - Authorized personnel
 - Operating and alignment procedures
 - Laser Safety Officer
- e. Describe requirements of laser warning signs, labels and postings

2. DOCUMENTATION AND REGULATIONS

2.1 A Facility Representative shall demonstrate a working level knowledge of the purpose, scope, and application of applicable Federal Regulations to include:

- 10 CFR 820, *Procedural Rules for DOE Nuclear Activities*
- 10 CFR 830, *Nuclear Safety Management*
- 10 CFR 835, *Occupational Radiation Protection*
- 29 CFR 1910.120, *Occupational Safety and Health Standards, Hazardous waste operations and emergency response*

Supporting Knowledge and/or Skills

- a. Discuss the purpose, scope, and application of the listed Federal Regulations. Include in this discussion the key terms, essential elements, and personnel responsibilities and authorities.
- b. Discuss what constitutes acceptable contractor work performance in categories as defined by the above Rules.
- c. Describe the methods by which Rule noncompliance is determined and communicated to contractor and DOE management.

2.2 A Facility Representative shall demonstrate a working level knowledge of the purpose, scope, and application of applicable DOE Orders to include:

- O 151.1A, *Comprehensive Emergency Management System*
- O 231.1, *Environment, Safety and Health Reporting*
- O 232.1A, *Occurrence Reporting and Processing of Operations Information*
- O 414.1A, *Quality Assurance*
- O 420.1, *Facility Safety*

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- O 420.2A, *Safety of Accelerator Facilities*
- O 425.1B, *Start-Up and Restart of Nuclear Facilities*
- O 430.1A, *Life Cycle Asset Management*
- O 433.1, *Maintenance Management Program for DOE Nuclear Facilities*
- O 435.1, *Radioactive Waste Management*
- O 440.1A, *Worker Protection Management For DOE Federal and Contractor Employees*
- O 451.1B, *National Environmental Policy Act Compliance Program*
- O 460.1A, *Packaging and Transportation Safety*
- O 5480.4, *Environmental Protection, Safety, and Health Protection Standards*
- O 5480.19, *Conduct of Operations Requirements for DOE Facilities*
- O 5480.20A, *Personnel Selection, Qualification, and Training, Requirements for DOE Nuclear Facilities*

Supporting Knowledge and/or Skills

- a. Discuss the purpose, scope, and application of the listed DOE Orders. Include in this discussion the key terms, essential elements, and personnel responsibilities and authorities.
- b. Discuss what constitutes acceptable contractor work performance in categories as defined by the above Orders.
- c. Describe the methods by which Order noncompliance is determined and communicated to contractor and DOE management.

2.3 A Facility Representative shall demonstrate a working level knowledge of the purpose, scope, and application of applicable DOE Guides to include:

- G 421.1-2, *Guide for the Mitigation of Natural Phenomena Hazards for DOE Nuclear Facilities and Nonnuclear Facilities*
- G 423.1-1, *Implementation Guide For Use In Developing Technical Safety Requirements*
- G 424.1-1, *Implementation Guide For Use In Addressing Unreviewed Safety Question Requirements*
- G 450.4-1B, *Volumes 1 and 2, Integrated Safety Management System Guide*

Supporting Knowledge and/or Skills

- a. Discuss the purpose, scope, and application of the listed DOE Guides. Include in this discussion the key terms, essential elements, and personnel responsibilities and authorities.

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2.4 A Facility Representative shall demonstrate a working level knowledge of the purpose, scope, and application of applicable DOE Standards to include:

- DOE-STD-1063-2000, *Facility Representatives*
- DOE-STD-1073-93, *Guide for Operational Configuration Management Program*
- DOE-STD-1104-96, *Review and Approval of Nonreactor Nuclear Facility Safety Analysis Reports*
- DOE-STD-3009-94, *Preparation Guide for U.S. DOE Nonreactor Nuclear Facility Safety Analysis Reports*

Supporting Knowledge and/or Skills

- a. Discuss the purpose, scope, and application of the listed DOE Standards. Include in this discussion the key terms, essential elements, and personnel responsibilities and authorities.
- b. Discuss the process described in DOE-STD-1063-2000, *Facility Representatives*, by which DOE line management determines an appropriate level of coverage by a Facility Representative. Include in this discussion, factors that may be considered to adjust the established level of coverage.
- c. Using the guidance in DOE-STD-1073-93, *Guide for Operational Configuration Management Program*, discuss the System Engineer concept as it applies to Facility Representative oversight of safety systems. Specifically address the areas of configuration management, assessment of system status and performance, and the technical support for operation and maintenance activities.

3. ADMINISTRATIVE

3.1 A Facility Representative shall demonstrate a working level knowledge of the Department of Energy/facility contract provisions necessary to provide oversight of the operating contractor operations.

Supporting Knowledge and/or Skills

- a. Describe the Facility Representative's role in contractor oversight.
- b. Compare and contrast the following:
 - Department of Energy's expectations of the operating contractor
 - Operating contractor's expectations of the Department of Energy
- c. Identify the key elements and features of an effective Department of Energy and operating contractor relationship.
- d. Describe the Facility Representative's responsibility associated with contractor compliance under the Price-Anderson Amendments.

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- e. Describe the role of the Facility Representative with respect to the contractor performance evaluation process.
- f. Review and discuss the most recently completed contractor award fee or similar performance evaluation documentation (as applicable).

3.2 A Facility Representative shall demonstrate a working level knowledge of the Department of Energy/facility Authorization Agreement process necessary to provide oversight of the operating contractor operations.

Supporting Knowledge and/or Skills

- a. Identify the purpose and key elements of an effective Department of Energy and operating contractor facility authorization agreement.
- b. Describe the Facility Representative's responsibility associated with contractor compliance.

4. MANAGEMENT, ASSESSMENT, AND OVERSIGHT

4.1 A Facility Representative shall demonstrate a working level knowledge of problem analysis principles and techniques necessary to identify problems, determine potential causes of the problems, and identify corrective action(s).

Supporting Knowledge and/or Skills

- a. Describe and explain the application of problem analysis techniques including the following:
 - Root Cause Analysis
 - Causal Factor Analysis
 - Change Analysis
 - Barrier Analysis
 - Management Oversight Risk Tree Analysis
- b. Describe and explain the application of the following Root Cause Analysis processes in the performance of occurrence investigations:
 - Events and Causal Factors Charting
 - Root Cause Coding
 - Recommendation Generation
 - Corrective Action development
 - Corrective Action verification
- c. Describe the following types of investigations and discuss an example of the application of each:
 - Type A
 - Type B

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- d. Explain the necessity for and differences between the immediate, short term, and long term actions taken as the result of a problem identification or occurrence.
- e. Explain and apply problem analysis techniques to the identification of potential problems and/or the prevention of problems. Include in your explanation, data gathering techniques and the use of trending/history.
- f. Observe a contractor problem analysis and critique their results.

4.2 A Facility Representative shall demonstrate a working knowledge of assessment techniques such as the planning and use of observations, interviews, and document reviews to assess facility performance, report results of assessments, and follow up on actions taken as the result of assessments.

Supporting Knowledge and/or Skills

- a. Describe the Facility Representative's role with respect to performance of oversight of Government-Owned Contractor Operated facilities.
- b. Describe the assessment requirements and limitations associated with the Facility Representative's interface with contractor employees.
- c. Conduct an interview representative of one that would be conducted during an occurrence investigation.
- d. Explain the essential elements of a performance-based assessment including the areas of investigation, fact finding, and reporting.
- e. Describe the contents of an assessment report.
- f. Explain the essential elements and processes associated with the following assessment activities including:
 - Exit Interviews
 - Closure Process
 - Tracking to Closure
 - Follow-up
 - Corrective Action Implementation
- g. Describe the actions to be taken if the contractor challenges the assessment findings and explain how such challenges can be avoided.
- h. Participate in formal meetings between DOE management and senior contractor management to discuss results of Facility Representative assessments.

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4.3 A Facility Representative shall demonstrate a working level knowledge of the Department of Energy Emergency Management System and response practices.

Supporting Knowledge and/or Skills

- a. Describe the key elements of Emergency Preparedness including planning, operations, principles, and methods.
- b. Explain the Facility Representative's role and responsibilities associated with emergency management and response to unplanned events.
- c. Explain the difference between the Occurrence Reporting and Processing System notification requirements and Emergency Management Systems event classification and notification requirements.

4.4 A Facility Representative shall demonstrate a working level knowledge of applicable DOE Orders sufficient to conduct independent assessment of contractor and/or Federal employee work activities.

Supporting Knowledge and/or Skills

- a. Conduct a minimum of three assessments of contractor or Federal employee (as appropriate) work performance related to the following Department of Energy Orders:
 - DOE O 430.1A, *Life Cycle Asset Management (for non-nuclear facilities)*
 - DOE O 5480.19, *Conduct of Operations Requirements for DOE Facilities*
 - DOE O 5480.20A, *Personnel Selection, Qualification, and Training, Requirements for DOE Nuclear Facilities*
 - DOE O 425.1B, *Start-Up and Restart of Nuclear Facilities*
 - DOE O 433.1, *Maintenance Management Program for DOE Nuclear Facilities*

4.5 A Facility Representative shall demonstrate a working level knowledge of Conduct of Maintenance principles and Department of Energy requirements to ensure maintenance is performed in a safe and efficient manner.

Supporting Knowledge and/or Skills

- a. Explain the Department of Energy's role in the oversight of contractor maintenance operations.
- b. Describe work activity observation skills.
- c. Explain the application of DOE O 433.1, *Maintenance Management Program for DOE Nuclear Facilities* and DOE Order 430.1A, *Life Cycle Asset Management (for non-nuclear facilities)*.

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- d. Define each of the following maintenance related terms and explain their relationship to each other:
 - Corrective
 - Preventive
 - Periodic
 - Planned
 - Reliability Centered
- e. Explain the purpose and content of a Master Equipment List.
- f. Observe a contractor preventive maintenance activity and describe the preventive maintenance factors to be considered as the activity is planned.
- g. Observe Post-Maintenance Testing and discuss the activity including several examples of maintenance activities to which Post-Maintenance Testing would be applied.
- h. Describe the procedure development, verification, and validation process.
- i. Explain the purpose of maintaining good facility condition and housekeeping.
- j. Conduct a facility observation walk through and identify deficiencies often found with respect to Material, Housekeeping, Industrial Safety, and Radiological areas.
- k. Describe configuration control and its relationship to the maintenance work control process and the maintenance history file.
- l. Explain the intent of a Maintenance Problem Analysis Program and discuss a maintenance problem where this program has been recently employed.
- m. Explain facility management's role in facility maintenance.
- n. Describe the principles of instrument calibration to ensure safe and efficient operation.
- o. Conduct an assessment of maintenance activities.

4.6 A Facility Representative shall demonstrate a working level knowledge of the Occurrence Reporting and Processing System necessary to ensure that occurrences are properly reported and processed in accordance with DOE Order 232.1A, Occurrence Reporting and Processing of Operations Information.

Supporting Knowledge and/or Skills

- a. Define the term Reportable Occurrence and using an actual facility-specific Occurrence Report and discuss the factors contributing to the Occurrence.

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- b. Describe the intent and contents of DOE O 232.1A requirements for Notification Reports including the following:
 - Reporting Philosophy
 - Identification
 - Categorization
 - Notification Process
 - Reporting Requirements
 - Analysis
 - Root Cause Determination
 - Generic Implications
 - Corrective Action Implementation
 - Tracking
 - Closeout
- c. Explain the Facility Representative and operating contractor's responsibilities for occurrence reporting including a discussion of the following:
 - Notification Report
 - Final Report
 - Closing out and verifying Occurrence Reports
 - Processing Occurrence Reports which cross lines of Facility Representative responsibility
 - Contractor Occurrence Reporting Procedures
- d. Given an actual Occurrence Report, determine the adequacy of the review process used, that causes were appropriately defined, that corrective actions addressed causes, that the lessons learned were communicated, that planned corrective actions were appropriate, and verify that corrective actions have been completed.
- e. Explain the Facility Representative's responsibilities associated with DOE O 442.1A, Department of Energy Employee Concerns Program with respect to the identification, reporting, reviewing, and documentation of employee concerns.
- f. Discuss the process for, and importance of, applying lessons learned from Occurrence Reports to facility operations.

4.7 A Facility Representative shall demonstrate a working level knowledge of the Department's philosophy and approach to implementing Integrated Safety Management.

Supporting Knowledge and/or Skills

- a. Explain the basis upon which the safety management functions could differ from facility to facility.
- b. Discuss the underlying safety management issues affecting the design, construction, operation, and maintenance of the Department's facilities, activities, and assets.

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- c. Describe the Departmental capabilities/resources that could be utilized to solve short-term technical safety issues.

4.8 A Facility Representative shall demonstrate a working level knowledge of the Department's philosophy and approach to implementing Quality Assurance programs.

Supporting Knowledge and/or Skills

- a. Identify the purpose and key elements of Quality Assurance programs.
- b. Describe performance measures for measuring the effectiveness of Quality Assurance programs.
- c. Contrast Quality Assurance and Quality Control.
- d. Explain the factors applicable to and methods of implementing the graded approach to quality.
- e. Explain the intent of 10CFR830, Subpart A and DOE O 414.1A.
- f. Compare the scope and exclusions of 10CFR830, Subpart A, DOE O 414.1A, RW/333P, and other Quality Assurance program documents.
- g. Describe methods for assessing the implementation of Quality Assurance Program elements.
- h. Explain facility management's and the individual's role in Quality Assurance.

4.9 A Facility Representative shall demonstrate a working level knowledge in the area of Industrial Safety programs.

Supporting Knowledge and/or Skills

- a. Identify the purpose and key elements of Industrial Safety programs.
- b. Describe performance measures for measuring the effectiveness of Industrial Safety programs.
- c. Explain facility management's and the individual's role in Industrial Safety.
- d. Describe the basic requirements for the following elements of the Industrial Safety programs:
 - Hearing protection
 - Eye protection
 - Fall Protection (including scaffolding)

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- Machine guarding
- Lockout/tagout
- Confined Spaces
- Non-radiological respirator protection
- Hoisting and rigging

4.10 A Facility Representative shall demonstrate a working level knowledge of the Safety Authorization Basis, including the Documented Safety Analysis, Technical Safety Requirements and Safety Evaluation Reports.

Supporting Knowledge and/or Skills

- a. Explain the Department of Energy's role in the oversight of the Safety Authorization Basis.
- b. Explain the application of 10CFR830 Subpart B and associated implementation Guides and Standards
- c. Define each of the Safety Authorization Basis related terms and explain their relationship to each other:
 - Documented Safety Analysis (DSA).
 - Technical Safety Requirements (TSR): This should include Safety Limit, Limiting Safety System Setting, Limiting Condition for Operation, and Administrative Control.
 - Unreviewed Safety Question (USQ) process.
 - Safety Evaluation Report (SER).
 - Safety System, Structure, or Component (safety SSC)
 - Defense in depth.
- d. Describe how Safety Authorization Basis requirements are implemented in a facility.
- e. Describe configuration control and its relationship to the Safety Authorization Basis.
- f. Observe a contractor TSR surveillance activity and describe the factors to be considered as the activity is planned and performed.
- g. Conduct a facility walk through and identify all facility safety SSCs as well as defense in depth SSCs or SSCs considered "important to safety".

4.11 A Facility Representative shall demonstrate a working level knowledge of the training and qualification requirements for facility operations personnel.

Supporting Knowledge and/or Skills

- a. Describe the five elements of a systematic approach to training described in DOE O 5480.20A.

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- b. Discuss the relationship between training, risk, and safe facility operations.
- c. Discuss key elements of an effective on-the-job training program as are described in DOE-HDBK-1206-98, *Guide to Good Practices for On-the-Job Training*.
- d. Using guidelines provided in the applicable DOE Standard or Handbook as a reference, observe and evaluate a contractor training evolution (technical staff training, written or oral examination, on shift training, etc.).
- e. Using contractor training procedures, applicable Department of Energy Orders, and DOE-STD-1070-94, *Guidelines for Evaluation of Nuclear Facility Training Programs*, select three elements of the contractor training program and assess for compliance and adequacy.

4.12 A Facility Representative shall demonstrate a working level knowledge of Conduct of Operations principles and Department of Energy requirements to ensure facility operations are performed in a safe and efficient manner.

Supporting Knowledge and/or Skills

- a. Explain the Department of Energy's role in the oversight and implementation of the contractor's Conduct of Operations Program.
- b. Describe the Facility Representative's role relative to conduct of operations at DOE facilities as is provided in Conduct of Operations Requirements for DOE Facilities, DOE O 5480.19.
- c. Explain how the graded approach is used in the application of the guidelines provided in DOE O 5480.19, Attachment I.
- d. Describe contractor responsibilities associated with implementing the conduct of operations at DOE facilities.
- e. Explain the key elements of conduct of operations associated with each chapter of DOE O 5480.19:
 - Chapter I, Operations Organization and Administration
 - Chapter II, Shift Routines and Operating Practices
 - Chapter III, Control Area Activities
 - Chapter IV, Communications
 - Chapter V, Control of On-Shift Training
 - Chapter VI, Investigation of Abnormal Events
 - Chapter VII, Notifications
 - Chapter VIII, Control of Equipment and System Status
 - Chapter IX, Lockouts and Tagouts
 - Chapter X, Independent Verification
 - Chapter XI, Logkeeping

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- Chapter XII, Operations Turnover
 - Chapter XIII, Operations Aspects of Facility Chemistry and Unique Processes
 - Chapter XIV, Required Reading
 - Chapter XV, Timely Orders to Operators
 - Chapter XVI, Operations Procedures
 - Chapter XVII, Operator Aid Postings
 - Chapter XVIII, Equipment and Piping Labeling
- f. Explain the relationship between the guidelines provided in DOE O 5480.19, Attachment I, Chapters I through XVIII, and the DOE Technical Standards associated with each Chapter:
- Chapter I -- DOE-STD-1032-92, *Guide to Good Practices for Operations Organization and Administration*
 - Chapter II -- DOE-STD-1041-93, *Guide to Good Practices for Shift Routines and Operating Practices*
 - Chapter III -- DOE-STD-1042-93, *Guide to Good Practices for Control Area Activities*
 - Chapter IV -- DOE-STD-1031-93, *Guide to Good Practices for Communications*
 - Chapter V -- DOE-STD-1040-93, *Guide to Good Practices for Control of On-Shift Training*
 - Chapter VI -- DOE-STD-1045-93, *Guide to Good Practices for Notifications and Investigation of Abnormal Events*
 - Chapter VII -- DOE-STD-1045-93, *Guide to Good Practices for Notifications and Investigation of Abnormal Events*
 - Chapter VIII -- DOE-STD-1039-93, *Guide to Good Practices for Control of Equipment and System Status*
 - Chapter IX -- DOE-STD-1030-96, *Guide to Good Practices for Lockouts and Tagouts*
 - Chapter X -- DOE-STD-1036-93, *Guide to Good Practices for Independent Verification*
 - Chapter XI -- DOE-STD-1035-93, *Guide to Good Practices for Logkeeping*
 - Chapter XII -- DOE-STD-1038-93, *Guide to Good Practices for Operations Turnover*
 - Chapter XIII -- DOE-STD-1037-93, *Guide to Good Practices for Operations Aspects of Facility Chemistry and Unique Processes*
 - Chapter XIV -- DOE-STD-1033-92, *Guide to Good Practices for Operations and Administration Updates Through Required Reading*
 - Chapter XV -- DOE-STD-1034-93, *Guide to Good Practices for Timely Orders to Operators*
 - Chapter XVI -- DOE-STD-1029-92, *Writer's Guide for Technical Procedures*
 - Chapter XVII -- DOE-STD-1043-93, *Guide to Good Practices for Operator Aid Postings*
 - Chapter XVIII -- DOE-STD-1044-93, *Guide to Good Practices for Equipment and Piping Labeling*

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CONCLUDING MATERIAL

Review Activity:

DOE

DP-NNSA

EH

EM

NE

NN-NNSA

SC

FE

Field and Operations Offices

AL

CH

ID

Fernald

NV

OAK

OH

OR

RF

RL

SF

SR

Carlsbad Field Office (CBFO)

Office of River Protection

Preparing Activity:

DOE-EH-53

Project Number:

TRNG-0019

Area Offices

Amarillo Area Office

Argonne Area Office

Brookhaven Area Office

Fermi Area Office

Kirtland Area Office

Los Alamos Area Office

Princeton Area Office

Rocky Flats Area Office

Y-12 Area Office