U.S. Department of Energy Orders Self-Study Program

DOE O 420.1B

FACILITY SAFETY

NATIONAL NUCLEAR SECURITY ADMINISTRATION
LEARNING AND CAREER DEVELOPMENT DEPARTMENT

CHANGE NO: 2
DOE O 420.1B
Level: Familiar
Date: 12/1/08

DOE ORDER O 420.1B
FACILITY SAFETY
FAMILIAR LEVEL

OBJECTIVES

Given the familiar level of this module and the listed resources, you will be able to perform the following:

1. State the purpose of implementing DOE O 420.1B.
2. State who is responsible for complying with the requirements of this Order.
3. State the general and design requirements for nuclear safety.
4. State the general programmatic requirements for an acceptable fire protection program.
5. State the fire protection design requirements for a comprehensive fire protection program.
6. State the objectives of the nuclear criticality safety program.
7. State the general requirements for evaluating and documenting a nuclear criticality safety program.
8. State the specific requirements for a contractor criticality safety program.
9. State the design requirements for natural phenomenon mitigation.
10. State the natural phenomena hazards assessment approaches for new and existing sites.
11. State the objectives of the system engineering program.

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RESOURCES

DOE O 420.1B, *Facility Safety*, 12/22/05.

Note: If you think that you can complete the practice at the end of this level without working through the instructional material and/or the examples, complete the practice now. The course manager will check your work. You will need to complete the practice in this level successfully before taking the criterion test.

CHANGE NO: 2
DOE O 420.1B
Level: Familiar
Date: 12/1/08

INTRODUCTION

The objective of DOE O 420.1B is to establish facility safety requirements related to the following five areas that are addressed in the familiar level of this module.

- Chapter1, Nuclear and Explosives Safety Design Criteria
- Chapter 2, Fire Protection
- Chapter 3, Criticality Safety
- Chapter 4, Natural Phenomena Hazards Mitigation
- Chapter 5, System Engineer Program

The information provided will meet the relevant requirements in the following DOE Functional Area Qualification Standards:

- DOE-STD-1176-2004, *Chemical Processing*
- DOE-STD-1182-2004, *Civil/Structural Engineering*
- DOE-STD-1180-2004, *Construction Management*
- DOE-STD-1170-2007, *Electrical Systems and Safety Oversight*
- DOE-STD-1151-2002, *Facility Representative*
- DOE-STD-1137-2007, *Fire Protection Engineering*
- DOE-STD-1146-2007, *General Technical Base*
- DOE-STD-1162-2003, *Instrumentation and Controls*
- DOE-STD-1161-2008, *Mechanical Systems*
- DOE-STD-1183-2007, *Nuclear Safety Specialist*
- DOE-STD-1174-2003, *Radiation Protection*
- DOE-STD-1171-2003, *Safeguards and Security*
- DOE-STD-1175-2006, *Senior Technical Safety Manager*
- DOE-STD-1178-2004, *Technical Program Manager*
- DOE-STD-1159-2003, *Waste Management*

Completion of this module also meets certain requirements associated with the DOE Facility Representative (FR) Program and the DOE Intern Program. The information contained in this module addresses specific requirements and as such does not include the entire text of the source document. Before continuing, you should obtain a copy of the Order and its accompanying manuals. Copies of the DOE Directives are available at http://www.directives.doe.gov/ or through the course manager.

SECTION 1, NUCLEAR AND EXPLOSIVES SAFETY DESIGN CRITERIA

OBJECTIVES

Nuclear Safety

To ensure that new DOE hazard category 1, 2, and 3 nuclear facilities are designed and constructed in a manner that ensures adequate protection to the public, workers, and the environment from nuclear hazards.

To ensure that major modifications to hazard category 1, 2, and 3 nuclear facilities comply with the design and construction requirements for new hazard category 1, 2, and 3 nuclear facilities.

To ensure that new DOE nuclear reactors comply with the requirements of DOE O 420.1B and the design requirements of DOE O 5480.30, *Nuclear Reactor Safety Design Criteria*.

Explosives Safety

To establish mandatory design and construction standards for safety in new DOE explosives facilities and for major modifications to such facilities. Explosives facilities include facilities and locations used for storage or operations with explosives or ammunition.

REQUIREMENTS

Integration of Design with Safety Analyses

Safety analyses must be used to establish

- the identity and functions of safety class and safety significant structures, systems, and components (SSCs), and
- the significance to safety of functions performed by safety class and safety significant SSCs.

Safety analyses must address

- hazards inherent to the facility and its activities,

- NPH, and
- external man-induced hazards.

Safety analyses must be performed as early as practical in conceptual or preliminary design processes to ensure that required safety SSCs are specified in the final design.

Safety analyses must be performed in accordance with the requirements for safety analysis defined in DOE directives and technical standards for a DSA.

Nuclear Facility Design

Nuclear facility design objectives must include multiple layers of protection to prevent or mitigate the unintended release of radioactive materials to the environment, otherwise known as defense in depth. These multiple layers must include multiple physical barriers unless the basis for not including multiple physical barriers is documented in the DSA and approved by DOE.

Defense in depth must include all of the following:

- choosing an appropriate site;
- minimizing the quantity of material at risk;
- applying conservative design margins and quality assurance;
- using successive physical barriers for protection against radioactive releases;
- using multiple means to ensure critical safety functions needed to
  - control processes,
  - maintain processes in safe status, and
  - confine and mitigate the potential for accidents with radiological releases;
- using equipment and administrative controls that—
  - restrict deviation from normal operations,
  - monitor facility conditions during and after an event, and
  - provide for response to accidents to achieve a safe condition;
- providing means to monitor accident releases as required for emergency response; and
- establishing emergency plans for minimizing the effects of an accident.

Hazard category 1, 2, and 3 nuclear facilities must be sited, designed, and constructed in a manner that ensures adequate protection of the health and safety of the public, workers, and the environment from the effects of accidents involving radioactive materials release.

Hazard category 1, 2, and 3 nuclear facilities with uncontained radioactive material must have the means to confine the uncontained radioactive materials to minimize their potential release in facility effluents during normal operations and during and following accidents.

Hazard Category 1, 2, and 3 nuclear facilities must be designed to—

- facilitate safe deactivation, decommissioning, and decontamination at the end of facility life, including incorporation of design considerations during the operational period that facilitate future decontamination and decommissioning;
- facilitate inspections, testing, maintenance, repair, and replacement of safety SSCs as part of a reliability, availability, and maintainability program with the objective that the facility is maintained in a safe state; and
- keep occupational radiation exposures within statutory limits and as low as reasonably achievable (ALARA).

Facility process systems must be designed to minimize waste production and mixing of radioactive and non-radioactive wastes.

Safety SSCs and safety software must be designed, commensurate with the importance of the safety functions performed, to perform their safety functions when called upon and to meet the quality assurance program requirements of either 10 CFR 830, Subpart A, or DOE O 414.1C, *Quality Assurance*, as applicable.

Safety class electrical systems must be designed to preclude single point failure.

New DOE nuclear reactors must comply with the requirements of DOE O 420.1B and DOE O 5480.30, *Nuclear Reactor Safety Design Criteria*.

Explosives Safety Design

New DOE explosives facilities and all modifications to existing explosives facilities must be designed consistent with the DOE explosives safety requirements established in DOE M

440.1-1A, *DOE Explosives Safety Manual*, and technical standards referenced in that manual.

Blast-resistant design to protect personnel and facilities must be based on the TNT equivalency of the maximum quantity of explosives and propellants permitted, increased by 20 percent in accordance with DoD TM5-1300.

Implementation

For new facilities, an implementation plan must be submitted to the responsible Secretarial Officer or designee describing the process for ensuring that facility design and construction will be in compliance with the nuclear facility safety requirements of DOE O 420.1B.

Deviations/exemptions from requirements must be appropriately documented, justified, and approved by DOE in accordance with the provisions stated in DOE O 420.1B.

SECTION 2, FIRE PROTECTION

OBJECTIVES

The objectives of this section are to establish requirements for a comprehensive fire and related hazards protection program for facilities sufficient to minimize the potential for:

- the occurrence of a fire or related event;
- a fire that causes an unacceptable on-site or off-site release of hazardous or radiological material that shall threaten the health and safety of employees, the public, or the environment;
- vital DOE programs suffering unacceptable interruptions as a result of fire and related hazards;
- property losses from a fire and related events exceeding defined limits established by DOE; and
- critical process controls and safety-class systems being damaged as a result of a fire and related events.

General Programmatic Requirements

The following eleven features shall be included in an acceptable fire protection program:

- A policy statement that incorporates the requirements of DOE 420.1B, chapter 2, related DOE directives, and other applicable Federal, state and local fire protection requirements.
- Comprehensive, written fire protection criteria that reflects additional site-specific aspects of the fire protection program, including the organization, training, and responsibilities of the fire protection staff, administrative aspects of the fire protection program, and requirements for the design, installation, operability, inspection, maintenance and testing of fire protection systems.
- Written fire safety procedures governing the use and storage of combustible, flammable, radioactive, and hazardous materials to minimize the risk from fire.
- A system to ensure that the requirements of the DOE fire protection program are documented and incorporated in the plans and specifications for all new facilities and for significant modifications of existing facilities.
- Fire hazards analyses for all nuclear facilities, significant new facilities, and facilities that represent unique or significant fire safety risks.
- Access to a qualified and trained fire protection staff, including fire protection engineers, technicians, and fire fighting personnel to implement the requirements of this Order.
- A needs assessment that establishes the minimum required capabilities of site fire fighting forces.
- Written pre-fire strategies, plans, and standard operating procedures to enhance the effectiveness of site fire fighting forces.
- A comprehensive, documented fire protection self-assessment program that includes all aspects of the fire protection program. Assessments shall be performed on a regular basis at a frequency established by DOE.
- A program to identify, prioritize, and monitor the status of fire protection-related appraisal findings/recommendations until final resolution is achieved.
- A process for reviewing and recommending approval of fire safety equivalencies and exemptions to the DOE authority who has jurisdiction for fire safety.

Fire Protection Design Requirements

A comprehensive fire protection program should include:

- A reliable water supply of adequate capacity for fire suppression.
- Noncombustible or fire-resistive construction, where appropriate. Complete fire-rated barriers that are commensurate with the fire hazard to isolate hazardous occupancies and to minimize fire spread and loss potential consistent with defined limits as established by DOE.
- Automatic fire extinguishing systems throughout all significant facilities and in all areas subject to loss of safety class systems, significant life safety hazards, unacceptable program interruption, or fire loss potential in excess of defined limits.
- Redundant fire protection systems in areas where safety class systems are vulnerable to fire damage and where no redundant safety capability exists outside of the fire area.
- A means to summon the fire department in case of a fire.
- A means to notify and evacuate building occupants in case of a fire.
- Physical access and appropriate equipment to facilitate effective intervention by the fire department.
- A means to prevent the accidental release of significant quantities of contaminated products of combustion and fire fighting water to the environment.
- Fire and related hazards that are unique to DOE and are not addressed by industry codes and standards shall be protected by isolation, segregation, or use of special fire control systems.
- Fire protection systems shall be designed so that their inadvertent operation, inactivation, or failure of structural stability shall not result in the loss of vital safety functions or inoperability of safety class systems.

Note: You do not have to do example 1 on the following pages, but it is a good time to check your skill and knowledge of the information covered. You may do example 1 or go to section 3.

EXAMPLE 1

Using the familiar level of this module and the resources, complete the following exercises.

1. State what the DOE hopes to achieve by implementing DOE O 420.1B.

2. State three programmatic requirements of a fire protection program.

3. List three components that should be included in the design of a comprehensive fire protection program.

Note: When you are finished, compare your answers to those contained in the example 1 self-check. When you are satisfied with your answers, go to section 3.

EXAMPLE 1 SELF-CHECK

Using the familiar level of this module and the resources, complete the following exercises.

1. State what the DOE hopes to achieve by implementing DOE O 420.1B.

   The objective of this Order is to establish facility safety requirements related to: nuclear safety design, criticality safety, fire protection and natural phenomena hazards mitigation, and a systems engineering program.

2. State three programmatic requirements of a fire protection program.

   Any three of the following constitutes a correct answer.
   - A policy statement that incorporates the requirements of this section, related DOE directives, and other applicable federal, state and local fire protection requirements.
   - Comprehensive, written fire protection criteria that reflects additional site-specific aspects of the fire protection program, including the organization, training and responsibilities of the fire protection staff, administrative aspects of the fire protection program, and requirements for the design, installation, operability, inspection, maintenance, and testing of fire protection systems.
   - Written fire safety procedures governing the use and storage of combustible, flammable, radioactive, and hazardous materials to minimize the risk from fire.
   - A system to ensure that the requirements of the DOE fire protection program are documented and incorporated in the plans and specifications for all new facilities and for significant modifications of existing facilities.
   - Fire hazards analyses for all nuclear facilities, significant new facilities, and facilities that represent unique or significant fire safety risks.
   - Access to a qualified and trained fire protection staff, including fire protection engineers, technicians, and fire fighting personnel to implement the requirements of this Order.

- A needs assessment that establishes the minimum required capabilities of site fire fighting forces.
- Written pre-fire strategies, plans, and standard operating procedures to enhance the effectiveness of site fire fighting forces.
- A comprehensive, documented fire protection self-assessment program that includes all aspects of the fire protection program. Assessments shall be performed on a regular basis at a frequency established by DOE.
- A program to identify, prioritize and monitor the status of fire protection-related appraisal findings/recommendations until final resolution is achieved.
- A process for reviewing and recommending approval of fire safety equivalencies and exemptions to the DOE authority who has jurisdiction for fire safety.

3. List three components that should be included in the design of a comprehensive fire protection program.

   Any three of the following constitute a correct answer.
   - A reliable water supply of adequate capacity for fire suppression.
   - Noncombustible or fire-resistive construction.
   - Automatic fire extinguishing.
   - Redundant fire protection systems.
   - A means to summon the fire department in case of a fire.
   - A means to notify and evacuate building occupants in case of a fire.
   - Physical access and appropriate equipment to facilitate effective intervention by the fire department.
   - A means to prevent the accidental release of significant quantities of contaminated products of combustion and fire fighting water to the environment.
   - Fire and related hazards that are unique to DOE and are not addressed by industry codes and standards shall be protected by isolation, segregation, or use of special fire control systems.

- Fire protection systems shall be designed so that their inadvertent operation, inactivation, or failure of structural stability shall not result in the loss of vital safety functions or inoperability of safety class systems.

SECTION 3, NUCLEAR CRITICALITY SAFETY

OBJECTIVES

To establish requirements for a criticality safety program (CSP) applicable to DOE nuclear facilities and activities, including transportation activities, with potential for criticality hazards so that adequate protection is provided to the public, workers, and the environment requirements

General Requirements

CSPs must be implemented to ensure that fissionable material operations will be evaluated and documented to demonstrate that operations will be sub-critical under both normal and credible abnormal conditions.

No single credible event or failure can result in a criticality.

The CSP description document must describe how the contractor will implement the requirements in the Contractor's Requirement Document. The CSP description document must be approved by DOE and implemented as approved.

CSPs must include the following:

- Criticality safety evaluations for fissionable materials operations that document parameters, limits, and controls required to maintain sub-criticality for all normal and credible abnormal conditions;
- The preferred order of controls must be passive engineered controls, active engineered controls, followed by administrative controls.
- Provisions for implementation of limits and controls identified by the criticality safety evaluations;
- Periodic reviews of operations and conditions to ensure that
    - limits and controls are effectively implemented, and
    - process conditions have not been altered resulting in compromise of safety limits and controls; and

- Assessment of the need for and installation of criticality accident alarm and detection systems where appropriate.
- Nuclear criticality safety staff responsible for implementing the CSP must be trained and qualified in accordance with a qualification program approved by DOE, unless the qualification program is compliant with DOE-STD-1135-99, *Guidance for Nuclear Criticality Safety Engineering Training and Qualification.*

SECTION 4, NATURAL PHENOMENA HAZARDS (NPH) MITIGATION

OBJECTIVES

To establish requirements for DOE facility design, construction, and operations that protect the public, workers, and the environment from the impact of all NPH events.

REQUIREMENTS

Natural Phenomena Mitigation Design Requirements

Systems, structures, and components shall be designed, constructed and operated to withstand the effects of natural phenomena as necessary to ensure:

- the confinement of hazardous material,
- the operation of essential facilities,
- the protection of government property, and
- the protection of life safety for occupants of DOE buildings.

The design process shall consider:

- potential damage and failure of SScs resulting fromo NPH events;
- common cause/effect and interactions resulting from failures of other SSCs; and
- compliance with seismic requirements of E.O. 12699, Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction.

Additions and modifications to existing DOE facilities must not degrade SSC performance during an NPH occurrence.

Natural Phenomena Hazards Assessment

The design and evaluation of facilities to withstand natural phenomena shall be based on an assessment of the likelihood of future natural phenomena occurrences. The natural phenomena hazards assessment shall be conducted commensurate with a graded approach and the potential hazard of the facility.

NPH Assessment

Facility design and evaluation criteria must address the potential types of NPH occurrences. The NPH assessment must use a graded approach commensurate with the potential hazard of the facility.

NPH assessment for new facilities must use a graded approach that considers the consequences of all types of NPHs. Site-wide information may be considered when appropriate.

NPH assessments must be reviewed and upgraded as necessary for existing sites/facilities following significant changes in NPH assessment methodology or site-specific information.

An NPH assessment review must be conducted at least every 10 years and must include recommendations to DOE for updating the existing assessments based on significant changes found in methods or data. If no change is warranted from the earlier assessment, then this only needs to be documented.

Seismic Detection

Facilities or sites with hazardous materials must have instrumentation or other means to detect and record the occurrence and severity of seismic events.

Post-Natural Phenomena Procedure

Facilities or sites with hazardous materials must have procedures for inspecting facilities for damage from severe NPH events and placing a facility into a safe configuration when damage has occurred.

Note: You do not have to do example 2 on the following page, but it is a good time to check your skill and knowledge of the information covered. You may do the example 2 or go directly to the next section

EXAMPLE 2

1. List three requirements for evaluating and documenting a nuclear criticality safety program.

2. List three elements that should be considered in NPH design.

3. State the maximum time interval between natural phenomena hazards assessments.

Note: When you are finished, compare your answers to those contained in the example 2 self-check. When you are satisfied with your answers, go to section 5.

EXAMPLE 2 SELF-CHECK

1. List three requirements for evaluating and documenting a nuclear criticality safety program.

   Any three of the following constitutes a correct answer.
   - Nuclear criticality safety evaluations shall be conducted for normal and credible abnormal conditions. The evaluation should document the parameters, limits, and controls required to ensure that the analyzed conditions are subcritical.
   - Limits should be implemented and controls identified by the nuclear criticality safety evaluations.
   - Operations should be reviewed to ascertain that limits and controls are being followed and that process conditions have not been altered such that the applicability of the nuclear criticality safety evaluation has been compromised.
   - Needs should be assessed for criticality accident detection devices and alarm systems, and equipment shall be installed where total risk to personnel will be reduced.

2. List three elements that should be considered in NPH design.

   The design process shall consider:
   - potential damage and failure of SSCs resulting from NPH events;
   - common cause/effect and interactions resulting from failures of other SSCs; and
   - compliance with seismic requirements of E.O. 12699, Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction.

3. State the maximum time interval between natural phenomena hazards assessments.

   Ten years.

SECTION 5, SYSTEM ENGINEER PROGRAM

OBJECTIVE

To establish requirements for a system engineer program for hazard category 1, 2, and 3 nuclear facilities and to ensure continued operational readiness of the systems within its scope.

REQUIREMENTS

General

Hazard category 1, 2, and 3 nuclear facilities must have a system engineer program, as well as a qualified cognizant system engineer (CSE) assigned to each system within the scope of the Program.

System Engineer Programs must be incorporated into the Integrated Safety Management System (ISMS),must flow down from site and facility implementing procedures, and must define CSE functions, responsibilities, and authorities.

A graded approach must be used in applying the requirements of the system engineer program.

Program Elements

The program elements must include and integrate the identification of systems within its scope, configuration management, and CSE support for operations and maintenance.

Configuration Management

An objective of the system engineer program is to ensure operational readiness of the systems within its scope. To achieve this, the principles of configuration management must be applied to these systems.

System Engineer Support for Operations and Maintenance

The functions of a system engineer program are required to maintain the integrity of a facility's safety basis. System engineer program functions are typically accomplished by various parts of a program's operating organization. This organization must designate one person as the CSE for each system to which the system engineer program applies. The CSE must maintain overall cognizance of the system and be responsible for system engineering support for operations and maintenance. The CSE must provide technical assistance in support of line management safety responsibilities and ensure continued system operational readiness.

Evaluation of a CSE's qualifications should include formal education, prior training, and work experience.

Consistent with the graded approach, large, complex, or very important systems may require assignment of more than one technical level CSE while small, simple, less important systems may only require assignment of a technician. Conversely, a single individual may be assigned to be the CSE for more than one system.

Graded Approach

Implementation of system engineer program requirements should be tailored to facility hazards and the systems relied upon to prevent or mitigate those hazards.

Note: You have finished this module. Proceed to the practice.

CHANGE NO: 2
DOE O 420.1B
Level: Familiar
Date: 12/1/08

PRACTICE

This practice is required if your proficiency is to be verified at the familiar level. The practice will prepare you for the criterion test. You will need to refer to the resources to answer the questions in the practice correctly. The practice and criterion test will also challenge additional analytical skills that you have acquired in other formal and on-the-job training.

1. What are the objectives of the nuclear and explosives safety design criteria?

2. In integrating design of nuclear and explosive safety with safety analysis what three elements must the safety analysis address?

3. What are three general requirements for fire protection in DOE facilities?

4. What are the objectives of natural phenomena hazard mitigation?

5. What is the objective of a system engineer program?

Note: The course manager will check your practice and verify your success at the familiar level. When you have successfully completed this practice, go to the general level module.

CHANGE NO: 1
DOE O 420.1B
LEVEL: GENERAL
DATE: 12/1/08

DOE O 420.1B
FACILITY SAFETY
GENERAL LEVEL

OBJECTIVES

Given the familiar level of this module, a scenario, and an analysis, you will be able to perform the following:

1. Describe the actions you would expect DOE and/or the contractor to take in the situation described in the scenario; and
2. State which requirements included in the resources apply to the situation described in the scenario.

Note: If you think that you can complete the practice at the end of this level without working through the instructional material and/or the examples, complete the practice now. The course manager will check your work. You will need to complete the practice in this level successfully before taking the criterion test.

RESOURCES

DOE Orders Self Study Program, DOE O 420.1B, Familiar Level, 12/1/08.
DOE O 420.1B, *Facility Safety*, 12/22/05.

CHANGE NO: 1
DOE O 420.1B
LEVEL: GENERAL
DATE: 12/1/08

INTRODUCTION

The familiar level of this module introduced DOE O 420.1B. Several requirements from the resources were discussed. In the general level of this module, students are asked to apply the information contained in the resources to a series of questions related to the Order. Students are also presented with a scenario that depicts a work situation related to the Order. The example scenario includes a situation, the actions taken to remedy the situation, and the requirements related to the situation. Students will be asked to review the actions taken and decide if they are correct. Students will also be asked to decide if the correct requirements were cited in each situation. Please refer to the resources to make your analysis and answer the questions.

Note: You do not have to do the example on the following page, but it is a good time to check your skill and knowledge of the information covered. You may do the example or go on to the practice.

EXAMPLE SCENARIO

While conducting a programmatic audit of gloveboxes, it was determined that the total quantity of nuclear material in a glovebox exceeded the posted nuclear material safety limits (NMSL). The amount of fissile material in the glovebox was recalculated, including the totals for uranium and americium, following the receipt of recent laboratory analysis results for one fissile solution bottle, and it was determined that the information on the glovebox material balance card was incorrect. When the recalculations were performed, the resulting amount of nuclear material exceeded the NMSL. The criticality safety engineer determined that this was a possible nuclear criticality safety infraction. Additionally, potential criticality safety infractions involving the volume measurement of fissile material were identified in two other gloveboxes.

During a fact-finding meeting, a team determined that differences in the techniques used to measure fissile material mass and a backlog of waste fissile material that was not reanalyzed could have created a potential for other infracted gloveboxes.

Further investigation of the incident revealed the following information.

- Solution bottle volumes are not consistently measured.
- Many bottles of backlog material have not been characterized for uranium and americium content.
- Multiple databases are being used throughout the site that are not consistent with each other, nor do they reflect actual bottle statistics.
- The best available laboratory data on solution bottles is not being reliably transmitted to operations personnel.
- Gloveboxes and drums may be loaded very close to their maximum NMSL limits.
- When tolerances associated with the above problems are combined, some of the NMSL limits may be exceeded.

Immediate actions taken by contractor.

- A no-intrusion order was issued for all gloveboxes containing backlog fissile liquids, pending completion of the audit and written guidance from criticality safety engineering.
- A fact-finding meeting was scheduled for all appropriate personnel when information-gathering activities were complete.

Other actions taken by the contractor.

- Reconcile database conflicts.
- Perform a floor level check, verify fissile mass inventory in each bottle, and perform a backlog bottle inventory.
- Evaluate the issue of accurate volume measurement and determine the cause of the volume discrepancies.
- Issue criticality safety engineering guidance to allow verification of volume measurements in the building.
- Issue a building operations order defining requirements for verifying actinide content of backlog fissile solution bottles.
- Verify how the laboratory analysis data is provided to the owner of the material.

Requirements that apply to this situation include the following.

- CSPs must be implemented to ensure that fissionable material operations will be evaluated and documented to demonstrate that operations will be sub-critical under both normal and credible abnormal conditions. [DOE O 420.1B, section III.3.a.(1)]
- CSPs must include criticality safety evaluations for fissionable materials operations that document parameters, limits, and controls required to maintain sub-criticality for all normal and credible abnormal conditions.
  [DOE O 420.1B, section III.3.a. (4)]

Take some time to review the example scenario and the actions the contractor took or didn't take to correct the situation. Then decide if the contractor's actions were complete and correct. Finally, determine if the requirements cited in the scenario were complete and correct. Write your answer below and then compare your answer to the one contained in the example self-check.

EXAMPLE SELF-CHECK

Your answer does not have to match the following exactly. You may have added more corrective actions or cited other requirements from the resources that apply. To be considered correct, you answer must include, at least the following.

The actions taken by the contractor were appropriate. One additional action should have been considered.

- The shift manager should have terminated operations in all gloveboxes.

The requirements cited in the situation were correct. One additional requirement that should have been included is

- Facilities that conduct operations using fissionable material in a form that could inadvertently accumulate in significant quantities must include a program and procedures for detecting and characterizing accumulations. [DOE O 420.1B, section 3.b.(6)]

PRACTICE

This practice is required if your proficiency is to be verified at the general level. The practice will prepare you for the criterion test. You will need to refer to the resources to answer the questions in the practice correctly. The practice and criterion test will also challenge additional analytical skills that you have acquired in other formal and on-the-job training.

Please review the scenario and answer the questions that follow.

SCENARIO

A fire system cognizant engineer notified the building emergency director that 3 of 7 sprinklers removed from the facility for testing by the manufacturer did not pass their test.

The company that manufactured the sprinklers had notified customers of potential defects with their brass sprinklers. They requested companies to remove a portion of their sprinklers and return them for testing. Seven sprinklers were removed and replacements were installed. The seven were shipped to the manufacturer for testing. The testing determined that 3 of the 7 exhibited swollen O-rings that prevented them from flowing water at the Underwriters Laboratory (UL) recommended test pressure of 7 psi. The three that failed did not flow water until they reached pressures of 12, 20, and 50 psi.

An investigation of the incident revealed that:

- Excess hydrocarbon caused swollen o-rings in the sprinklers. The swelling prevented the sprinklers from flowing water at the UL recommended pressure of 7 psi. The exact source of the hydrocarbon was not positively identified.
- The fire suppression systems remained operable because the water pressure provided to these sprinklers is 100 psi.

Actions taken by the contractor.

- Notifications were made.
- Arrangements were made to have the vendor replace all the brass sprinklers.
- Thorough engineering analysis to determine the source of hydrocarbons and adequacy of the system as installed.

Requirements that apply to this situation include the following.

- Basic requirements of a fire protection program shall include a reliable water supply of acceptable capacity for fire suppression. (DOE Order 5480.7A, section 9)

1. Was the situation handled correctly? If not, what should have been done?
2. Was the list of requirements relevant to the resources in this module complete and correct? If not, state the correct or omitted requirements.

Write your answers to questions 1 and 2 here and on the next page and then bring the completed practice to the course manager for review.

Note: The course manager will check your practice and verify your success at the general level. When you have successfully completed this practice, the course manager will give you the criterion test.