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

# DOE-STD-3009-94

PREPARATION GUIDE FOR
U.S. DEPARTMENT OF ENERGY NONREACTOR NUCLEAR FACILITY DOCUMENTED SAFETY ANALYSES

**NATIONAL NUCLEAR SECURITY ADMINISTRATION**
**LEARNING AND CAREER DEVELOPMENT DEPARTMENT**

Change No: 1
DOE-STD 3009-94
Level: Familiar
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# DOE-STD-3009-94
# PREPARATION GUIDE FOR U.S. DEPARTMENT OF ENERGY NONREACTOR NUCLEAR FACILITY DOCUMENTED SAFETY ANALYSES (DSA)
# FAMILIAR LEVEL

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## OBJECTIVES

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

1. State the purpose of a DSA.
2. Discuss the following in relation to the preparation of the DSA:
   - Worker safety
   - Defense-in-depth
   - Programmatic commitments
   - Technical Safety Requirements (TSRs)
   - Structures, Systems, and Components (SSCs)
   - Hazard analysis
   - Accident analysis
   - Application of the graded approach.
3. State the objective of accident analysis in safety basis documents.
4. Define the following terms:
   - Airborne release fraction
   - Respirable fraction
   - Material at risk
   - Leak path factor
   - Damage ratio
5. Discuss the use of the source term five factor formula in accident analysis.
6. State the five steps in the DSA development process.

**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 example, 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**

10 CFR 830, "Nuclear Safety Management," January 1, 2008.

29 CFR 1910.119, "Process Safety Management of Highly Hazardous Chemicals," July 1, 2008.

DOE G 423.1-1, *Implementation Guide For Use In Developing Technical Safety Requirements*, October 24, 2001.

DOE-HDBK-3010-94, *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities*, Change Notice 1, March 2000.

DOE O 440.1B, *Worker Protection Program for DOE (Including the National Nuclear Security Administration) Federal Employees*, 5/17/2007.

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, October 23, 2001.

DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*, September 1997.

DOE-STD-1186-2004, *Specific Administrative Controls*, August 2004.

DOE-STD-3009-94, change 3, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facilities Documented Safety Analyses*, March 2006.

DOE-HDBK-3010-94, *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities*, March 2000.

DOE-STD-3011-2002, *Guidance for Preparation of Basis for Interim Operation (BIO) Documents*, December 2002.

U.S. Nuclear Regulatory Commission, "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants," Regulatory Guide 1.145, Revision 1, November 1982.

## INTRODUCTION

The familiar level of this module is designed to provide the basic information to meet the requirements that are related to DOE-STD-3009-94, change 3, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facilities Documented Safety Analyses*, in the following DOE Functional Area Qualification Standards:

- DOE-STD-1156-2002, *Environmental Compliance*
- DOE-STD-1157-2002, *Environmental Restoration*
- DOE-STD-1181-2004, *Facility Maintenance Management*
- DOE-STD-1151-2002, *Facility Representative*
- DOE-STD-1137-2007, *Fire Protection*
- DOE-STD-1146-2007, *General Technical Base*
- DOE-STD-1138-2007, *Industrial Hygiene*
- DOE-STD-1183-2007, *Nuclear Safety Specialist*
- DOE-STD-1160-2003, *Occupational Safety*
- DOE-STD-1150-2002, *Quality Assurance*
- DOE-STD-1175-2006, *Senior Technical Safety Manager*
- DOE-STD-1178-2004, *Technical Program Manager*
- DOE-STD-1155-2002, *Transportation and Traffic Management*
- DOE-STD-1159-2003, *Waste Management*

Completion of this module also meets certain requirements associated with the DOE Facility Representative 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. Copies of the DOE Orders are available at http://www.directives.doe.gov/ or through the course manager.

## SECTION 1, INTRODUCTION TO DOE-STD-3009-94

### PURPOSE OF DOE-STD-3009-94

DOE-STD-3009-94 describes a DSA preparation method that is acceptable to the National Nuclear Security Administration (NNSA). It was developed to assist hazard category 2 and 3 facilities in preparing DSAs that will satisfy the requirements of 10 CFR 830, Nuclear Safety Management.

### DSA PREPARATION CONCEPTUAL BASIS AND PROCESS

The safety management programmatic requirements identified in 10 CFR 830, and illustrated in figure 1, form the boundaries within which the safety analysis is performed and represent the

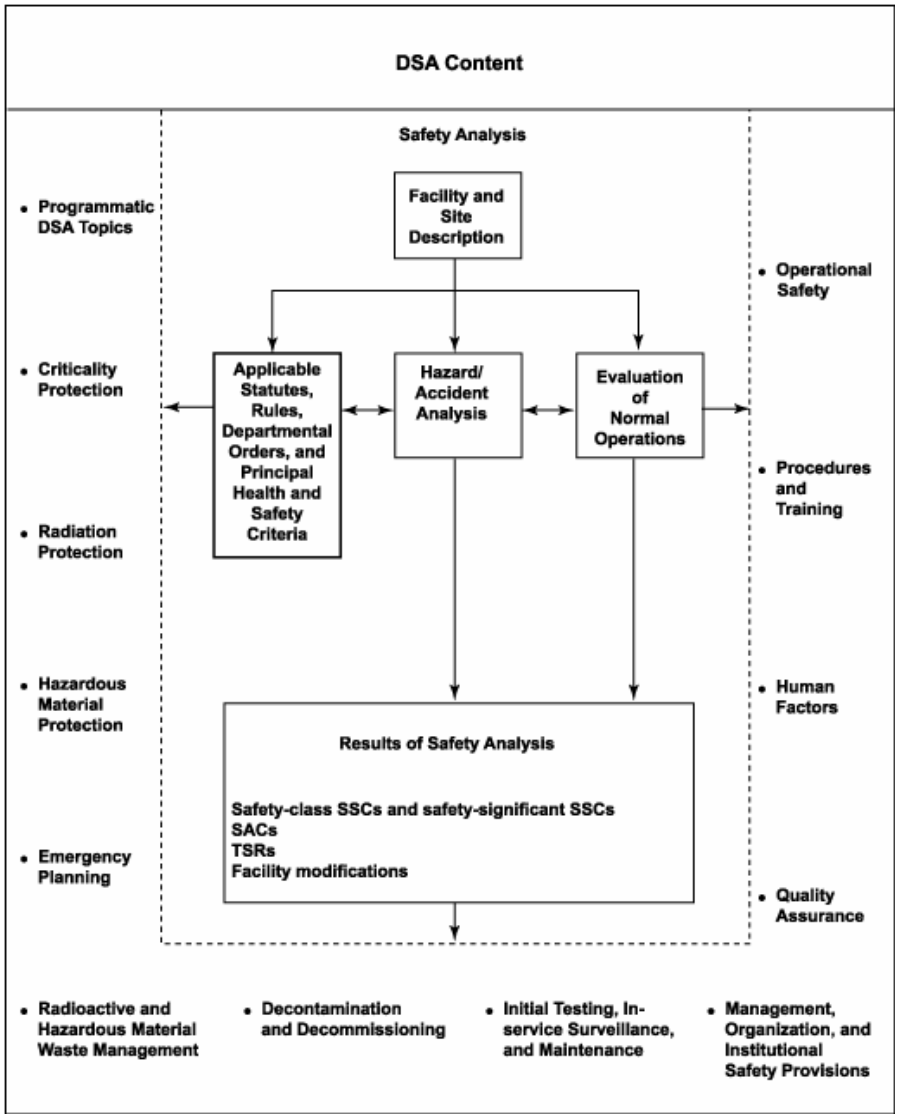
means of assuring safe operation of the facility. Hazard analysis and accident analysis are performed to identify specific controls and improvements that feed back into overall safety management. Consequence and likelihood estimates obtained from this process also form the bases for grading the level of detail and control needed in specific programs. The result is documentation of the safety basis that emphasizes the controls needed to maintain safe operation of a facility.

The DSA preparation process is illustrated in figure 2. The level of detail provided in the DSA depends on numerous factors. Applying the guidance for the graded approach will assist the preparer in establishing an acceptable level of detail.

The foundation for effectively preparing a DSA is the assembly and integration of an experienced preparation team. The size and makeup of the team depend on the magnitude and type of facility hazards and the complexity of the processes that are required to be addressed in the DSA. In determining the makeup of the preparation team, careful consideration should be given to the key hazard analysis activity. In general, the safety analysis base team should include, as a minimum, individuals experienced in process hazard and accident analyses, facility systems engineers, and process operators. Individuals with experience in specific subject matter such as nuclear criticality, radiological safety, fire safety, chemical safety, or process operations may be needed in the hazard analysis on a regular or as needed basis. Such individuals will typically be necessary in the development of programmatic DSA chapters as well. Consistent, accurate exchange of information among the team members is at least as important as the makeup of the team itself. This can be assured through meaningful integration of the required tasks.

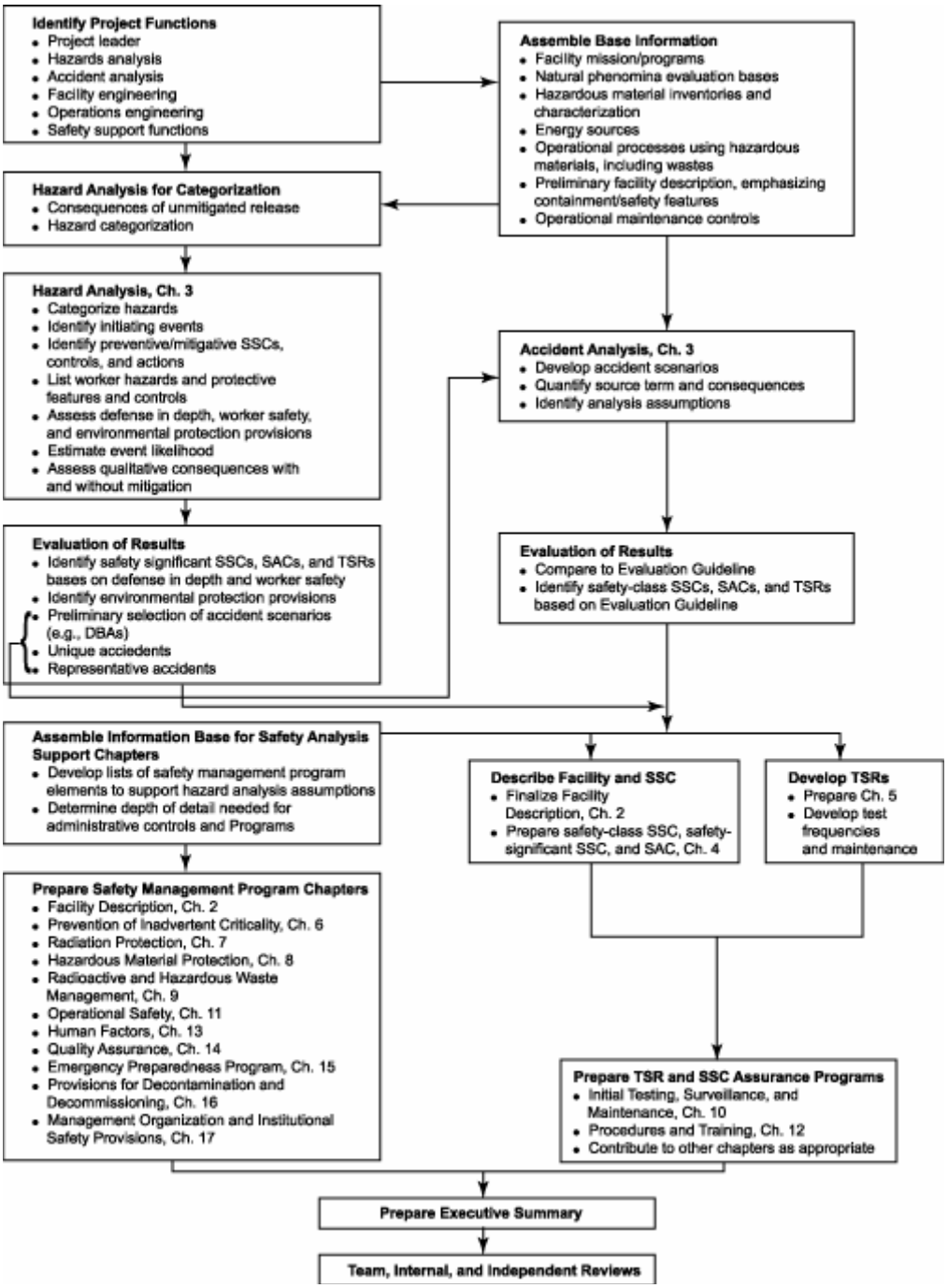
Once team makeup is determined, base information needed to support DSA development is gathered. Maximum advantage should be taken of pertinent existing safety analyses and design information (i.e., requirements and their bases) that are immediately available, or can be retrieved through reasonable efforts. Other information arises from existing sources such as process hazards analyses, fire hazards analyses, explosive safety analyses, health and safety plans, environmental impact statements, etc. The need for additional or specific information becomes apparent throughout the hazard analysis process. The remaining key steps for efficient completion of the safety analysis and the DSA development process are:

- Identify the DSA project functions using project information and ensure the team matches the functions that are required.
- Perform hazard analysis to provide facility hazard classification, evaluate worker safety and defense in depth, and identify unique and representative accidents to be carried forward to accident analysis. Safety-significant structures, systems, and components (SSCs), specific administrative controls (SACs) and technical safety requirements (TSRs) are designated in hazard analysis as well, with a preference given to safety-related SSCs over SACs.

- Perform an accident analysis and assess the results to identify any safety-class SSCs, SACs and accident specific TSRs based on comparison of accident consequences to the Evaluation Guideline.
- Develop the chapters for the DSA by providing information necessary to support the results of the safety analysis. These chapters detail the results of the analysis, describe the facility and the safety SSCs, and the safety management programs that relate to the facility safety basis.
- Prepare the executive summary.
- 


*Source:* DOE-STD-3009-94

**Figure 1.** DSA Scope and Integration




*Source:* DOE-STD-3009-94

**Figure 2**. DSA preparation process

Several specific topics are directly relevant to understanding the conceptual basis of this Standard. These topics are worker safety, defense in depth, programmatic commitments, SSC and TSR commitments, and correlation of this Standard to 10 CFR 830 requirements. The remainder of this part of the module discusses each of these topics.

## Worker Safety

Workers, typically those in close proximity to operations, are the population principally at risk from potential consequences associated with hazard category 2 and 3 facilities. The DOE recognizes, via 10 CFR 830, the importance of including worker safety in safety analyses by specifically noting the worker as a population of concern. Developing a conceptual basis for the methodology used in this Standard requires answering the fundamental question of how worker safety is most appropriately addressed in the DSA.

The Occupational Health and Safety Administration (OSHA) has published 29 CFR 1910.119, "Process Safety Management of Highly Hazardous Chemicals." OSHA defines the purpose of this regulation in summary fashion as, "Employees have been and continue to be exposed to the hazards of toxicity, fires, and explosions from catastrophic releases of highly hazardous chemicals in their workplaces. The requirements in 29 CFR 1910.119 are intended to eliminate or mitigate the consequences of such releases." Many of the topics requiring coverage in this federal regulation, such as design codes and standards, process hazard analysis, human factors, training, etc., are directly parallel to the requirements in 10 CFR 830.

DOE O 440.1B, *Worker Protection Program for DOE (Including the National Nuclear Security Administration) Federal Employees*. and the OSHA standard address the issue of worker safety from process accidents by requiring the performance of hazards analyses for processes in conjunction with implementation of basic safety programs that discipline operations and ensure judgments made in hazard analyses are supported by actual operating conditions. These requirements effectively integrate programs and analyses into an overall safety management structure without requiring quantitative risk assessment. This integration and the basic concepts of Process Safety Management (PSM) described by OSHA regulations and the manuals and codes of practice described in DOE O 440.1B are philosophically accepted as appropriate for DSAs. DOE-STD-3009-94 effectively merges PSM principles with traditional DSA precepts.

## Defense in Depth

Defense in depth as an approach to facility safety has extensive precedent in nuclear safety philosophy. It builds in layers of defense against release of hazardous materials so that no one layer by itself, no matter how good, is completely relied upon. To compensate for potential human and mechanical failures, defense in depth is based on several layers of protection with successive barriers to prevent the release of hazardous material to the environment. This

approach includes protection of the barriers to avert damage to the plant and to the barriers themselves. It includes further measures to protect the public, workers, and the environment from harm in case these barriers are not fully effective.

The defense- in-depth philosophy is a fundamental approach to hazard control for nonreactor nuclear facilities even though they do not possess the catastrophic accident potential associated with nuclear power plants. In keeping with the graded-approach concept, no requirement to demonstrate a generic, minimum number of layers of defense in depth is imposed. However, defining defense in depth as it exists at a given facility is crucial for determining a safety basis.

**Safety Management Program Commitments**

Sections 10 CFR 830.204(b) (5) and 830.204(b) (6) of the Rule require that the DSA define the characteristics of the safety management programs necessary to ensure the safe operation of the facility. Program commitments (e.g., radiation protection, maintenance, quality assurance) encompass a large number of details that are more appropriately covered in specific program documents (e.g., plans and procedures) external to the DSA.

The cumulative effect of these details, however, are recognized as being important to facility safety, which is the rationale for a top level program commitment becoming part of the safety basis.

As appropriate to the hazard, the safety basis may identify specific controls (e.g., hazardous material inventory limits) that are required for safety. These controls should be considered for designation as a SAC as discussed in DOE-STD-3009-94 and DOE-STD-1186-2004, *Specific Administrative Controls*.

**TSR and SSC Commitments**

To comply with 10 CFR 830, specific safety controls must be developed in the DSA. In keeping with the graded-approach principle, distinctions are made to avoid wasting effort by providing detailed descriptions of all facility SSCs. While a basic descriptive model of the facility and its equipment must be provided, highly detailed descriptions are reserved for two categories of SSCs comprising the most crucial aspects of facility safety. These two categories are safety-class SSCs and safety-significant SSCs.

Technical safety requirements. TSRs comprise: (1) safety limits (SLs); (2) operational limits consisting of limiting control settings (LCSs) and limiting conditions for operation (LCOs) and associated surveillance requirements (SRs); (3) ACs, (4) SACs, (5)use and application provisions, (6) design features, and (7) Bases Appendix.

Based on the results of hazard and accident analysis TSRs are designated for: (1) safety-class SSCs and controls established on the basis of application of the evaluation guideline; (2) safety-

significant SSCs; (3) defense in depth in accordance with the screening criteria of DOE G 423.1-1; and (4) safety management programs for defense in depth or worker safety. The Bases Appendix provides the linkage to the DSA.

Safety-class structures, systems, and components. 10 CFR 830 defines safety-class designation for SSCs that are established on the basis of application of the evaluation guidelines. This designation carries with it the most stringent requirements.

Safety-significant structures, systems, and components. This category of SSCs is provided to ensure that important SSCs will be given adequate attention in the DSA and facility operations programs. Safety-significant SSCs are those of particular importance to defense in depth or worker safety as determined in hazard analysis. Control of such SSCs does not require meeting the level of stringency associated with safety-class SSCs.

## HAZARD ANALYSIS

The initial analytical effort for all facilities is a hazard analysis that systematically identifies facility hazards and accident potentials through hazard identification and hazard evaluation. The focus of the hazard analysis is on thoroughness and requires evaluation of the complete spectrum of hazards and accidents. This largely qualitative effort forms the basis for the entire safety analysis effort, including specifically addressing defense in depth and protection of workers and the environment. Basic industrial methods for hazard analysis, its interface with more structured quantitative evaluations, and the basis for both have been described in references such as the American Institute of Chemical Engineers, Guidelines for Hazard Evaluation Procedures (1992). These guidelines have been accepted by the Occupational Safety and Health Administration as the standard for analytical adequacy in characterizing commercial chemical processes that perform the same type of unit operations conducted at NNSA nonreactor nuclear facilities. Appropriately applied, they help fulfill the requirements of DSAs for hazard category 2 and 3 facilities as specified in 10 CFR 830.

The basic identification of hazards inherent in the process provides a broad, initial basis for identifying needed safety programs such as radiation protection and hazardous chemical protection. The hazard analysis then moves beyond basic hazard identification to evaluation of the expected consequences and estimation of likelihood of accidents.

Throughout the evaluation process, preventive and mitigative SSCs and pertinent elements of programmatic controls are identified. This identification also establishes functional requirements for SSCs, which will subsequently delineate the technical information needed to establish performance criteria. The DSA summarizes these requirements and criteria for safety-class and safety-significant SSCs only. Refinement of the information obtained in hazard evaluation leads to overall definition of defense in depth, worker safety, and environmental protection. The most significant aspects of defense in depth and worker safety are subject to definition designation as

safety-significant SSCs and coverage by TSRs. Other items noted are encompassed by the details of safety management programs (e.g., procedures, training, maintenance, quality assurance), which can be captured in top-level fashion in TSR administrative controls. The hazard evaluation conducted to assess the accident spectrum associated with hazards germane to the DSA indicates the adequacy of programmatic efforts and provides input to programmatic activities whose discipline provides a significant margin of safety.

The final purpose of hazard analysis is to identify a limited subset of accidents that are carried forward to accident analysis. Identifying DBAs in safety analysis and the use of DBAs is appropriate in defining a facility safety basis. DBAs are a device for designing individual equipment or systems to meet functional requirements. An accident can be defined as a DBA if relevant SSCs were specifically designed to function during that accident and appropriate documentation of this fact exists.

## ACCIDENT ANALYSIS

The complete spectrum of accidents is examined in hazard analysis. A limited subset of accidents that bound the envelope of accident conditions to which the operation could be subjected are carried forward to accident analysis where safety-class SSCs are designated by comparing accident consequences to the evaluation guideline. These scenarios are the accidents requiring formal definition.

## APPLICATION OF THE GRADED APPROACH

10 CFR 830 prescribes the use of a graded approach for the effort expended in safety analysis and the level of detail presented in associated documentation. The graded approach applied to DSA preparation and updates is intended to produce cost efficient safety analysis and DSA content that provide adequate assurance to the DOE that a facility has acceptable safety provisions without providing unnecessary information. As described in 10 CFR 830, the graded approach adjusts the magnitude of the preparation effort to the characteristics of the subject facility based on the following factors:

- The relative importance to safety, safeguards, and security;
- The magnitude of any hazard involved;
- The life cycle stage of a facility;
- The programmatic mission of a facility;
- The particular characteristics of a facility;
- The relative importance of radiological and nonradiological hazards; and
- Any other relevant factor.

10 CFR 830 provides for developing the DSA based on judgment of the facility in relation to these seven factors. For example, simple hazard category 3 facilities or facilities that have a short

operational life may only require a limited but adequate analysis documented to a level less than that required for a hazard category 2 facility. In addition, facilities with short operational lives should consider the appropriateness of using DOE-STD-3011-2002 to meet the requirements of 10 CFR 830. On the opposite end of the spectrum, a complex hazard category 1 facility that is just going into operation requires extensive analysis and highly detailed documentation.

The application of the graded approach may allow for much simpler analysis and documentation for some of these facilities. For facilities of little hazard, or hazards at the hazard category 3 level, for which only a modest reduction of risk is required, the DSA may be simple and short. In such cases all of the topics for the DSA listed in DOE-STD-3009-94 may not be necessary and with proper technical bases some topics may be omitted or reduced in the detail that would otherwise be required of hazard category 1 or 2 facilities.

**Note: You do not have to do example 1 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 1 or go to section 2.**

**EXAMPLE 1**

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

1. State the two components that make up defense in depth.

2. State the conditions in which an accident can be defined as a DBA.

3. Discuss the purpose of DOE-STD-3009-94.

**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 2.**

**EXAMPLE 1 SELF-CHECK**

1. State the two components that make up defense in depth.

   - Defense in depth, as discussed in the standard, consists of two components: equipment and administrative features providing preventive or mitigative functions so that multiple features are relied on for prevention or mitigation to a degree proportional to the hazard potential, and
   - integrated safety management programs that control and discipline operations.

2. State the conditions in which an accident can be defined as a DBA.

   An accident can be defined as a DBA if relevant SSCs are specifically designed to function during that accident and appropriate documentation exists.

3. Discuss the purpose of DOE-STD-3009-94.

   DOE-STD-3009-94 was developed to assist hazard category 2 and 3 facilities in preparing DSAs that will satisfy the requirements in 10 CFR 830, “Nuclear Safety Management.”

## SECTION 2, DSA PREPARATION GUIDANCE

This section contains a brief description of the purpose and basic content of the executive summary, the 17 chapters of a DSA, and appendix A.

### EXECUTIVE SUMMARY

The DSA executive summary provides an overview of the facility safety basis and presents information sufficient to establish a top-level understanding of the facility, its operations, and the results of the safety analysis. It summarizes the facility safety basis as documented in detail in the remainder of the DSA. Expected products of this summary, as applicable based on the graded approach, include the following:

- Summary of the facility background and mission
- Overview of the facility including location and boundaries
- Description of the facility hazard category
- Summary of the results of the facility safety analysis including operational hazards analyzed, DBAs, and significant preventive and mitigative features
- Summary of the acceptability of the facility safety basis
- Guide to the structure and content of the DSA

### CHAPTER 1, SITE CHARACTERISTICS

This chapter provides a description of site characteristics necessary for understanding the facility environs important to the safety basis. Information is provided to support and clarify assumptions used in the hazard and accident analyses to identify and analyze potential external and natural event accident initiators and accident consequences external to the facility. Expected products of this chapter, as applicable based on the graded approach, include the following:

- Description of the location of the site, location of the facility within the site, its proximity to the public and to other facilities, and identification of the point where the Evaluation Guideline is applied.
- Specification of population sheltering, population location and density, and other aspects of the surrounding area to the site that relate to assessment of the protection of the health and safety of the public.
- Determination of the historical basis for site characteristics in meteorology, hydrology, geology, seismology, volcanology, and other natural events to the extent needed for hazard and accident analyses.
- Identification of design basis natural events.
- Identification of sources of external accidents, such as nearby airports, railroads, or utilities such as natural gas lines.
- Identification of nearby facilities impacting, or impacted by, the facility under evaluation.
- Validation of site characteristic assumptions common to safety analysis that were used in

prior environmental analyses and impact statements, or of the need to revise and update such assumptions used in facility environmental impact statements

CHAPTER 2, FACILITY DESCRIPTION

This chapter provides descriptions of the facility and processes to support assumptions used in the hazard and accident analyses. These descriptions focus on all major facility features necessary to understand the hazard analysis and accident analysis, not just safety SSCs. Expected products of this chapter, as applicable based on the graded approach, include the following:

- Overview of the facility, its inputs and its outputs, including mission and history
- Description of the facility structure and design basis
- Description of the facility process systems and constituent components, instrumentation, controls, operating parameters, and relationships of SSCs.
- Description of confinement systems
- Description of the facility safety support systems
- Description of the facility utilities
- Description of facility auxiliary systems and support systems

CHAPTER 3, HAZARD AND ACCIDENT ANALYSIS

The purpose of this DSA chapter is to provide information that will satisfy the requirements of 10 CFR 830 to evaluate normal, abnormal, and accident conditions, including consideration of natural and man-made external events, identification of energy sources or process that might contribute to the generation or uncontrolled release of radioactive and other hazardous materials, and consideration of the need for analysis of accidents that may be beyond the design basis of the facility.

This chapter describes the process used to systematically identify and assess hazards to evaluate the potential internal, man-made external, and natural events that can cause the identified hazards to develop into accidents. This chapter also presents the results of this hazard identification and assessment process. Hazard analysis considers the complete spectrum of accidents that may occur due to facility operations; analyzes potential accident consequences to the public and workers; estimates likelihood of occurrence; identifies and assesses associated preventive and mitigative features; identifies safety significant SSCs; and identifies a selected subset of accidents, designated DBAs, to be formally defined in accident analysis. Subsequent accident analysis evaluates these DBAs for comparison with the evaluation guideline. This chapter covers the topics of hazard identification, facility hazard categorization, hazard evaluation, and accident analysis.

Expected products of this chapter, as applicable based on the graded approach, include the following:

- Description of the methodology for and approach to hazard and accident analyses

- Identification of hazardous materials and energy sources present by type, quantity, form, and location
- Facility hazard categorization, including segmentation in accordance with DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*
- Identification in the hazard analysis of the spectrum of potential accidents at the facility in terms of largely qualitative consequence and frequency estimates. The summary of this activity will also include:
    - Identification of planned design and operational safety improvements
    - Summary of defense in depth, including identification of safety-significant SSCs, SACs and other items needing TSR coverage in accordance with10 CFR 830.
    - Summary of the significant worker safety features, including identification of safety-significant SSCs and any relevant programs to be covered under TSR and administrative controls, including those controls designated as SACs.
    - Summary of design and operational features that reduces the potential for large material releases to the environment.
    - Identification of the limited set of unique and representative accidents (i.e., DBAs) to be assessed further in accident analysis.
- Accident analysis of DBAs identified in the hazard analysis. The summary of this activity will include for each accident analyzed, the following:
    - Estimation of source term and consequence
    - Documentation of the rationale for binning frequency of occurrence in a broad range in hazard analysis
    - Documentation of accident assumptions and identification of safety-class SSCs based on the evaluation guideline.

This chapter presents the formal development of the potential accidents identified in section 3.3.2.3.5, “Accident Selection,” beginning with a formal sequence of developing connecting initiating events to preventive feature and mitigative feature responses. The principal purpose of the accident analysis is to identify any safety-class SSCs, SACs and TSRs needed for protection of the public.

CHAPTER 4, SAFETY STRUCTURES, SYSTEMS, AND COMPONENTS

This chapter provides details on those facility SSCs that are necessary for the facility to protect the public, provide defense in depth, or contribute to worker safety. Similarly, this chapter provides details on SACs that are significant to specific accident risk reduction. Descriptions are provided of the attributes required to support the safety functions identified in the hazard and accident analyses and to support subsequent derivation of TSRs. Expected products of this

chapter, as applicable based on the graded approach, include the following:

- Descriptions of safety SSCs and SACs including safety functions
- Identification of support systems safety SSCs depend upon to carry out safety functions
- Identification of the functional requirements necessary for the safety SSCs and SACs to perform their safety functions, and the general conditions caused by postulated accidents under which the safety SSCs or SACs must operate
- Identification of the performance criteria necessary to provide reasonable assurance that the functional requirements will be met
- Identification of assumptions needing TSR coverage

CHAPTER 5, DERIVATION OF TECHNICAL SAFETY REQUIREMENTS

This chapter builds upon the control functions determined to be essential in chapter 3, “Hazard and Accident Analyses,” and chapter 4, “Safety Structures, Systems, and Components,” to derive TSRs. This chapter is meant to support and provide the information necessary for the separate TSR document required by 10 CFR 830.205.

Derivation of TSRs consists of summaries and references to pertinent sections of the DSA in which design and administrative features are needed to prevent or mitigate the consequences of accidents. Design and administrative features addressed include ones that: (1) provide significant defense in depth; (2) provide for significant worker safety; or (3) provide for the protection of the public. Expected products of this chapter, as applicable based on the graded approach, include the following:

- Information with sufficient basis from which to derive, as appropriate, any of the following TSR parameters for individual TSRs:
- SLs
- LCSs
- LCOs
- SRs
- Information with sufficient basis from which to derive TSR administrative controls for specific control features or to specify programs necessary to perform institutional safety functions.
- Identification of passive design features addressed in the DSA.
- Identification of TSRs from other facilities that affect the facility’s safety basis.

## CHAPTER 6, PREVENTION OF INADVERTENT CRITICALITY

The purpose of this chapter is to provide information that will support the development of a safety basis in compliance with the provisions of 10 CFR 830.204(b) (6) regarding the definition of a criticality safety program. If this information is available in a site-wide criticality safety program description, and it complies with 10 CFR 830 requirements, then it can be included by reference and summarized in this chapter.

Expected products of this chapter include the following:

- Definition of a criticality safety program that (1) ensures that operations with fissionable material remain subcritical under all normal and credible abnormal conditions, (2) identifies applicable nuclear criticality safety standards, and (3) describes how the program meets applicable nuclear criticality standards
- Description of the basis and analytical approach the facility uses for deriving operational criticality limits
- Summary

## CHAPTER 7, RADIATION PROTECTION

This chapter summarizes provisions for radiation protection. Summaries focus on radiation protection based on facility hazards to provide a basic understanding of the scope of the radiation protection program. Expected products of this chapter, as applicable based on the graded approach, include the following:

- Description of the overall radiation protection program and organization
- Description of the radiological ALARA policy and program
- Description of radiation exposure control including administrative limits, radiological practices, dosimetry, and respiratory protection
- Identification of radiological monitoring to protect workers, the public, and the environment
- Discussion of radiological protection instrumentation
- Description of the plans and procedures for maintaining records of radiation sources, releases, and occupational exposures

## CHAPTER 8, HAZARDOUS MATERIAL PROTECTION

This chapter summarizes provisions for hazardous material protection other than radiological hazards. Summaries focus on hazardous material protection based on facility hazards to provide a basic understanding of the scope of the hazardous material protection program. Expected products of this chapter, as applicable based on the graded approach, include the following:

- Description of the overall hazardous material protection program and organization

- Description of the hazardous material ALARA policy and program
- Description of hazardous material exposure control, including identification of hazardous material, administrative limits, occupational medical programs, and respiratory protection
- Identification of hazardous material monitoring to protect workers, the public, and the environment
- Discussion of hazardous material protection instrumentation
- Description of the plans and procedures for maintaining hazardous material records, hazard communications, and occupational exposures

CHAPTER 9, RADIOACTIVE AND HAZARDOUS WASTE MANAGEMENT

This chapter describes the provisions for radioactive and hazardous waste management. Expected products of this chapter, as applicable based on the graded approach, include the following:

- Description of the overall radioactive and hazardous waste management program and organization
- Description of the site-specific radioactive, mixed, and hazardous material waste management policy, objectives, and philosophy
- Identification of hazardous waste streams, including types, sources, and quantities
- Description of the waste management process, and waste treatment and disposal systems, including design and administrative controls

CHAPTER 10, INITIAL TESTING, IN-SERVICE SURVEILLANCE AND MAINTENANCE

This chapter describes the essential features of the testing, surveillance, and maintenance programs. Expected products of this chapter, as applicable based on the graded approach, include the following:

- Description of the facility initial testing program
- Description of the facility in-service surveillance program
- Description of the planned, predictive, preventive, and corrective facility maintenance programs

CHAPTER 11, OPERATIONAL SAFETY

This chapter discusses general aspects of operational safety. It specifically focuses on the bases for the conduct of operations program specified by DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities.*

This chapter describes: (1) the bases for the conduct of operations program; and (2) the fire protection program. Expected products of this chapter, as applicable based on the graded

approach, include the following:

- Identification of the aspects of conduct of operations directly applicable to the facility
- Integrated summary of the main features of the facility Conduct of Operations Program
- Description of facility fire protection program

CHAPTER 12, PROCEDURES AND TRAINING

This chapter describes the processes by which the technical content of the procedures and training programs are developed, verified, and validated. These processes will ensure that the facility is operated and maintained by personnel who are well qualified and competent to carry out their job responsibilities using procedures and training elements that have been well developed and are kept current by the use of feedback and continuous improvement.

A programmatic commitment to ongoing procedures and training programs is considered to be a necessary part of safety assurance. Expected products of this chapter, as applicable based on the graded approach, include:

- Summary of the overall facility procedures and training programs
- Description of the processes by which the form and content of procedures and training materials are developed, verified and validated for normal, abnormal, and emergency operations; surveillance testing and maintenance
- Summary of the processes for maintaining written procedures, training materials, and training records
- Summary of the processes for modifying procedures and training materials
- Summary of the methods used to feed back operations experience, new analyses, other DSA changes, etc., to the procedures and training programs
- Description of the mechanisms to identify and correct technical or human factors deficiencies

CHAPTER 13, HUMAN FACTORS

This chapter focuses on human factors engineering, its importance to facility safety, and the design of the facility to optimize human performance. Human factors consist of:

- Human factors engineering that focuses on designing facilities, systems, equipment, and tools so they are sensitive to the capabilities, limitations, and needs of humans
- Human reliability analysis that quantifies the contribution of human error to the facility risk

This chapter focuses exclusively on human factors engineering. Use of the term human factors in DOE-STD-3009-94 does not connote an expectation of or requirement for human reliability analysis.

This chapter demonstrates that human factors are considered in facility operations where humans are relied on for preventive actions, and for operator mitigative actions during abnormal and emergency operations. In this respect, the human-machine interface is an integral part of facility safety and, thus, requires special treatment in the DSA. The emphasis is on human-machine interfaces required for ensuring the safety function of safety SSCs that are important to safety and on the provisions made for optimizing the design of those human-machine interfaces to enhance reliable human performance.

A complete discussion of human factors without application of the graded approach includes:

- Description of the human- factors process for systematically inquiring into the importance of human factors in facility safety
- Description of human-machine interfaces with safety-significant SSCs and safety-class SSCs that are important to safety
- Description of the systematic inquiry into the optimization human-machine interfaces with safety-significant SSCs and safety-class SSCs to enhance human performance.

## CHAPTER 14, QUALITY ASSURANCE

This chapter describes the provisions for a quality assurance program. Expected products of this chapter, as applicable based on the graded approach, include the following:

- Description of quality assurance program and organization
- Description of document control and records management
- Description of the quality assurance process ensuring that performed safety related work meets requirements

## CHAPTER 15, EMERGENCY PREPAREDNESS PROGRAM

This chapter summarizes the emergency preparedness functions and response at the facility. Expected products of this chapter, as applicable based on the graded approach, include the following:

- Identification of the scope of the facility Emergency Preparedness Plan (EPP)
- Description of the philosophy, objectives, organization, and emergency response of facility emergency preparedness

## CHAPTER 16, PROVISIONS FOR DECONTAMINATION AND DECOMMISSIONING

This chapter describes provisions that facilitate future decontamination and decommissioning (D&D) of a facility. Design of significant modifications to an existing facility must consider provisions for D&D. This chapter also contains guidance on the description of the conceptual D&D plan for existing facilities. Expected products of this chapter, as applicable based on the

graded approach and project mission phase, include the following:

- Description of design features incorporated in major modifications of an existing facility to facilitate future D&D of the facility
- Description of operational considerations to facilitate future D&D
- Description of conceptual D&D plan

CHAPTER 17, MANAGEMENT, ORGANIZATION, AND INSTITUTIONAL SAFETY PROVISIONS

This chapter presents information on management, technical, and other organizations that support safe operation. This chapter also enumerates the requirements used to develop the safety management programs, includes descriptions of the responsibilities of and relationships between the non-operating organizations having a safety function and their interfaces with the line operating organization, and presents sufficient information on the safety management policies and programs to demonstrate that the facility operations are embedded in a safety conscious environment. Expected products of this chapter, as applicable based on the graded approach, include the following:

- Description of the overall structure of the organizations and personnel with responsibilities for facility safety and interfaces between those organizations
- Description of the programs that promote safety consciousness and morale, including safety culture, performance assessment, configuration and document control, occurrence reporting, and staffing and qualification.

APPENDIX A

This appendix specifies a numerical radiological dose value to be used in identifying safety-class SSCs. Calculation methods and assumptions needed to provide general consistency in dose estimation are also described, with relevant background and interpretation discussions included as appropriate.

The methodology provided by DOE-STD-3009-94 focuses on characterizing facility safety with or without well-documented design information. The evaluation guideline construct as described in this appendix is primarily intended for use with existing facilities.

Once a set of SC SSCs has been identified, accident consequences can be estimated in a DBA calculation, which represents the accident scenario progression where SC SSCs successfully perform their intended safety function.

For each scenario in the DSA, sufficient documentation of the unmitigated and mitigated accident scenarios should be made such that the thought process of determining the SC SSCs is well understood. In all cases, the level of protection provided by the identified SC SSCs should

be evident. However, this does not require explicit reporting of unmitigated consequences in the DSA, if it is evident that the unmitigated release consequences are large.

**Source Term Calculation**

The radioactive airborne source term is typically estimated as the product of five factors: (1) MAR, (2) damage ratio, (3) airborne release fraction, (4) respirable fraction, and (5) leakpath factor. Detailed discussion of these parameters is provided in DOE-HDBK-3010-94, *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities*.

Material at Risk (MAR).The MAR values used in hazard and accident analysis must be consistent with the values noted in hazard identification as described in DOE-STD-3009-94, section 3.3.2.1, and should represent documented maxima for a given process or activity. Such documentation may be present in TSRs or lower-tier documents referenced in TSRs, as necessary. While DOE-STD-1027-92 excludes material in qualified containers from consideration for the purposes of hazard classification, the existence of such material should be acknowledged in a DSA. Such material should later be excluded from the source term for the applicable accident scenarios if the containers can be shown to perform their functions under the accident environments. Exclusion of MAR from the source term may be based on qualified containers, consideration regarding the specifics of the accident scenario through the definition of the damage ratio (defined below), or other appropriate means.

Damage Ratio (DR). The DR is that fraction of material actually impacted by the accident generating conditions. DOE-HDBK-3010-94 notes that some degree of ambiguity can result from overlapping definitions of MAR and DR in various applications. One consistent definition should be used throughout a given DSA.

Airborne Release Fractions (ARFs) And Respirable Fractions (RFs). Bounding estimates for radionuclide ARFs and RFs for a wide variety of MAR and release phenomena are systematically presented in DOE-HDBK-3010-94. In those cases where there may be significant direct shine contribution to dose, that contribution should be evaluated without the use of the respirable fraction.

Leakpath Factor (LPF). The LPF is the fraction of material passing through some confinement deposition or filtration mechanism. Several LPFs may be associated with a specific accident, e.g., fraction passing from a glovebox, fraction passing from a room, fraction passing through filtration vis-à-vis door leakage. For the purposes of the unmitigated release calculation, the LPF should be set to unity.

**Dose Estimation**

The relevant factors for dose estimation are receptor location, meteorological dispersion, and

dose conversion values. Specific guidance for each is provided below.

Dose Calculation Location. For the purposes of comparison to the EG, the comparison point is taken to be the location of a theoretical maximally-exposed offsite individual (MOI) standing at the site boundary. This location can also be beyond the DOE site boundary if a buoyant or elevated plume is not at ground level at the DOE site boundary. In such cases, the calculation location is taken at the point of maximum exposure, typically where the plume reaches the ground level. It is DOE practice and expectation that onsite individuals, both workers and public, are protected under the emergency response plans and capabilities of its sites. This protection, along with implementation of defense-in-depth and worker safety philosophy, safety significant (SS) (and indirectly, through SC) SSC designation, and DOE's safety management programs, address onsite safety.

However, an annual assessment of any changes in the site boundary and potential effects on safety SSC classification should be performed in association with the required annual update of the DSA for a facility. Privatization and site turnover initiatives may affect these determinations.

Atmospheric Dispersion. The 95th percentile of the distribution of doses to the MOI, accounting for variations in distance to the site boundary as a function of direction, is the comparison point for assessment against the EG.

The method used should be consistent with the statistical treatment of calculated X/Q values described in regulatory position 3 of NRC Regulatory Guide 1.145 for the evaluation of consequences along the exclusion area boundary. The determination of distance to the site boundary should be made in accordance with the procedure outline in position 1.2 of Regulatory Guide 1.145. NRC Regulatory Guide 1.23 describes acceptable means of generating the meteorological data upon which dispersion is based. Accident phenomenology may be modeled assuming straight- line Gaussian dispersion characteristics, applying meteorological data representing a 1-hour average for the duration of the accident. Accident duration is defined in terms of plume passage at the location of dose calculation, for a period not to exceed 8 hours.

Prolonged effects, such as resuspension, need not be modeled. The accident progression should not be defined so that the MOI is not substantially exposed (i.e., using a release rate that is specifically intended to expose the MOI to only a small fraction of the total material released, or defining time and wind speed so that the plume has not reached the MOI). The exposure period begins from the time the plume reaches the MOI.

For ground releases, the calculated dose equates to the centerline dose at the site boundary. For elevated, thermally buoyant, or jet releases, plume touchdown may occur beyond the site boundary. As noted in the discussion of receptor location, these cases should locate the dose calculation at the point of maximum dose beyond the site boundary, which is typically at the point of plume touchdown.

Accidents with unique dispersion characteristics, such as explosions, may be modeled using phenomenon-specific codes more accurately representing the release conditions. Discussion should be provided justifying the appropriateness of the model to the specific situation. For accident phenomena defined by weather extremes, actual meteorological conditions associated with the phenomena may be used for comparison to the EG.

**Note: You have finished the familiar level of this module. The practice follows.**

This practice is required if your proficiency is to be verified at the familiar level. You will need to refer to the standard to answer the questions in the practice correctly. The practice and criterion test will also challenge additional skills that you have acquired in other formal and on-the-job training. If verification of your proficiency is not required the practice and criterion test are optional. However, successful completion is an approved method that may be used to demonstrate knowledge of the subject.

**PRACTICE**

1. Which of the following forms the basis for the entire safety analysis effort?
   a. Accident analysis
   b. Derivation of TSRs
   c. Hazard analysis
   d. Operational safety

2. What serves as the foundation for effectively preparing a DSA?

3. What is the purpose of the executive summary in a DSA?

4. The purpose of this DSA chapter is to provide information that will satisfy the requirements of:
   a. 10 CFR 830
   b. 10 CFR 835
   c. 29 CFR 1910.1200
   d. 29 CFR 1910.1450

5. What are four elements that should be identified in a description of hazardous material exposure control?

6. Which DOE Order is the focus of DOE-3009-94, chapter 11, Operational Safety?

7. List the two elements that comprise human factors.

8. What are two expected products of the DSA chapter 15, Emergency Preparedness Program?

9. What is the numerical radiological dose value (EG ) to be used in identifying safety-class Systems, Structures, and Components.

10. What are the five factors that are used to estimate the radioactive airborne source term?

**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-STD-3009-94
Level: General
Date: 11/1/08

# DOE-STD-3009-94
# PREPARATION GUIDE FOR U.S. DEPARMENT OF ENERGY NONREACTOR NUCLEAR FACILITY DOCUMENTED SAFETY ANALYSES
# GENERAL LEVEL

## OBJECTIVES

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

1. Is the contractor's action plan correct? If not, state what should have been done.

2. Were the correct sections of the documented safety analysis (DSA) referenced? If not, state the correct sections.

**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-STD-3009-94, *Preparation Guidance for U.S. Department Of Energy Nonreactor Nuclear Facility Documented Safety Analyses*, October 2008.

10 CFR 830, "Nuclear Safety Management, Subpart B, Safety Basis Requirements."

## INTRODUCTION

The familiar level of this module included the safety documents that make up the safety basis for a nuclear facility. The general level applies the knowledge gained in the familiar level to an example scenario, which includes a situation, the actions taken to remedy the situation, and the requirements related to the situation. Students will be asked to review the contractor's actions 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. You are not required to complete the example. However, doing so will help prepare you for the criterion test.

**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**

A routine National Nuclear Security Administration (NNSA) survey of facility operations raised a concern regarding the level of detail present in fire inspection procedures used to satisfy technical safety requirements (TSR) surveillances. Follow-up by facility engineering personnel led to the discovery that the fire system surveillance procedure that was credited for satisfying TSR surveillances for Building 234-H did not contain steps to perform the required inspections. The surveillances in question were the visual inspection of sprinkler heads and the visual inspection of sprinkler piping and fittings.

During a critique, personnel from the Facility Support Services Division (FSSD) indicated that they had revised the template for the procedure that was credited for performance of the annual surveillance on the 234-H fire system. This revision removed the two sections that described the visual inspection of the sprinklers and the piping. These inspections were required by National Fire Protection Association (NFPA) Code, but were not part of the Defense Programs (DP) TSRs at that time. These sections were removed by FSSD in anticipation of a proposed change to site procedure 2Q 5.11. This revision to the procedure template occurred sometime before September 2001. Subsequently, a DP-specific revision of the procedure was sent to the facility for review in September 2001, but the revision sheet did not indicate that these two sections of the procedure had been removed during the earlier template revision.

A phase II critique was held with FSSD and site fire protection engineering. During the critique, it was learned that during the period that the template for the 234-H annual test was revised, there was no formal process for controlling such changes. The procedure writers for FSSD typically sought to obtain consensus (no formal routing) for the change, and then make the change once they reached some level of agreement.

Apart from the FSSD inspection, the tritium fire protection coordinator conducts a quarterly inspection of fire systems. Facility management conducted a review to determine if the TSR requirements were adequately satisfied by this procedure and concluded that they were, thus preventing an actual TSR violation. NNSA concurred with this conclusion and a white paper was written to provide documentation.

Coincidental to the FSSD procedure revision in September 2001, the tritium facilities implemented an update to the DSA in October of 2001. For the fire system limiting condition for operations, the following surveillance requirements were added:

- a five year preventive maintenance on certain valves in the system

- visual inspection of the sprinkler heads
- visual inspection of the sprinkler piping and fittings

During the DSA implementation, a review was conducted to ensure that the newly applied TSR requirements were satisfied by the completion of a procedure. The 234-H annual inspection procedure that had just been completed was incorrectly credited as satisfying the TSR requirements under the assumption that it contained the required inspections.

Action plans taken

- Review all fire system surveillances from September 2001 to June 2002 and ensure that they are complete.
- Revise the procedure to indicate that it fulfills the requirements of the fire system surveillance requirements for the visual inspection of the sprinklers, piping, and fittings.
- Develop a formal change control process for the revision, review, and approval of procedures.

Sections of the DSA where you find information related to the scenario

- Section 10.4, “In-Service Surveillance Program”
- Section 12.3.1, “Development of Procedures”
- Section 12.3.2, “Maintenance of Procedures”
- Section 12.4.1, “Development of Training”

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 by the contractor apply to this situation. Write your answer on the next page and then compare your answer to the one contained in the example self-check.

Write your answer here.

**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, your answer must include, at least the following.

The action plans taken were complete and correct.

The sections cited were correct. However, one additional section should have been included: Section 5.5.X.2, Surveillance Requirements.

Additionally, facilities that have DSAs with surveillance requirements that are performed by outside support work groups need to be diligent in ensuring that the documents used by the outside work groups perform the surveillance as required. A formal change control process, with facility involvement, for the implementing document is essential to ensure that the DSA requirements are being met.

Implementation of future DSAs will have the required rigor and diligence by the system engineer and management to ensure that lessons learned from this event are implemented. This will include a rigorous plan that has sufficient detail for the implementation, and rigorous checks and reviews will be performed to ensure that the facility and personnel have a complete understanding of the DSA.

**PRACTICE**

This practice is required if your proficiency is to be verified at the general level. If you are to be qualified as a facility representative, the practice will prepare you for the criterion test. You will need to refer to the CFR and standard listed in the resources to answer the questions in the practice correctly. The practice and the criterion test will also challenge additional analytical skills that you have acquired in other formal and on-the-job training for the facility representative position.

Please review the following scenario, and then answer these questions.

1. Is the contractor's action plan correct? If not, state what should have been done.
2. Were the correct sections of DOE-STD-3009-94 cited? If not, state the correct sections.

SCENARIO

Personnel were working in a facility operating room preparing to obtain material characterization samples from fissile material items that were introduced into a glove box earlier in the shift. The work was being performed per a standard operating procedure. During the preparations, the operators discovered that one of the fissile items in the glove box was not authorized to be in the glove box based on the item identifications previously recorded in the procedure. The operating procedure requires that before introducing fissile material into the glove box, two operations personnel must verify that only authorized items will be introduced by completing a nuclear safety control step that requires that the item identification, recorded on the can, be compared to the authorized item identifications recorded in the procedure. Additionally, an engineering representative is required to perform the same verification per a nuclear safety control step in the procedure. When these verifications were performed, the operations and engineering personnel failed to recognize that the item that was subsequently introduced to the glove box was not on the authorized item list in the procedure. The verification by operations personnel and an engineering representative of the item identifications on the fissile material cans versus the authorized list of item identifications previously recorded in the procedure are the two defenses for nuclear criticality safety double contingency analysis initiating event. The unauthorized item in the glove box exceeded the glove box fissile mass limit. However, introduction of the material did not cause the criticality safety limit to be exceeded.

An investigation of the event revealed the following.

The first error occurred when the new pail labels reflected wrong item numbers based on item 7 and item13 being repacked into the wrong pails outside of the repack hut. The common error precursor was complacency/overconfidence. Two operators and a radiological control inspector (RCI) were at room 304 for the purpose of sorting and repacking. The original pail removed from the vault was opened by operator 1. All radiological surveys were performed by the RCI. Items 7 and 13 were removed from the pail, and were placed outside of the repack hut for repackaging. Operator 2 stationed outside of the repack hut placed item 13 into pail B and item 7 into pail A.

Placement of the items should have been made by placing item 13 into pail A and item 7 into pail B. The A pail was transported to the vault and the B pail was transported to the dissolver maintenance room (DMR) for eventual introduction into the material characterization glove box. The self-check of the work was less than adequate.

The second error occurred when markings on items were incorrectly verified against the master sequencing procedure before items were introduced into the material characterization glove box. Two operators verified tamper-indicating device (TID) seals and pail identifiers, but did not verify item identifiers against the procedure. A nuclear safety specialist (NSS) verified pail and TID identifiers, but did not verify item identifiers, based on over-confidence that the right pails, items, and TID seals were to be bagged into the cabinet. The present procedure refers to “product container” identification instead of “item identification.

Normally, third-level operators sort and repack items to be transported to DMR. Material characterization operators then introduce material into the material characterization glove box. When the material characterization operators (two) and the NSS perform verifications in DMR, it is usually the first time that they have seen the pails/items, which constitutes a fresh set of eyes verifying identification of pails/items.

For this event, one of the material characterization operators was the same individual that sorted and repacked the items in room 304. Personnel interviews revealed that the operator had a high confidence level that the right item was in the pail because the qualified operator had sorted and

repacked the item in room 304. Based on the confidence level of the one operator, a less than adequate verification was performed by all of the operators in DMR.

Action plans taken

- Engineering submitted a procedure change request to change all references where "product container" is listed to read "item" for clarification.
- The facility will issue an operating experience program lessons learned to facility operators covering the issues surrounding this event.
-

Sections of DOE-STD-3009-94 that apply to this scenario

- Section 6.4, "Criticality Controls"
- Section 6.4.1, "Engineering Controls"

Take some time to review the scenario and determine if the contractor's action plans were complete and correct, and determine if the correct sections from DOE-STD-3009-94 were cited.

Write your answers 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.**