U.S. Department of Energy
Oak Ridge Operations Office

Nuclear Facility Safety Basis Fundamentals

Self-Study Guide

[Fulfills ORO Safety Basis Competency 1, 2 (Part 1), or 7 (Part 1)]

November 2002

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ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
DOE	Department of Energy
DSA	Documented Safety Analysis
JCO	Justification for Continued Operations
LCO	Limiting Conditions for Operation
LCS	Limiting Control Setting
NRC	Nuclear Regulatory Commission
ORO	Oak Ridge Operations Office
PAAA	Price-Andersen Amendments Act
PDSA	Preliminary Documented Safety Analysis
PISA	Potential Inadequacy in the Safety Analysis
SAR	Safety Analysis Report
SER	Safety Evaluation Report
SSC	Structures, Systems, and Components
TSR	Technical Safety Requirements
USQ	Unreviewed Safety Question
USQD	Unreviewed Safety Question Determination

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INTRODUCTION

Title 10 Code of Federal Regulations (CFR) Part 830, Subpart B, "Safety Basis Requirements," requires the contractor responsible for a Department of Energy (DOE) nuclear facility to analyze the facility, the work to be performed, and the associated hazards and then identify the conditions, safe boundaries, and hazard controls necessary to protect the workers, the public, and the environment from adverse consequences. These analyses and hazard controls constitute the safety basis on which the contractor and DOE rely to conclude that facility operations or activities can be conducted safely. Performing work consistent with the safety basis provides reasonable assurance of adequate protection of the workers, the public, and the environment.

Course Purpose and Objectives

This self-study guide provides an overview of safety basis terminology, requirements, and activities that are applicable to DOE and Oak Ridge Operations Office (ORO) nuclear facilities on the Oak Ridge Reservation. By completing this self-study guide, the reader will fulfill ORO Safety Basis Qualification Standard Competency 1, 2 (Part 1), or 7 (Part 1) and gain a familiarity level of knowledge regarding the following:

- The importance of the safety basis with respect to managing a nuclear facility's environment, safety, and health risks
- The definition of safety basis and other relevant terminology, including Documented Safety Analyses (DSA), Technical Safety Requirements (TSR), Safety Evaluation Reports (SERs) and Unreviewed Safety Questions (USQs)
- Fundamentals of the safety basis document development, review, and approval process
- Discussion of how the safety basis documents flow down to operating procedures, processes, and programs as part of Integrated Safety Management
- Maintaining safety basis documents through the TSR change and USQ processes

Learning Modules

This self-study guide contains four learning modules and a list of references. The first module explains the concepts of risk and risk acceptance and their relationship to the nuclear facility safety basis. The second module introduces fundamental concepts necessary to understand DOE's responsibilities related to safety basis. The third module provides key details on the primary parts of the authorization basis process. The fourth module provides a general overview of how safety basis documents flow down and the responsibilities of both DOE and the contractor in implementing and maintaining the authorization basis.

Examination

On page 26 of this self-study guide are instructions for accessing and completing the review questions. A score of 80% on the questions is required for course credit.

MODULE 1

SAFETY BASIS AND RISK MANAGEMENT

Learning Objectives

On completion of this module, the student should be able to:

- Define the components of "risk" and how it relates to DOE nuclear facilities.
- State key methods for reducing risk.
- Define the relationship of safety basis and risk management.
- State DOE's role in managing risk at DOE nuclear facilities.
- Know what law governs development of the safety basis.

Acronyms Used in This Module

CFR	Code of Federal Regulations
DOE	Department of Energy
DSA	Documented Safety Analysis
NRC	Nuclear Regulatory Commission
SAR	Safety Analysis Report
TSR	Technical Safety Requirements
USQ	Unreviewed Safety Question

What is Risk?

Risk is defined in the dictionary as the possibility of suffering harm or loss. Risk is determined by combining the likelihood that an event will occur (i.e., probability) and the consequences of the event if it did occur. Everything we do involves some level of risk. This includes driving an automobile, traveling in an airplane, smoking, or participating in sports.

With respect to operation of a DOE nuclear facility, there are intrinsic risks that relate to worker and public safety. These include the risk of exposure to ionizing radiation from radioactive materials or to toxic chemicals. It is important to understand the magnitude of these risks, so that DOE can ensure that appropriate controls are established and operations can be conducted safely.

Acceptance and Reduction of Risks

When the risks are not well understood, they can't be managed in a reasonable and cost-effective manner. This can lead to overreaction (i.e., phobia), a lack of appropriate controls, or possibly taking unnecessary risks. Conversely, when the risks are identified and evaluated, actions can be taken to manage them appropriately. This includes incorporating controls that balance the costs and some level of risk acceptance. [Note: Risks can never be completely eliminated!]

Risk can be reduced through prevention and/or mitigation. As an illustration, consider how one might reduce the risk associated with driving to work. This can be accomplished by establishing controls that reduce the risk of having an automobile accident. Some controls prevent an accident from occurring, while others mitigate the effects of an accident after it occurs. Examples might include the following:

Prevention	Mitigation
Driving experience	Drive a well-built car
Obey traffic laws	Wear seat belts
Obey traffic signs	Car air bags
Good brakes	Fire extinguisher in car

Now consider how this concept might apply to the operation of a DOE nuclear facility. How can the risk of an accident be reduced at a nuclear facility located within the Oak Ridge Reservation? Examples might include the following:

Prevention	Mitigation
Facility design features (structures, systems)	High efficiency particulate air filtration system
Limit combustible materials	Fire suppression
Approved procedures	Operator actions in response to an accident
Spacing or separation of fissile materials	Personal protective equipment (e.g., respirator)

Safety Basis and DOE Risk Acceptance

In order for a DOE contractor to operate certain nuclear facilities or to conduct certain nuclear-related activities, DOE requires the contractor to submit a DSA describing the facility risks and the proposed controls that will be employed to assure that operations can be conducted safely. The contractor submits this document to the authorizing official within DOE for review and approval. This document becomes the "safety basis" that is used as the primary input for DOE to determine whether operations can be authorized. The process of approving the safety basis constitutes DOE's acceptance of the risks.

The concept of authorizing operations based on risk acceptance is essentially a "license" under which the contractor may operate a facility. This concept is analogous to many formal and informal authorization basis models encountered in all aspects of society. Examples include the following:

- A father authorizing a teenager's use of the family car
- A state organization authorizing an individual to hunt or fish
- The Federal Aviation Administration authorizing a major carrier to operate an airline
- The Nuclear Regulatory Commission (NRC) authorizing a utility to operate a nuclear power reactor

DOE has developed a formal process to determine the risk and the controls needed for that risk. The basic process is contained in the Integrated Safety Management process. One of the first steps is to identify and analyze the hazards, which allows the determination of the controls

needed to perform the work safely. For DOE nuclear facilities, that first step is to develop a hazard analysis and determine the hazard categorization of the facility.

The Law

When 10 CFR 830, Subpart B, "Safety Basis Requirements," was promulgated in 2001, many of the basic DOE order requirements for nuclear facility safety basis documents became the law. Along with 10 CFR 830, Subpart A, "Quality Assurance Requirements," the safety basis requirements are now law and cannot be waived by contract or any mechanism other than a formal exemption request. This Rule also removes some of the flexibility that DOE previously had in implementing safety documentation requirements under the DOE Orders. Safety basis terminology has also been slightly changed.

Title 10 CFR 830, Subpart B, codified a process that DOE had already implemented through DOE Orders (primarily the old 5480 series Orders). That process comprehensively identifies the hazards, evaluates the hazards at DOE facilities, categorizes the facilities based on those hazards, analyzes the impacts from facility operations and potential accidents, develops the controls for the hazards, and creates a "risk envelope" that establishes the risk DOE accepts in the operation of the facility. The approach to this process is graded to the rigor of the requirements based on the hazards posed by the facility and its operation.

The "graded approach" used by DOE takes the following factors into account in ensuring that the level of analysis and documentation and the actions used to comply with the requirements are commensurate with the risk:

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

NOTE: The "graded approach" does not, however, reduce the contractor's responsibility to comprehensively identify the hazards of the facility and its operations, nor does this approach apply to the TSR or USQ process.

Some of the older terms applied to safety basis documents that may still be encountered include (a) the Safety Analysis Report (SAR), which is now the DSA, and (b) the Operational Safety Requirements, which is now the TSR. DSAs and TSRs are discussed in detail in Module 3.

MODULE 2

SAFETY BASIS TERMINOLOGY AND CONCEPTS

Learning Objectives

On completion of this module the student should be able to:

- Define primary safety and authorization basis terminology.
- State the relationship between the safety basis, authorization basis, and authorization agreement.
- Define DSA.
- Recognize the DOE requirements and guidance for establishing the safety basis.

Acronyms Used in this Module

CFR	Code of Federal Regulations
DOE	Department of Energy
DSA	Documented Safety Analysis
JCO	Justification for Continued Operations (Figure 1)
ORO	Oak Ridge Operations Office
SER	Safety Evaluation Report
TSR	Technical Safety Requirements (Figure 1)
USQ	Unreviewed Safety Question (Figure 1)

What is Safety Basis?

The safety basis describes the nuclear facility hazards and the risks to the workers, the public, and the environment and defines the safety-related equipment, procedures, and practices relied on to adequately control those hazards. The safety basis must be established and maintained in accordance with the requirements of 10 CFR 830, Subpart B, to ensure that operations can be conducted within an acceptable "risk envelope." The safety basis can be modified and reestablished as needed through a formal change control process. It is used to describe those documents prepared by the contractor to meet the requirements contained in 10 CFR 830, Subpart B.

safety basis	The documented safety analysis and hazard controls that provide reasonable assurance that a DOE nuclear facility can be operated safely in a manner that adequately protects workers, the public and the environment [10 CFR 830.1]

This safety basis, which provides the technical basis for controlling the hazards at the facility, differs from a more hardware-oriented design basis in that it is broader in scope and includes engineering analyses and administrative controls. The design basis provides information on the physical parameters of an operation and describes the operation and equipment that form the foundation of the safety analysis. Management controls, staffing, qualification procedures,

training, emergency planning, and self-assessment programs are all part of the facility's safety basis, though not part of its design basis.

What is Authorization Basis?

The term "authorization basis" is defined in DOE M 411.1-1B, *Safety Management Functions, Responsibilities, and Authorities Manual*, as:

> *Those aspects of facility design basis and operational requirements relied upon by DOE to authorize operations. These aspects are considered to be important to the safety of facility operations. The authorization basis is described in documents such as the facility safety analysis report and other documented safety analysis; hazard classification documents, and the Technical Safety Requirements, DOE-issued safety evaluation reports, and facility specific commitments made in order to comply with DOE Orders and policies.*

Approval of a facility's safety basis documentation is documented in a DOE-generated SER. This process, together with acceptance of other environment-, safety-, and health-related commitments, constitutes DOE's acceptance of the risks of operating a nuclear facility (i.e., authorization basis). The term "authorization basis" is an older term developed prior to the issuance of 10 CFR 830, Subpart B. It has evolved via DOE's contract language to mean a broader group of documents that DOE uses to authorize activities that are covered by documents such as environmental permits, environmental assessments, environmental impact statements, readiness review reports, and Integrated Safety Management System verification reports.

What is Authorization Agreement?

The term "authorization agreement" is defined in DOE G 450.4-1B, *Integrated Safety Management System Guide*, as:

> *A documented agreement between DOE and the contractor for high-hazard facilities (Category 1 and 2), incorporating the results of DOE's review of the contractor's proposed authorization basis for a defined scope of work. The authorization agreement contains key terms and conditions (controls and commitments) under which the contractor is authorized to perform the work. Any changes to these terms and conditions would require DOE approval.*

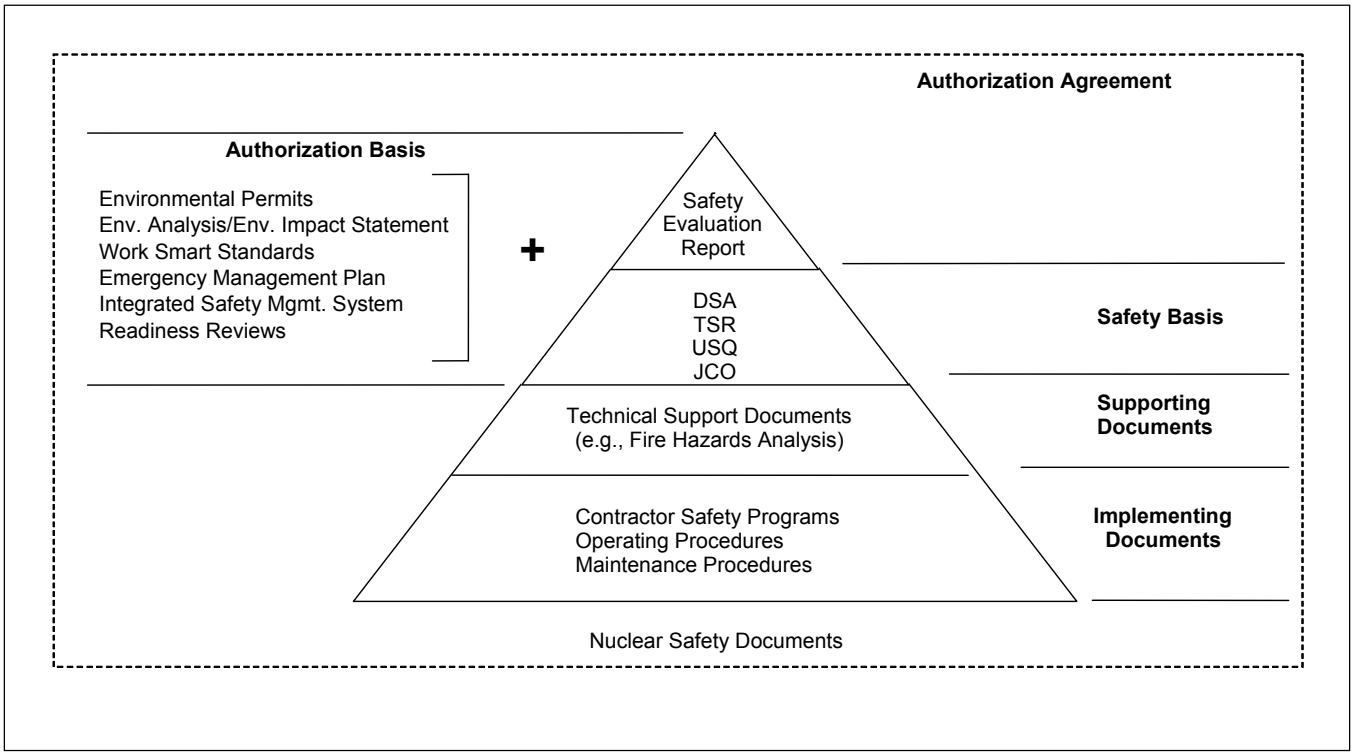
The authorization agreement describes the basis on which DOE bases its decision to authorize operations. As described in DOE G 450.4-1B, it should include the following elements:

- Scope of the agreement
- DOE's basis for approval
- List of documents that constitute the authorization basis
- Terms and conditions
- Contractor qualifications
- Special conditions
- Effective and expiration dates

- Statement of agreement
- Exceptions

The relationship of the safety basis, authorization basis, and authorization agreement is shown in Figure 1.

Figure 1. Relationship of the Safety Basis, Authorization Basis, and Authorization Agreement



What is a Documented Safety Analysis?

The DSA is the formal document that is required by 10 CFR 830.204. The DSA includes a systematic identification of the hazards, analyses of potential accidents, and analyses of measures to eliminate, reduce, control, and mitigate the hazards. The DSA is a living document that must change as the facility configuration or operations are modified or changed.

documented safety analysis	A documented analysis of the extent to which a nuclear facility can be operated safely with respect to workers, the public, and the environment, including a description of the conditions, safe boundaries, and hazard controls that provide the basis for ensuring safety. [10 CFR 830.3]

The DSA can be in a variety of formats, depending on the type of facility involved. Title 10 CFR 830, Subpart B, Table 2, lists acceptable methodologies that may be used, and are also known as "safe harbors." Other methodologies may be used, but they must first be approved by

DOE. The Reference section of this study guide contains a summary of the safe harbor methodologies.

Title 10 CFR 830, Subpart B, requires a DSA for all Hazard Category 1, 2, and 3 nuclear facilities, as determined using DOE-STD-1027-92[1]. The High Flux Isotope Reactor is currently the only Hazard Category 1 nuclear facility (reactor) on the Oak Ridge Reservation.

nonreactor nuclear facility	Those facilities, activities, or operations that involve, or will involve, radioactive and/or fissionable materials in such form and quantity that a nuclear or nuclear explosive hazard potentially exists to workers, the public, or the environment, but does not include accelerators and their operations and does not include activities involving only incidental use and generation of radioactive materials or radiation such as check and calibration sources, use of radioactive sources in research, and experimental and analytical laboratory activities, electron microscopes, and X-ray machines. [10 CFR 830]

Primary Safety Basis Requirements and Guidance

Safety basis requirements are found in 10 CFR 830, Subpart B. Further guidance can be found in the following documents:

- DOE G 421.1-2, *Implementation Guide For Use in Developing Documented Safety Analyses to Meet Subpart B of 10 CFR 830*
- DOE G 423.1-1, *Implementation Guide For Use In Developing Technical Safety Requirements*
- DOE G 424.1-1*, Implementation Guide For Use In Addressing Unreviewed Safety Question Requirements*

[1] DOE-STD-1027-92, Change Notice 1, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*

Module 3

SAFETY BASIS PROCESS AND DOCUMENTATION DETAILS

Learning Objectives

Upon completion of this module the student should be able to:

- Define hazard categorization requirements.
- Describe the systematic processes associated with DSA preparation.
- Define TSR.
- Describe the Limiting Conditions for Operation (LCO).
- Describe the potential inadequacies of the safety analysis.
- Describe the USQ process.
- Define a nonreactor nuclear facility.
- Define a radiological facility.

Acronyms Used in This Module

CFR	Code of Federal Regulations
DOE	Department of Energy
DSA	Documented Safety Analysis
LCO	Limiting Conditions for Operation
LCS	Limiting Control Setting
PAAA	Price-Anderson Amendments Act
PDSA	Preliminary Documented Safety Analysis
PISA	Potential Inadequacy in the Safety Analysis
SAR	Safety Analysis Report
SSC	Structure, System, or Component
TSR	Technical Safety Requirements
USQ	Unreviewed Safety Question
USQD	Unreviewed Safety Question Determination

Hazard Categorization

Basis of Requirement: 10 CFR 830.202(b)

Title 10 CFR 830, Subpart B, requirements apply to all facilities that are categorized as Hazard Category 1, 2 or 3 using DOE-STD-1027-92[2]. This standard prescribes acceptable approaches for categorizing facilities based on the quantities (inventory) and types of radiological materials present in the facility. Table 1 provides definitions for various hazard categories.

[2] DOE-STD-1027-92, Change Notice 1, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*

DOE-STD-1027-92 only applies to facilities that have radiological materials. Other hazard evaluation processes apply to facilities with (a) chemical or industrial hazards or (b) radiological materials in quantities that are less than the threshold for Hazard Category 3 (typically termed "radiological facilities"). It should be noted that all facilities with radiological materials are subject to the quality assurance requirements of 10 CFR 830, Subpart A, and potential enforcement actions of the Price-Anderson Amendments Act (PAAA).

Application of DOE-STD-1027-92[3] requires determination of the total facility radiological inventory and comparison of this inventory to the threshold quantities given in Appendix A of DOE-STD-1027-92. This provides the initial hazard categorization. The results of the categorization may then be refined based on a hazard analysis that considers material quantity, form, location, dispersibility, and interaction with available energy sources. Adjustments in threshold quantity values are allowed based on these parameters.

Hazard categorization is used to help determine the graded approach (i.e., level of detail) needed to fully evaluate the risks at a facility or from its operation and determine the controls needed. The next step in the safety management process requires the development of safety analyses that will fully evaluate the risks and determine what controls are needed in order to perform the work safely.

Table 1. Summary of Hazard Categories from DOE-STD-1027-92

A facility categorized as:	Has the potential for:	This includes facilities:
Hazard Category 1	Potential for significant off-site consequences	Category A reactors (.20 Megawatt Thermal)
		As designated by the Program Secretarial Officer
Hazard Category 2	Potential for significant on-site consequences beyond localized consequences	Potential for a nuclear criticality events
		With sufficient quantities of hazardous material and energy that would require on-site emergency planning (based on a total dose of 1 rem at 100 meters)
Hazard Category 3	Potential for local significant consequences	Potential for exposure to workers at Table A-1 threshold levels (based on a 10 rem exposure at 30 meters for 24-hour exposure)
Below Hazard Category 3	Only consequences less than those that provide a basis for categorization as a Hazard Category 1, 2, or 3 nuclear facility	

[3] DOE-STD-1027-92, Change Notice 1, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*

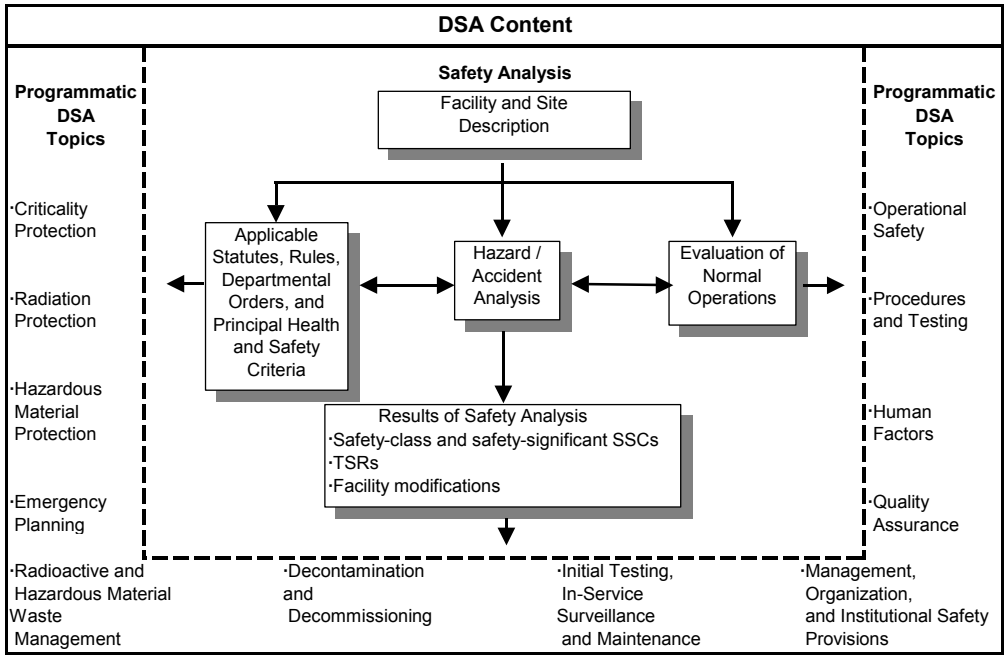
Documented Safety Analysis

As discussed in Module 2, the DSA is the primary technical reference that documents and supports management's determination that the nuclear facility can be operated safely. A facility DSA defines the safety basis and the logic of its derivation, and it demonstrates the adequacy of the measures for protecting the health and safety of the public, workers, and the environment. The safety analysis process, which must be documented in the DSA, does the following:

- Provides a systematic identification of the hazards
- Describes and analyzes the measures to be taken to eliminate, control, or mitigate the identified hazards
- Analyzes and evaluates the potential accidents and their associated risks

A summary of the primary DSA requirements of 10 CFR 830 Subpart B is provided in Table 2. Figure 2 was developed using SAR terminology, but it still describes the basic process used for DSAs.

Figure 2. Basic DSA Process



The foundation for preparing a DSA is the assembly and integration of a preparation team that includes the following:

- Individuals experienced in process, hazard, and accident analysis
- Facility systems engineers
- Process operators
- Subject matter experts in areas such as nuclear criticality, fire protection, radiological protection, chemical safety, radioactive and hazardous waste management, and quality assurance, as required

10 CFR 830.204 Requirements

Table 2. 10 CFR 830.204 Requirements

204(a)	The contractor responsible for a hazard category 1, 2, or 3 DOE nuclear facility must obtain approval from DOE for the methodology used to prepare the DSA for the facility unless the contractor uses a methodology set forth in Table 2 of Appendix A *(safe harbor methodology)*
204(b)	The DSA for a hazard category 1, 2, or 3 DOE nuclear facility must, as appropriate for the complexities and hazards associated with the facility:
204(b)(1)	Describe the facility (including the design of safety structures, systems and components) and work to be performed;
204(b)(2)	Provide a systematic identification of both natural and man-made hazards associated with the facility;
204(b)(3)	Evaluate normal, abnormal, and accident conditions, including consideration of natural and man-made external events, identification of energy sources or processes that might contribute to the generation or uncontrolled release of radioactive and other hazardous materials, and consideration of the need for analysis of accidents which may be beyond the design basis of the facility;
204(b)(4)	Derive the hazard controls necessary to ensure adequate protection of workers, the public and the environment, demonstrate the adequacy of these controls to eliminate, limit, or mitigate identified hazards, and define the process for maintaining the hazard controls current at all times, and controlling their use;
204(b)(5)	Define the characteristics of the safety management programs necessary to ensure the safe operation of the facility, including (where applicable) quality assurance, procedures, maintenance, personnel training, conduct of operations, emergency preparedness, fire protection, waste management, and radiation protection; and
204(b)(6)	With respect to a nonreactor nuclear facility with fissionable material in a form and amount sufficient to pose a potential for criticality, define a criticality safety program that:
204(b)(6)(i)	Ensures that operations with fissionable material remain subcritical under all normal and credible abnormal conditions,
204(b)(6)(ii)	Identifies applicable nuclear criticality safety standard, and
204(b)(6)(iii)	Describes how the program meets applicable nuclear criticality safety standards.

The Process

Developing a DSA requires the identification, categorization, and evaluation of the potential hazards associated with that facility, as well as identifying the controls to prevent or mitigate possible consequences to the workers, the public, or the environment. This is a systematic process that first involves identification of hazardous and radioactive materials and their forms, locations, and quantities. This information is also used to complete a hazard categorization in

accordance with DOE-STD-1027-92[4]. Next, potential energy sources that could interact with the hazardous and radioactive materials are identified and possible initiating events and accident scenarios are postulated. The specific method used to identify and document the hazards is dependent on the application of the graded approach, and it may include methods such as Preliminary Hazard Analysis, Hazard and Operability Study, and Failure Modes and Effects Analysis.

After the hazards are identified, the potential consequences posed by those hazards are analyzed. This is accomplished either quantitatively or qualitatively, depending on the graded approach. The specific safe harbor used gives guidelines as to the level of detail that is appropriate. Hazards analyses evaluate the hazards to determine the risk to workers, the hazard controls needed for worker safety, and the representative and unique accident scenarios that must be further analyzed in the accident analyses. Accident analyses are required for hazards that pose a potentially significant risk to the public and workers. Accident analyses are used to identify what further controls are necessary to provide adequate protection to the workers and public. Those added controls might be in the form of administrative procedures and processes, or for more significant potential impacts, they would be in the form of equipment and facility process systems.

DSAs must specifically look at those Structures, Systems, or Components (SSCs), including portions of process systems, whose preventive or mitigative function is necessary to limit hazardous/radioactive material exposure to the public, as determined from the hazard/accident analysis. The level of protection or control imposed on an SSC is dependent on its function and the potential level of exposure to the public from the radioactive material. A comparison of unmitigated consequences (i.e., taking credit only for the material quantity, form, location, dispersibility, and interaction with available energy sources but not for the safety features) from a limited subset of potential accidents to an established DOE evaluation guideline is used to determine if any SSCs should be classified as safety class. DOE has set the evaluation guideline for potential public exposures at 25 rem per Appendix A of DOE-STD-3009-94[5]. This is a guideline, and any exposures that challenge that level must be considered for safety class designation. This guideline does not constitute an acceptable level of public exposure, and it is used strictly for determining safety-class SSCs.

The DSA also must evaluate SSCs for those hazards that need more control or protection to further assure safety. Some SSCs are designated as "defense in depth" to build layers of defense against the release of hazardous materials (both radioactive and chemical) so that no one layer by itself is completely relied on. This is to compensate for potential human and mechanical failures. This process has an extensive precedent in the nuclear safety industry. For high hazard operations, there are typically many layers of defense in depth. For low hazard operations, training and procedures may be deemed sufficient, and no SSCs may be needed.

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[4] DOE-STD-1027-92, Change Notice 1, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*

[5] DOE-STD-3009-94, Change 2, *DOE Standard Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*

SSCs that are major contributors to defense in depth and/or worker safety are designated as safety-significant SSCs. DOE-STD-3009-94 gives the following rule of thumb for the designation of safety-significant SSCs:

> *Safety-significant SSC designations based on worker safety are limited to those systems, structures, and components whose failure is estimated to result in a prompt worker fatality or serious injuries or significant radiological or chemical exposures to workers.*

There is no numerical guideline for designation of either safety-significant or defense-in-depth SSC. Both rely on the use of engineering judgment and accident analysis to predict potential consequences. Both defense-in-depth and safety-significant SSCs may require use of the TSR to assure that they are provided with a special level of control commensurate with their safety function.

DSA Updates

After DOE approves the DSA, the contractor must maintain it (systematically review and update it) to ensure that the information is kept current with facility configuration and its operation. The contractor must submit DSA revisions to DOE at least annually, and those submissions must reflect all of the changes implemented at the facility up to six months before that submission. DOE considers approved USQs and TSR amendments as addenda to the DSA until the information is incorporated into the DSA as part of the next annual update.

DSA Formats

Under 10 CFR 830 requirements, DSAs may be prepared in a variety of formats, based on the type of facility and the safe harbor methodology used. The formats may include those for a Safety Analysis Report, Basis for Interim Operations, Safety Analysis for Packaging and Transportation, Health and Safety Plan, and Hazard Analysis Report. The safe harbors referenced in Table 2 of 10 CFR 830, Subpart B, provide details on the specific form and content for each type of document.

Preliminary Documented Safety Analyses

This is a special category of DSA that applies only to construction projects or major modifications. Under the 5480 series Orders, these were known as Preliminary SARs. The focus of a Preliminary Documented Safety Analysis (PDSA) is design criteria, as opposed to completed equipment and systems. DOE must approve the nuclear safety design criteria used as the basis for the design and development of the SSCs, unless the design criteria contained in DOE O 420.1, *Facility Safety*, are used. In addition, DOE must approve the PDSA before the contractor can procure materials or components or begin construction.

major modification	A modification to a DOE nuclear facility that is completed on or after April 9, 2001, that substantially changes the existing safety basis for the facility [10 CFR 830.3]

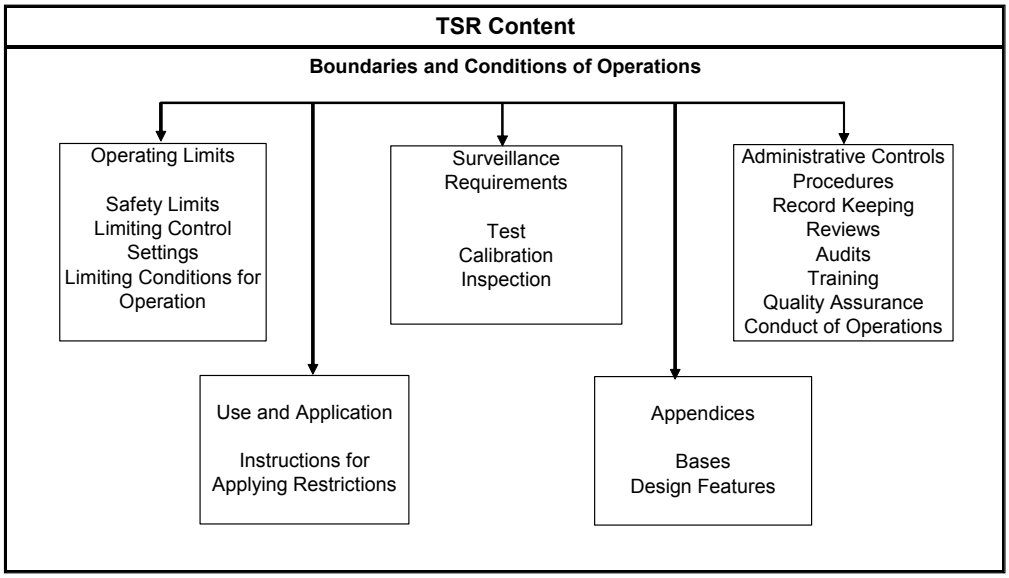
There is a provision in 10 CFR 830.206(b)(2) that gives DOE the authority to authorize the contractor to perform limited procurement and construction activities without approval of a PDSA if DOE determines that the activities are not detrimental to public health and safety and are in the best interests of DOE. DOE G 421.1-2[6] contains extensive guidance on developing PDSAs.

Technical Safety Requirements

The TSR defines the operating conditions, the safe boundaries, the surveillance requirements, and the management or administrative controls necessary for safe operations and for reducing the risk to the public, the workers, or the environment from uncontrolled releases of radiological and nonradiological materials or energy. The TSR is derived from the DSA. The diagram in Figure 3 illustrates the TSR content. Table 3 provides a summary of TSR requirements in 10 CFR 830 Subpart B.

The TSR defines the minimum acceptable limits for operation of nuclear facilities under normal and specified failure conditions. The TSR constitutes an agreement between DOE and the contractor regarding the safe operation of the facility. These limits cannot be changed without prior DOE authorization. DOE G 423.1-1[7] establishes the technical content, scope, format, approval process, and reporting requirements for TSRs. The TSR is a commitment document with the force of a legally binding contract. Failure to comply with the provisions of the TSR may involve civil or criminal penalties as defined by the Price-Anderson Amendment Act and the DOE Enforcement Program. The TSR addresses only the *most important* safety issues—it is not all inclusive.

Figure 3. TSR Content



[6] DOE G 421.1-2, *Implementation Guide For Use in Developing Documented Safety Analyses To Meet Subpart B Of 10 CFR 830*
[7] DOE G 423.1-1, *Implementation Guide for Use in Developing Technical Safety Requirements*

The purpose of the TSR is to:

- State clearly the limits of safe operation.
- Ensure that the safety envelope is not breached.
- Supply a consistent and uniform statement of the surveillance requirements.
- Establish administrative controls to ensure that the requirements are met.
- Establish the actions to take if the requirements are not met.

DOE G 423.1-1 provides DOE's expectation that a facility with an inventory larger than Hazard Category 3 limits will have a TSR. A facility with a safety analysis based on an assumed maximum amount of radioactive, fissile, or hazardous material *and* that relies on controls to maintain the quantity below that assumed amount *must* have a TSR.

DOE's and the contractor's first responsibility is the protection of the public. Facilities must also operate in a manner that minimizes the risk to the workers and limits exposures to hazardous materials. The TSR, by requiring operations within predetermined safety limits, not only protects public health and safety and the environment but also inherently reduces the risk to the workers and the facility by reducing the likelihood of uncontrolled releases. This responsibility is accomplished by the development of the safety requirements in the TSR for those systems, components, and equipment that perform the following:

- Provide barriers to prevent uncontrolled releases
- Mitigate such releases
- Prevent inadvertent criticality

Table 3. 10 CFR 830.205 Requirements

205(a)	A contractor responsible for a Hazard Category 1, 2, or 3 DOE nuclear facility must:
205(a)(1)	Develop technical safety requirements that are derived from the documented safety analysis;
205(a)(2)	Prior to use, obtain DOE approval of technical safety requirements and any change to technical safety requirements; and
205(a)(3)	Notify DOE of any violation of a technical safety requirement.
205(b)	A contractor may take emergency actions that depart from an approved technical safety requirement when no actions consistent with the technical safety requirement are immediately apparent, and when these actions are needed to protect workers, the public or the environment from imminent and significant harm. Such actions must be approved by a certified operator for a reactor or by a person in authority as designated in the technical safety requirements for nonreactor nuclear facilities. The contractor must report the emergency actions to DOE as soon as practicable.
205(c)	A contractor for an environmental restoration activity may follow the provisions of 29 CFR 1910.120 or 1926.65 to develop the appropriate hazard controls (rather than the provisions for technical safety requirements in paragraph (a) of this section), provided the activity involves either
205(c)(1)	Work not done within a permanent structure, or
205(c)(2)	The decommissioning of a facility with only low-level residual fixed radioactivity.

TSR Processes

The facility manager must keep the TSR current because it is the document by which the facility operates and the document that reflects the facility as it exists and as it is analyzed in the DSA. Proposed revisions to the TSR must undergo an internal safety review by the contractor and then be submitted, along with the basis that supports the change, to DOE for approval. Only the current DOE-approved TSR may be used to operate the facility. The TSR must be maintained as a controlled document to ensure that users of the TSR have the latest DOE-approved edition to implement the current facility requirements.

TSR Contents

DOE G 423.1-1[8] provides the basic TSR contents. The components to be included in a TSR are as follows:

Operating Limits. These limits provide an envelope for operating specific, important safety SSCs during facility operation. Operating limits include the following:

- Safety Limits identify limits on process variables associated with those physical barriers that are necessary for the facility to function and which are required to guard against uncontrolled releases of radioactivity and other hazardous materials. [Note: Few, if any, contractor facilities will require Safety Limits.]

- Limiting Control Settings (LCSs) provide settings on safety systems that control process variables to prevent exceeding the Safety Limits during normal operation and in the event of anticipated accidents. [Note: Only facilities with Safety Limits will have LCSs.]

- LCOs establish the lowest functional capability or performance level of safety-class and safety-significant SSCs and their support systems required for normal, safe operation of the facility. LCOs are always associated with action statements that specify both the response to a defined failure or challenge and an associated completion time.

Surveillance Requirements. Testing, calibration, or inspection requirements maintain the necessary operability and quality of safety-related SSCs and their support systems. These requirements ensure that the facility is operating within the Safety Limits, LCSs, and LCOs.

Administrative Controls. These controls provide guidance related to the safety programs, organization and management procedures, recordkeeping, reviews, and audits. Administrative and staffing requirements support programs for training, quality assurance, and conduct of operations.

Design Features. This section contains descriptions of the passive design features of the facility that, if altered or modified, will have a significant effect on safe operation.

[8] DOE G 423.1-1, *Implementation Guide for Use in Developing Technical Safety Requirements*

- **Bases.** This section contains summary statements of the reasons for the operating limits and associated surveillance requirements, which show how the numerical value, the condition, or the surveillance fulfills the purpose derived from the safety documentation.

Unreviewed Safety Questions

The purpose of the USQ process is to determine whether a proposed activity or change requires DOE approval prior to implementation. It provides contractors with the flexibility needed to conduct day-to-day operations. The intent is also to require that those issues with potential impact on the authorization basis (and therefore the safety basis of the facility) be brought to DOE's attention, thus maintaining the appropriate level of approval. The USQ process protects the approved risk envelope.

Title 10 CFR 830.203 defines the elements of the USQ process (see Table 4). DOE G 424.1-1[9] provides guidance for determining the existence of a USQ.

Table 4. 10 CFR 830.203 Requirements

203(a)	The contractor responsible for a hazard category 1, 2, or 3 DOE nuclear facility must establish, implement and take actions consistent with a USQ process that meets the requirements of this section.
203(c)	The contractor responsible for a hazard category 1, 2, or 3 DOE new nuclear facility must submit for DOE approval a procedure for its USQ process on a scheduled that allows DOE approval in a safety evaluation report issued pursuant to section 207(d) of this Part.
203(d)	The contractor responsible for a hazard category 1, 2, or 3 DOE nuclear facility must implement the DOE-approved USQ procedure in situations where there is a:
203(d)(1)	Temporary or permanent change in the facility as described in the existing documented safety analysis;
203(d)(2)	Temporary or permanent change in the procedures as described in the existing documented safety analysis;
203(d)(3)	Test or experiment not described in the existing documented safety analysis; or
203(d)(4)	Potential inadequacy of the documented safety analysis because the analysis potentially may not be bounding or may be otherwise inadequate.
203(e)	A contractor responsible for a hazard category 1, 2, or 3 DOE nuclear facility must obtain DOE approval prior to taking any action determined to involve a USQ.
203(f)	The contractor responsible for a hazard category 1, 2, or 3 DOE nuclear facility must annually submit to DOE a summary of the USQ determinations performed since the prior submission.
203(g)	If a contractor responsible for a hazard category 1, 2, or 3 DOE nuclear facility discovers or is made aware of a potential inadequacy of the documented safety analysis, it must:
203(g)(1)	Take action, as appropriate, to place or maintain the facility in a safe condition until an evaluation of the safety of the situation is completed;
203(g)(2)	Notify DOE of the situation;
203(g)(3)	Perform a USQ determination and notify DOE promptly of the results; and
203(g)(4)	Submit the evaluation of the safety of the situation to DOE prior to removing any operational restrictions initiated to meet paragraph (g)(1) of this section.

[9] DOE G 424.1-1, *Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements*

Unreviewed Safety Question Determination

The USQ Determination (USQD) is the process for determining the existence of a significant proposed change or existing condition that is not contained in the safety basis. This determination is *not* a substitute for a safety analysis and does not determine the safety of a given situation. It is more limited in scope and merely determines whether the safety basis is being preserved and identifies changes or conditions that may require DOE's approval. The purpose of the USQ process can be summarized in the following question:

> *Does DOE, who approved the safety basis, have to review and approve this change or discovered condition or can this change be made without DOE's prior approval?*

The USQ process consists of documenting answers and their bases for seven questions (provided below) that (a) identify impacts to the probability or consequences from accidents, (b) identify an increased probability of malfunction of equipment important to safety (safety class, safety significant, or defense in depth), (c) could create a new accident, or (d) could reduce the margin of safety. A positive USQ (i.e., DOE review and approval required) must be declared by the contractor if the answer to any of the seven questions is "yes."

Table 5. Seven USQ Determination Questions

1. Could the proposed change increase the probability of an accident previously analyzed in the existing safety analyses?
2. Could the proposed change increase the consequences of an accident previously evaluated in the existing safety analyses?
3. Could the proposed change increase the probability of a malfunction of equipment important to safety described in the existing safety analyses?
4. Could the proposed change increase the consequences of a malfunction of equipment important to safety described in the existing safety analyses?
5. Could the proposed create the possibility of an accident of a different type than any previously evaluated in the existing safety analyses?
6. Could the proposed create the possibility of a malfunction of equipment important to safety of a different type than any previously evaluated in the existing safety analyses?
7. Does the proposed change reduce the margin of safety?

A USQD is required for the following:

- Revisions to the basis of a DSA or TSR
- Changes in the nuclear facility as described in the existing DSA
- Changes in the procedures as described in the existing DSA
- Conducting tests or experiments not described in the existing DSA

Routine maintenance activities do not require a USQD unless the activities are not enveloped by the current analyses or might violate the TSR, such as failing to meet a surveillance requirement. A USQ screening may be used as an initial examination or analysis of the proposed change using the criteria defined in the contractor's USQ procedure that will allow the change to be made without a USQD being performed.

A special type of condition requiring a USQD is a Potential Inadequacy in the Safety Analysis (PISA). When a PISA is suspected, based on a discrepancy or as-found condition, the usual USQ process may be used in a backward-looking manner. That is, the as-found condition can be viewed as a proposed activity. Other PISAs may result from an operational event or incident or from new information, including discovery of an error. The USQ process is often modified to add a question that asks if the issue is a PISA to ensure that all potential inadequacies are properly identified. Once declared, a PISA must be the subject of a USQD, and it cannot be screened out of the process.

If a PISA or a possible reduction in the safety margins defined in the TSR Bases is identified, the safety basis may no longer be bounding or it may be inadequate in other ways. In this case, the contractor must perform the following:

- Notify DOE.
- Place the facility in a safe and stable condition until the safety evaluation is completed.
- Conduct a USQD (within a few days, not weeks or months).
- Submit a completed safety evaluation to DOE before removing any operational restrictions.

For all USQDs, the facility must perform the following:

- Document the basis for the USQ.
- Maintain the documentation.
- Incorporate into the annual update of the existing DSA any changes needed and/or any action taken.
- Submit to DOE, on a schedule that parallels the DSA updates, a report summarizing the USQDs for all changes implemented six months before the submittal date of the report.

Module 4

SAFETY BASIS RESPONSIBILITIES AND REQUIREMENTS FLOWDOWN

Learning Objectives

Upon completion of this module the student should be able to:

- Understand the basic DOE and contractor responsibilities under Federal law relating to authorization basis.
- Understand the concepts related to approval authority.
- Understand the flowdown of safety basis requirements.
- Understand the importance of remaining within the authorization basis.

Acronyms Used in This Module

CFR	Code of Federal Regulations
DOE	Department of Energy
DSA	Documented Safety Analysis
ORO	Oak Ridge Operations Office
PAAA	Price-Anderson Amendments Act
PDSA	Preliminary Documented Safety Analysis
SSC	System, Structure, or Component
SER	Safety Evaluation Report
TSR	Technical Safety Requirements
USQ	Unreviewed Safety Question
USQD	Unreviewed Safety Question Determination

DOE Responsibility

DOE must review and approve safety basis documents prepared by the contractor. According to 10 CFR 830.3, DOE must prepare an SER to document the following:

- The sufficiency of the DSA for a Hazard Category 1, 2, or 3 nuclear facility
- The extent to which the contractor has satisfied the requirements of 10 CFR 803, Subpart B
- The basis for approval by DOE of the safety basis for the facility, including any conditions for approval

In order to do this, DOE must be prepared to perform the actions identified in the following Table 6.

Table 6. DOE Actions to Approve a DSA

Action	Requirement	Source
1.	Determine if the contractor methodology used to prepare the DSA is appropriate.	830.204(a)
2.	Review and approve the nuclear safety design criteria to be used in preparing the PDSA.	830.206(b)(1)
3.	Review and approve the PDSAs for any new facilities or for major modifications to Hazard Category 1, 2, or 3 facilities.	830.206(b)]
4.	Determine if the contractor may perform limited procurement and construction activities without approval of the PDSA for a new (or major modifications to a) Hazard Category 1, 2, or 3 facility.	830.207(b)(2)
5.	Issue a SER for any new (or major modification to) Hazard Category 1, 2, or 3 facility before operations or modification can begin.	830.207(d)
6.	Review and approve the contractor TSR(s) and any changes to the TSR(s).	830.205(a)
7.	Review the safety basis for an existing Hazard Category 1, 2, or 3 facility and issue a SER.	830.207(c)
8.	Review and approve the contractor's USQ procedure (initially by April 10, 2001) and any revisions thereafter.	830.203(b)
9.	Review and approve (or take other action, as appropriate) USQs submitted by the contractor, including those for facility changes and discovery conditions.	830.203(e)

Approval Authority

Within DOE, the authority for operations ultimately rests with the Secretary of Energy. However, the Secretary, through DOE Orders and Policies, has established approval authority for various safety basis documents. The Program Secretarial Offices (Office of Environmental Management and Office of Science) have further delegated approval authority, where appropriate, down to the Operations/Field Office level. The Operations Office may further delegate the approval authority. This authority may be extended or withdrawn for a number of reasons.

Title 10 CFR 830, Subpart B, Appendix A, states that "The DOE Management Official for a DOE nuclear facility (that is, the Assistant Secretary, the Assistant Administrator, or the Office Director, who is primarily responsible for the management of the facility) has the primary responsibility with DOE for ensuring that the safety basis for the facility is adequate and complies with the safety basis requirements of Part 830. The DOE Management Official is responsible for ensuring the timely and proper (1) review of all safety basis documents submitted to DOE and (2) preparation of a safety evaluation report concerning the safety basis for a facility."

Contractor Responsibility

The contractor responsible for operation of a Hazard Category 1, 2, or 3 DOE nuclear facility must perform the actions identified in the following Table 7.

Table 7. Contractor Actions for a Hazard Category 1, 2, or 3 Nuclear Facility

Action	Requirement	Source
1.	a. Establish the safety basis for the facility. b. Define the scope of work to be performed. c. Identify and analyze the hazards associated with the work. d. Categorize the facility consistent with DOE-STD-1027-92, Change Notice 1. e. Prepare a DSA for the facility. f. Establish the hazard controls upon which the contractor will rely to ensure adequate protection of the workers, the public, and the environment.	830.202(a) 830.202(b)(1) 830.303(b)(3) 830.202(b)(3) 830.202(b)(4) 830.202(b)(5)
2.	a. Maintain the safety basis for the facility. b. Update the safety basis to keep it current. c. Annually submit to DOE either the updated DSA for approval or a letter stating that there have been no changes in the DSA since the prior submission. d. Incorporate into the safety basis any changes, conditions, or hazard controls directed by DOE.	830.2.2(a) 830.2020(c)(1) 830.202(c)(2) 830.202(c)(3)
3.	Perform the work in accordance with the safety basis.	830.201
4.	Obtain DOE's approval of the methodology used to prepare the DSA unless using a safe harbor.	830.204(a)
5.	Prepare a DSA that meets the content requirements of 10 CFR 830.204(b).	830.204(b)

In terms of a USQ program, the contractor must perform the actions identified in Table 8.

Table 8. Contractor Actions for a USQ Program

Action	Requirement	Source
1.	Submit a USQ procedure for DOE approval.	830.203(b)]
2.	Submit a USQ procedure for existing or new Hazard Category 1, 2, or 3 nuclear facility to DOE on a schedule that will allow for DOE review and approval via the DOE SER prior to operation of the new facility.	830.203(c)]
3.	Implement the approved process for: a. Any temporary or permanent changes in the facility as described in the existing DSA. b. The procedures as described in the existing DSA. c. Tests or experiments not described in the existing DSA. d. Any potential inadequacy in the DSA.	830.203(d)]
4.	Obtain DOE's approval prior to taking any action determined to involve a USQ.	830.203(e)
5.	Annually submit to DOE a summary of the USQDs performed since the prior submission.	830.203(f)
6.	If a discovery is made of a potential inadequacy in the DSA, place or maintain the facility in a safe condition. Then, perform the following: a. Notify DOE of the situation. b. Perform a USQD and notify DOE promptly of the results. c. Submit an evaluation of safety of the situation to DOE prior to removing any operational restrictions.	830.203(g)

For the TSR, the contractor must perform the actions identified in Table 9.

Table 9. Contractor Actions for the TSR

Action	Requirement	Source
1.	Develop the TSR derived from the DSA.	830.205(a)(1)]
2.	Prior to use, obtain DOE's approval of the TSR.	830.205(a)(2)]
3.	Prior to use, obtain DOE's approval of any changes to the TSR.	830.205(a)(2)]
4.	Notify DOE of any violation of the TSR.	830.205(2)(3)]

For any construction of new facilities or major modifications to a Hazard Category 1, 2 or 3 nuclear facility, the contractor must perform the actions identified in Table 10.

Table 10. Contractor Actions for New Construction or a Major Modification

Action	Requirement	Source
1.	Prepare a PDSA.	830.206(a)]
2.	Obtain DOE approval of: a. The nuclear safety design criteria unless using the design criteria in DOE O 420.1, *Facility Safety*. b. The PDSA prior to procurement of material or components or beginning construction.	830.206(b)(1)] 830.206(b)(2)]

Requirements Flowdown

Requirements that describe the basis for the flowdown of safety basis requirements are identified in Table 11.

Table 11. Requirements That Describe Flowdown of Safety Basis Requirements

Source	Flowdown Action
10 CFR 830.122(e)(1)	The contractor must "perform work consistent with technical standards, administrate controls, and other hazard controls adopted to meet regulatory or contract requirements, using approved instructions, procedures, or other appropriate means."
10 CFR 830.201	A contractor must perform work in accordance with the safety basis for a Hazard Category 1, 2, or 3 DOE nuclear facility and, in particular, with the hazard controls that ensure adequate protection of the workers, the public, and the environment.
10 CFR 830.3(a)	"Hazard controls" are "measures to eliminate, limit, or mitigate hazards to workers, public or the environment, including: 1) Physical, design, structural and engineering features 2) Safety structures, systems and components; 3) Safety management programs; 4) Technical safety requirements, and 5) Other controls necessary to provide adequate protection from hazards."
10 CFR 830, Subpart B, Appendix A, Section B	Performing work consistent with the safety basis provides reasonable assurance of adequate protection of workers, the public, and the environment. The safety basis requirements are intended to further the objective of making safety an integral part of how work is performed . . ."
10 CFR 830.203	Requires the implementation of the USQ process for proposed temporary or permanent changes to the facility or procedures (including other command media) described in the safety basis, as well as for proposed test and experiments not described and potential inadequacies of the safety basis.
10 CFR 830.205	Requires DOE approval for any change to TSRs.

Safety basis documents identify the safety-class, safety-significant, and defense-in-depth SSCs. The safety basis also specifies the safety functions, functional requirements, and minimum performance criteria for these SSCs. Design specifications and drawings; operations, surveillance (inspection, testing, and verification), and maintenance procedures; and systems engineering program elements are some of the ways the safety basis requirements for SSCs are implemented.

Design specifications and drawings are the typical ways that safety basis requirements for passive structures or features are imposed. Some maintenance or surveillance procedures,

configuration management, and systems engineer cognizance may be needed to ensure that the features retain their safety function.

Program plans, manuals, and associated implementing procedures and other command media are the typical means of flowing down safety basis requirements for safety management programs. Some elements of the programs may involve professional inspections, analysis, and reporting of results, such as prefire plans, fire hazard analyses, emergency management hazard analyses, nuclear criticality safety evaluations, etc. The processes and procedures also flow down the safety basis requirements.

As part of the configuration management and change control process, the TSR change process and the USQ process ensure that the impact of proposed changes on the safety basis are evaluated to ensure that the integrity of the safety basis is maintained. If a proposed change requires a TSR change or involves a USQ, DOE must approve the change prior to implementation. The request for approval will contain the analytical justification of the change and the necessary revision to the safety basis for DOE's review and approval. If a proposed change does not require a TSR change or does not involve a USQ, the contractor may implement the proposed change and submit any required change to the safety basis at the next annual update.

Remaining within the Approved Safety Basis

Operation outside of the approved safety basis may reduce the margin of safety for a facility, could remove a barrier assumed to be in place that mitigates a release or accident, and could place the operation or facility in an unsafe or unanalyzed condition. Operation outside of the safety basis places the facility outside of the risk envelope that DOE has accepted for that facility, and it may carry legal and financial penalties under PAAA.

The key ways to keep operations within the safety basis are as follows:

- Keep the systems, equipment, and components as they are described in the safety basis documents.
- Operate within the constraints of the limits, procedures, tests, and experiments described in the safety basis documents.
- Implement a change control process that determines if a proposed change, test, or experiment or a discovery has an effect (explicitly or implicitly) on the safety basis.

Review Questions

In order to receive credit for completing this self-study guide, you must contact the ORO Training Center (576-1082) and request a copy of the "open book" review questions, complete the questions, and submit your answers to the Training Center. Someone will check your answers and if you achieve 80%, you will receive a completion certificate.

RELEVANT REFERENCES AND DOCUMENTS

10 CFR 830, Subpart B, References

Required for all Nuclear Facilities	DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*
Acceptable Methodologies (Safe Harbors)	Nonreactor nuclear facilities: • DOE-STD-3009-94, *Preparation Guide for US Department of Energy Nonreactor Nuclear Facility Documented Safety Analysis* Nuclear facilities with limited life: • DOE-STD-3009-94, *Preparation Guide for US Department of Energy Nonreactor Nuclear Facility Documented Safety Analysis,* **or** • DOE-STD-3011-94, *Guidance for Preparation of DOE 5480.22 (TSR) and DOE 5480.23 (SAR) Implementation Plans* Deactivation or transition to surveillance and maintenance of a nuclear facility: • DOE-STD-3009-94, *Preparation Guide for US Department of Energy Nonreactor Nuclear Facility Documented Safety Analysis,* **or** • DOE-STD-3011-94, *Guidance for Preparation of DOE 5480.22 (TSR) and DOE 5480.23 (SAR) Implementation Plans* Decommissioning of a nuclear facility: • DOE-STD-1120-98, *Integration of Environment, Safety, and Health into Facility Disposition Activities*, Volumes 1 and 2, **and** • 29 CFR 1910.120 (29 CFR 1926.65 for construction activities), **and** • Derived hazard controls based on Safety and Health Programs, Work Plans, Health and Safety Plans, and Emergency Response Plans Environmental restoration activity (not in permanent structure or decommissioning a facility with only low-level residual fixed radioactivity): • DOE-STD-1120-98, *Integration of Environment, Safety, and Health into Facility Disposition Activities*, Volumes 1 and 2, **and** • 29 CFR 1910.120 (29 CFR 1926.65 for construction activities) provisions for Safety and Health Program, and a site-specific Health and Safety Plan Nuclear explosives facilities: • DOE-STD-3009-94, *Preparation Guide for US Department of Energy Nonreactor Nuclear Facility Documented Safety Analysis,* **and** • DOE-STD-3016-99, *Limited Standard, Hazard Analysis Reports for Nuclear Explosive Operations* Hazard Category 3 nonreactor nuclear facility: • Chapters 2, 3, 4, and 5 of DOE-STD-3009-94, *Preparation Guide for US Department of Energy Nonreactor Nuclear Facility Documented Safety Analysis* Transportation activities: • DOE O 460.1, *Packaging and Transportation Safety,* **and** • DOE G 460.1-1, *Implementation Guide for Use with DOE O 460.1A, Packaging and Transportation Safety* Transportation and onsite transfer of nuclear explosives: • DOE O 460.1, *Packaging and Transportation Safety,* **and** • DOE M 461.1-1*, Packaging and Transfer of Materials of National Security Interest Manual* DOE Reactors • NRC Regulatory Guide, 1.70

Other DOE Orders, Guides, and Standards That Apply to Safety Basis Documents

DOE O 420.1	*Facility Safety*
DOE G 421.1-2	*Implementation Guide For Use in Developing Documented Safety Analyses to Meet Subpart B of 10 CFR 830*
DOE G 423.1-1	*Implementation Guide For Use In Developing Technical Safety Requirements*
DOE G 424.1-1	*Implementation Guide For Use In Addressing Unreviewed Safety Question Requirements*
DOE O 425.1B	*Startup and Restart of Nuclear Facilities*
DOE-STD-1020-2002	*Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities*
DOE-STD-1021-93	*Natural Phenomena Hazards Performance Categorization Guidelines for Structures, Systems, and Components*
DOE-STD-1022-94	*Natural Phenomena Hazards Characterization Criteria*
DOE-STD-1083-95	*Requesting and Granting Exemptions to Nuclear Safety Rules*
DOE-STD-1104-96	*Review and Approval of Nonreactor Nuclear Facility Safety Analysis Reports*
DOE-STD-3006-95	*Planning and Conduct of Operational Readiness Reviews*
DOE-HDBK-3010-94	*Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities*
ORO O 420	*Facility Authorization*